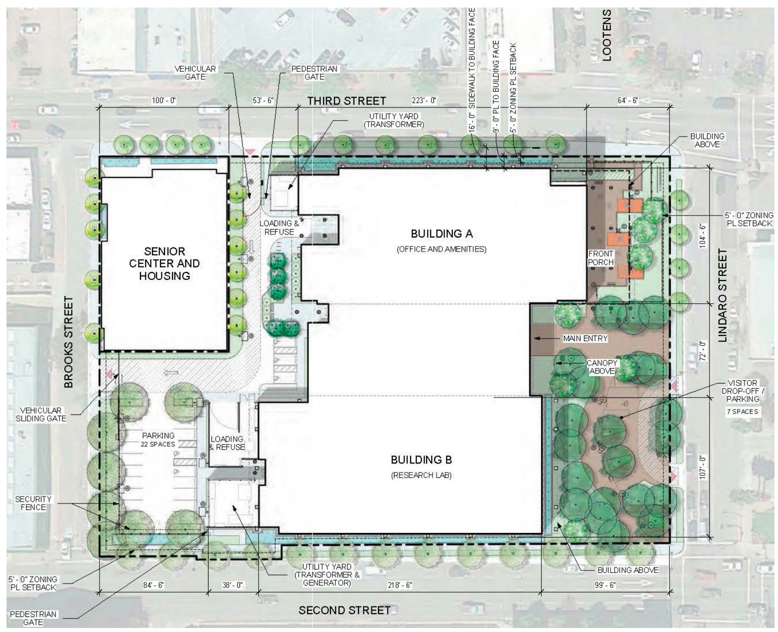
DRAFT EIR

for the

BIOMARIN AND WHISTLESTOP/EDEN HOUSING PROJECT

STATE CLEARINGHOUSE NUMBER 2019029046



Prepared for

City of San Rafael

August 2019

Prepared by

Amy Skewes-Cox, AICP

DRAFT EIR

for the

BIOMARIN AND WHISTLESTOP/EDEN HOUSING PROJECT

STATE CLEARINGHOUSE NUMBER 2019029046

Prepared for

City of San Rafael

August 2019

Prepared by

Amy Skewes-Cox, AICP

In conjunction with

BASELINE ENVIRONMENTAL CONSULTING
ENVIRONMENTAL COLLABORATIVE
LSA ASSOCIATES
NATALIE MACRIS
PARISI TRANSPORTATION CONSULTING
WORDSMITH WORD PROCESSING
TOM CAMARA GRAPHICS
RON TEITEL GRAPHICS

TABLE OF CONTENTS

FIGURES

TABLES

1. INTRODUCTION

This document is a Draft Environmental Impact Report (DEIR) for the BioMarin and Whistlestop/ Eden Housing Project ("the project" or "the proposed project") proposed for a 3.05-acre project site at 999 3rd Street in downtown San Rafael, California. The DEIR has been prepared in accordance with the California Environmental Quality Act of 1970 (CEQA), as amended. The City of San Rafael is the lead agency for the project evaluated in this DEIR and is the public agency with the principal responsibility for approving and carrying out the project.

CEQA requires that, before a project with potentially significant environmental effects may be approved, an EIR must be prepared that fully describes the environmental effects of the project, identifies mitigation measures to lessen or eliminate adverse impacts, and examines feasible alternatives to the project (CEQA Guidelines, Section15121(a)). An EIR should be prepared with a sufficient degree of analysis to provide decision-makers with information that enables them to make a decision that intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure (CEQA Guidelines, Section 15151).

This DEIR is intended to provide the information and environmental analyses necessary to help the public understand the project and its likely environmental consequences, and to assist public agency decision-makers in considering the approvals necessary to implement the proposed project. As stated in Section 15125(a) of the CEQA Guidelines, the DEIR addresses "baseline" conditions, which are the physical environmental conditions at the project site and vicinity that exist at the time of publication of the Notice of Preparation (NOP) (see **Appendix A**). The project impacts are then evaluated in comparison to these baseline conditions. In identifying the significant impacts of the project, this DEIR concentrates on the project's substantial physical effects and on mitigation measures to avoid, reduce, or otherwise alleviate those effects. This DEIR also describes and analyzes a reasonable range of alternatives, including a "No Project" alternative as required under CEQA (CEQA Guidelines, Section 15126.6). The determinations of the lead agency concerning the feasibility, acceptance, or rejection of each and all alternatives considered in this DEIR will be addressed and resolved in the City's findings when it considers approval of the project, as required by CEQA.

1.1 PROJECT SUMMARY

The proposed project consists of two major developments—the BioMarin project and the Whistlestop/Eden Housing project—that are proposed as one combined project application. The BioMarin portion of the project would be constructed in two phases as follows:

- ***Phase I*** would consist of construction of Building A, which would be located on the north side of the project site and would include 77,000 square feet of office space and 33,000 square feet of amenities for employees and visitors of the overall BioMarin campus. The 33,000 square feet of amenities would be located on the ground floor and would include lobbies, conference rooms, a fitness center, dining space, and retail space. The retail space, consisting of about 3,500 square feet, would be open to the public. Additional public use space would be an adjacent landscaped plaza (approximately 6,000 square feet) that could be an outdoor public gathering area during daytime hours.

- ***Phase II*** would consist of construction of Building B, which would provide 97,000 square feet of laboratory (research and development [R&D]) space in the southern portion of the project site.

Both Building A and Building B, as measured from finished ground floor to the top of the roof deck, would be 69 feet in height, but they would be officially considered 72 feet (four stories) in height as measured by the 2016 California Uniform Building Code, which determines maximum height from the lowest adjacent grade 5 feet from the proposed building (at the northeast corner of the site). Additional architectural features, including screened rooftop mechanical equipment and towers, would extend above the maximum 72 feet but in accordance with the San Rafael Zoning Ordinance would be excluded from maximum height limits. Building A would have approximately 262 feet of frontage on 3rd Street and 180 feet of frontage on Lindaro Street. Building B would have approximately 244 feet of frontage on 2nd Street and 109 feet of frontage on Lindaro Street.

Whistlestop/Eden Housing would develop its building on 0.34 acre at the northwest corner of the project site. The building would provide approximately 18,000 square feet of space for a Healthy Aging Center and 67 affordable senior housing units. The building would be developed independently of the BioMarin project, but most likely at the same time as BioMarin Building A (Phase I). The proposed 67 housing units would be leased at affordable rents to those aged 62 and over who earn less than 60 percent of the area median income. Residential amenities would include a community room, computer center and library, and landscaped courtyards with community gardens for residents to grow vegetables and herbs. A roof deck would be provided on the northwest and southwest corners of the sixth floor.

A total of 29 surface parking spaces would be provided for the BioMarin portion of the project at the completion of Phase II. Seven parking spaces would be provided at the southeast corner of the site for temporary/visitor parking at the main entrance. An additional 22 surface parking spaces would be provided for the BioMarin portion of the project at the southwest corner of the site, with access from 3rd Street. Cars would enter the site from 3rd Street, travel south to the parking area, and then exit onto Brooks Street. The 12 ground-floor parking spaces provided within the Whistlestop/Eden Housing project would have ingress and egress points on Brooks Street, north of the exit point for the surface parking area. In Phase I, when only BioMarin Building A and the Whistlestop/Eden Housing project would be located on the site, a total of 78 surface parking spaces would be provided since space would be available where Building B (Phase II) is proposed.

Approvals requested for the project include a General Plan amendment to modify the maximum intensity of non-residential development and to increase the height maximums for the BioMarin portion, and a rezoning to expand the Planned Development District boundary for the BioMarin portion. In addition, the project requires design review approval of all components of the project. The Whistlestop/Eden Housing portion of the project does not require a General Plan amendment or a rezoning.

Project plans, project description, and technical studies for this project can be found on the City of San Rafael project web page at https://www.cityofsanrafael.org/999-3rd/.

1.2 NOTICE OF PREPARATION AND SCOPING MEETING

The City of San Rafael, as lead agency, determined during the preliminary review of the project that preparation of an EIR was necessary for the project. The NOP for the EIR was circulated from February 8 to March 12, 2019 and can be found in **Appendix A**. Unless otherwise noted, the date of the NOP—February 8, 2019—is the date assumed for the “baseline” conditions against which the environmental impacts of the proposed project are analyzed. Copies of the comments received in response to the NOP are included in Appendix A of this DEIR.

As stated in the NOP (see **Appendix A**), the City determined that the following environmental factors would not warrant further discussion in the EIR because they are not applicable to the project or project site:

- Agriculture and Forestry Resources
- Mineral Resources
- Population and Housing

The topic of Biological Resources also was not addressed in the EIR because no resources are present on the project site, which is entirely disturbed.

This DEIR was prepared based on the comments received on the NOP and the project information provided. The following topics were found to have potential environmental impacts and thus are addressed herein in this DEIR:

- Aesthetics
- Air Quality
- Cultural Resources
- Energy
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Public Services
- Recreation
- Transportation
- Tribal Cultural Resources
- Utilities and Service Systems

A scoping meeting for the project was held in the Council Chambers of the City of San Rafael on March 12, 2019 at 7:00 PM. A summary of comments made at that scoping meeting is included in Appendix A.

1.3 PUBLIC REVIEW

This DEIR will be circulated for review and comment by the public and other interested parties, agencies, and organizations for a 45-day period as indicated on the Public Notice of Availability of this document. During the public review period, written comments on the adequacy of the DEIR may be submitted to:

City of San Rafael
Mr. Sean Kennings, Contract Planner
Community Development Department
1400 Fifth Avenue, 3rd Floor
San Rafael, CA 94901

Written comments via email can be sent to contract planner, Sean Kennings, at sean@lakassociates.com.

Responses to all substantive comments received on the adequacy of the DEIR and submitted within the specified review period will be prepared and included in the Responses to Comments/ Final Environmental Impact Report (FEIR). Prior to approval of the project, the City must certify the FEIR and adopt a Mitigation Monitoring and Reporting Program (MMRP) for mitigation measures identified in the EIR, in accordance with the requirements of California Public Resources Code (PRC) Section 21001.

1.4 ORGANIZATION OF THE DEIR

This DEIR is organized into the following chapters:

Chapter 1, Introduction: Provides an introduction and overview that describes the intended use of this DEIR, project background, the DEIR process, and organization of the document.

Chapter 2, Summary: Briefly describes the project and concerns associated with it, identifies levels of significance for each impact addressed in the DEIR, summarizes the project-specific effects of the project, identifies mitigation measures, and compares impacts of the project with those of alternatives to the project. Table 2-1, Summary of Potentially Significant Impacts and Mitigation Measures, is provided at the end of Chapter 2.

Chapter 3, Project Description: Contains information on the project site, project objectives, project characteristics, and required project approvals.

Chapter 4, Environmental Setting, Impacts, and Mitigation Measures: Contains an analysis of environmental topics. Each topic is addressed in a separate section. Each section is divided into an *Introduction* that describes the general content and approach used for the topic; an *Environmental Setting* section that describes baseline environmental information; a *Regulatory Framework* section that describes federal, state, and local regulations applicable to the topic; and an *Environmental Impacts and Mitigation Measures* section that describes project-specific impacts and mitigation measures, along with cumulative impacts.

Chapter 5, Alternatives: Assesses impacts of four alternatives to the project, consisting of the No Project Alternative, the Reduced Scale Alternative, the Code-Compliant BioMarin and Off-Site Whistlestop/Eden Housing Project Alternative, and the Code-Compliant BioMarin and Whistlestop/Eden Housing Project Alternative. The alternatives are compared to the proposed project and an "environmentally superior alternative" is identified.

Chapter 6, CEQA Considerations: Contains sections required by CEQA, including a discussion of cumulative impacts, growth inducement, and significant unavoidable impacts.

Chapter 7, EIR Authors: Lists the persons directly involved in preparing this DEIR.

Chapter 8, References: Lists the persons, agencies, and organizations contacted and documents used during preparation of this DEIR.

Appendices: The following appendices are included on a disk at the back of the hard copies of the DEIR:

Appendix A: Notice of Preparation, Notice of Preparation Comments, and Scoping Meeting Comments
Appendix B: Air Quality Background Data
Appendix C: Noise Background Data
Appendix D: Transportation Background Data

1.5 REFERENCES

California Environmental Quality Act (CEQA), Public Resources Code Sections 21000 to 21189.3, as amended January 1, 2016.

CEQA Guidelines, 14 California Code of Regulations (CCR) Sections 15000-15387, as amended December 1, 2013.

California Government Code, Section 53094, effective January 1, 2002.

2. SUMMARY

This chapter briefly describes the proposed BioMarin and Whistlestop/Eden Housing project. It also summarizes the project-specific impacts and mitigation measures identified in this DEIR (see **Table 2-1**). Alternatives to the project that are considered in this DEIR are also summarized.

2.1 PROJECT UNDER REVIEW

The two components of the proposed project are the BioMarin project and the Whistlestop/ Eden Housing project. Both are located within the downtown San Rafael block bounded by 2nd Street on the south, 3rd Street on the north, Lindaro Street on the east, and Brooks Street on the west.

The BioMarin portion of the project would be constructed in two phases as follows:

- ***Phase I*** would consist of construction of Building A, which would be located on the north side of the project site and would include 77,000 square feet of office space and 33,000 square feet of amenities for employees and visitors of the overall BioMarin campus. The 33,000 square feet of amenities would be located on the ground floor and would include lobbies, conference rooms, a fitness center, dining space, and retail space. The retail space, consisting of about 3,500 square feet, would be open to the public. Additional public use space would be an adjacent landscaped plaza (approximately 6,000 square feet) that could be an outdoor public gathering area during daytime hours.
- ***Phase II*** would consist of construction of Building B, which would provide 97,000 square feet of laboratory (research and development [R&D]) space in the southern portion of the project site.

Both Building A and Building B, as measured from finished ground floor to the top of the roof deck, would be 69 feet in height, but they would be officially considered 72 feet (four stories) in height, as measured by the 2016 California Uniform Building Code, which determines maximum height from the lowest adjacent grade 5 feet from the proposed building (at the northeast corner of the site). Building A would have approximately 262 feet of frontage on 3rd Street and 180 feet of frontage on Lindaro Street. Building B would have approximately 244 feet of frontage on 2nd Street and 109 feet of frontage on Lindaro Street.

Whistlestop/Eden Housing would develop its building on 0.34 acre at the northwest corner of the project site. The building would provide approximately 18,000 square feet of space for a Healthy Aging Center and 67 affordable senior housing units and would be considered a "Healthy Aging Campus." The building would be developed independently from the BioMarin project but most likely at the same time as BioMarin Building A (Phase I). The proposed 67 housing units would be leased at affordable rents to those aged 62 and over who earn less than 60 percent of the area median income. Residential amenities would include a community room, computer center and library, and landscaped courtyards with community gardens for residents to grow vegetables and herbs. A roof deck would be provided on the northwest and southwest corners of the sixth floor.

A total of 29 surface parking spaces would be provided for the BioMarin portion of the project after full development of both buildings. This total would consist of 7 spaces at the entrance to the project site off Lindaro Street at the southeast corner of the project site, and 22 additional surface parking spaces at the southwest corner of the site, with access from 3rd Street. Cars would enter the site from 3rd Street, travel south to the parking area, and then exit onto Brooks Street. The 12 ground-floor parking spaces provided within the Whistlestop/Eden Housing project would have ingress and egress points on Brooks Street, north of the exit point for the surface parking area. In Phase I, when only BioMarin Building A and the Whistlestop/Eden Housing project would be located on the site, a total of 78 surface parking spaces would be provided since space would be available where Building B (Phase II) is proposed. A site plan for both projects can be seen in Figure 3-3 in Chapter 3, Project Description, of this DEIR.

Approvals requested for the project include a General Plan amendment to modify the maximum intensity of non-residential development and a rezoning to expand and combine the Planned Development District boundary of the San Rafael Corporate Center (SRCC) with the BioMarin portion of the subject property.

Electronic copies of the project plans, project description, and technical studies for this project can be found on the City of San Rafael project web page at https://www.cityofsanrafael.org/999-3rd/.

AREAS OF POTENTIAL CONTROVERSY

A Notice of Preparation (NOP) was prepared by the City of San Rafael to obtain comments from agencies and the public regarding issues to be addressed in the DEIR. The NOP can be viewed at the City of San Rafael's website, at the following address: https://www.cityofsanrafael.org/documents/notice-of-preparationnop/.

The NOP was circulated for public comment for 30 days between February 8, 2019 and March 12, 2019. The City of San Rafael held a public hearing at the San Rafael Planning Commission to receive public comments on the scope of the DEIR. Copies of the comments received in response to the NOP are included in **Appendix A** of this DEIR.

The following environmental topics were scoped out of the DEIR: Agricultural, Mineral Resources, and Biological Resources. In addition, the topic of Population/Housing was scoped out of the DEIR after the NOP scoping hearing because the concern focused on housing demand associated with the BioMarin project, and this concern could be addressed under "Growth Inducement" in Chapter 6, CEQA Considerations, of this DEIR.

The DEIR was prepared based on the comments received on the NOP and the project information provided. The following topics were found to have potential impacts and thus are addressed in this DEIR:

- Aesthetics
- Air Quality
- Cultural Resources
- Energy
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials

- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Public Services
- Recreation
- Transportation
- Tribal Cultural Resources
- Utilities and Service Systems

2.2 IMPACTS AND MITIGATION MEASURES

Under CEQA, a significant effect on the environment is defined as a substantial or potentially substantial adverse change in any of the physical conditions within the area affected by a project, including effects on land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance (CEQA Guidelines Section 15382). In this DEIR, the criteria used to determine whether or not effects are significant are included in the "Environmental Impacts and Mitigation Measures" section for each topic discussion.

All potential impacts identified for the project could be mitigated to a less-than-significant level except for land use and transportation-related impacts.

Prior to approval of the project, written findings regarding each of the identified environmental impacts must be prepared. Also, a monitoring program for the mitigation measures must be adopted. This monitoring program will be prepared as part of the Final EIR for this project.

2.3 ALTERNATIVES TO THE PROJECT

Four alternatives to the proposed project are evaluated in Chapter 5, Alternatives. Alternative 1 is the No Project Alternative, in which no changes from existing conditions would occur. Alternative 2 is the Reduced Scale Alternative, in which both projects would be reduced in overall scale. Alternative 3 is the Code-Compliant BioMarin and Off-Site Whistlestop/Eden Housing Project Alternative, which assumes that the BioMarin project would not require a General Plan amendment and rezoning, and the Whistlestop/Eden Housing project would be developed at the existing Whistlestop site on Tamalpais Avenue. The last alternative, Alternative 4, is the Code-Compliant BioMarin and Whistlestop/Eden Housing Project Alternative, in which both projects would be developed on the project site but would not require a General Plan amendment or rezoning. Other alternatives that were considered but rejected are discussed in more detail in Chapter 5. The environmental impacts of each alternative are compared. The ability of each alternative to meet project objectives is also evaluated. In addition to the No Project Alternative, the Reduced Scale Alternative would be the "environmentally superior alternative."

2.4 SUMMARY TABLE

Table 2-1 summarizes potentially significant project impacts and mitigation measures. The table identifies each impact's level of significance both before and after mitigation. The two columns on the right indicate whether the mitigation measures would apply to the BioMarin project, the Whistlestop/Eden Housing project, or both (i.e., the project as a whole).

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
Aesthetics					
The project would not have any potentially significant impacts on aesthetics.					
Air Quality					
AIR-1: Fugitive dust emissions during project construction could adversely affect a substantial number of people.	PS	AIR-1: During project construction, the contractor shall implement a dust control program that includes the following measures recommended by the BAAQMD: ▪ All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. ▪ All haul trucks transporting soil, sand, or other loose material off-site shall be covered. ▪ All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. ▪ All vehicle speeds on unpaved roads shall be limited to 15 miles per hour. ▪ All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. ▪ A publicly visible sign shall be posted with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Bay Area Air Quality Management District (BAAQMD) phone number shall also be visible to ensure compliance with applicable regulations. The above measures shall be included in contract specifications. In addition, an independent construction monitor shall conduct periodic site inspections, but in no event less than four total inspections, during the course of construction to ensure these mitigation measures are implemented and shall issue a letter report to the City of San Rafael Building Division documenting the inspection results. Reports indicating non-compliance with construction mitigation measures shall be cause to issue a stop work order until such time as compliance is achieved. Implementation of Mitigation Measure AIR-1 would reduce potentially significant impacts of fugitive dust emissions during project construction to a less-than-significant level.	LTS	✓	✓
Cultural Resources					
CULT-1: The proposed project could cause a substantial adverse change in the significance of archaeological deposits that qualify as historical resources, as defined in CEQA	PS	CULT-1: Should an archaeological deposit be encountered during project subsurface construction activities, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist meeting the Secretary of the Interior's Professional	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
Guidelines Section 15064.5. Archaeological deposits could be unearthed or otherwise displaced during project ground disturbance below fill at the project site.		Qualifications Standards for Archeology contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. If the deposit is found to be significant (i.e., eligible for listing in the California Register of Historical Resources), the applicant shall be responsible for funding and implementing appropriate mitigation measures. Mitigation measures may include recordation of the archaeological deposit, data recovery and analysis, and public outreach regarding the scientific and cultural importance of the discovery. Upon completion of the selected mitigations, a report documenting methods, findings, and recommendations shall be prepared and submitted to the City for review, and the final report shall be submitted to the Northwest Information Center at Sonoma State University. Significant archaeological materials shall be submitted to an appropriate curation facility and used for public interpretive displays, as appropriate and in coordination with a local Native American tribal representative. The applicant shall inform its contractor(s) of the sensitivity of the project area for archaeological deposits and shall verify that the following directive has been included in the appropriate contract documents: "The subsurface of the construction site may be sensitive for Native American archaeological deposits. If archaeological deposits are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any archaeological materials. Archaeological deposits can include shellfish remains; bones; flakes of, and tools made from, obsidian, chert, and basalt; and mortars and pestles. Contractor acknowledges and understands that excavation or removal of archaeological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5."			
CULT-2: The proposed project could cause a substantial adverse change in the significance of an archaeological resource, as defined in CEQA Guidelines Section 15064.5. Archaeological resources could be unearthed or otherwise displaced during project ground disturbance below fill underlying the project site.	PS	CULT-2: Mitigation Measure CULT-1 shall be implemented.	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
Energy					
The project would not have any potentially significant impacts on energy.					
Geology and Soils					
GEO-1: During its design life, the project would likely be subject to strong ground shaking from a seismic event, seismic-related ground failure, and unstable soils, creating the potential for a significant risk to structures and human lives.	PS	GEO-1: The project applicants shall implement all of the recommendations of the design-level geotechnical investigation, including design criteria, plan review, and construction period monitoring recommendations. Prior to the issuance of a grading permit and building permit, the applicants shall demonstrate to the satisfaction of the City Engineer that the recommendations of the design-level geotechnical investigation have been incorporated into the project grading plans and building plans.	LTS	✓	✓
GEO-2: Expansive, unstable, and/or corrosive soils at the project site could result in structural damage to project facilities, creating the potential for a significant risk to structures and human lives.	PS	GEO-2: The project applicants shall implement Mitigation Measure GEO-1.	LTS	✓	✓
GEO-3: The project could result in damage to, or destruction of, an as-yet unknown unique paleontological resource or site or unique geologic feature.	PS	GEO-3: Should paleontological resources be encountered during project subsurface construction activities located in previously undisturbed soil and bedrock, all ground-disturbing activities within 25 feet shall be halted and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. For purposes of this mitigation, a "qualified paleontologist" shall be an individual with the following qualifications: 1) a graduate degree in paleontology or geology and/or a person with a demonstrated publication record in peer-reviewed paleontological journals; 2) at least two years of professional experience related to paleontology; 3) proficiency in recognizing fossils in the field and determining their significance; 4) expertise in local geology, stratigraphy, and biostratigraphy; and 5) experience collecting vertebrate fossils in the field. If the paleontological resources are found to be significant and project activities cannot avoid them, measures shall be implemented to ensure that the project does not cause a substantial adverse change in the significance of the paleontological resource. Measures may include monitoring, recording the fossil locality, data recovery and analysis, a final report, and accessioning the fossil material and technical report to a paleontological repository. Upon completion of the assessment, a report documenting methods, findings, and recommendations shall be prepared and submitted to the City for review. If paleontological materials are recovered, this report also shall be submitted to a paleontological repository such as the University of California Museum of Paleontology, along with significant paleontological materials.	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
		Public educational outreach may also be appropriate. The project applicants shall inform its contractor(s) of the sensitivity of the project site for paleontological resources and shall verify that the following directive has been included in the appropriate contract specification documents: "The subsurface of the construction site may contain fossils. If fossils are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be halted and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any paleontological materials. Fossils can include plants and animals, and such trace fossil evidence of past life as tracks or plant imprints. Marine sediments may contain invertebrate fossils such as snails, clam and oyster shells, sponges, and protozoa; and vertebrate fossils such as fish, whale, and sea lion bones. Vertebrate land mammals may include bones of mammoth, camel, saber tooth cat, horse, and bison. Contractor acknowledges and understands that excavation or removal of paleontological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5."			
Greenhouse Gas Emissions					
The project would not have any potentially significant impacts on greenhouse gas emissions.					
Hazards and Hazardous Materials					
HAZ-1: Future occupants of the project site could be exposed to hazardous materials in indoor air from vapor intrusion during operation of the project.	PS	HAZ-1: Prior to the approval of building permits, the applicants shall provide the City of San Rafael with a letter from the Department of Toxic Substances Control (DTSC) indicating that the project site has been appropriately remediated and appropriate engineering controls have been incorporated into the project design, as necessary, to ensure that future occupants of the project site would not be exposed to unacceptable health risks from hazardous materials in the subsurface of the project site. The Covenant and Agreement to Restrict Use of Property (Covenant) and Operation and Maintenance (O&M) Plan for the project site shall be amended to account for post-remediation conditions of the project site and ensure the engineering controls are operated and maintained such that conditions at the project site remain protective of human health and the environment. Implementation of Mitigation Measure HAZ-1, compliance with the requirements of the Covenant and O&M Plan as required by DTSC, and compliance with existing regulations related to hazardous materials that would be handled during operation of the project would ensure that the proposed project would result in less-than-	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
		significant impacts related to accidental releases of hazardous materials during operation.			
Hydrology and Water Quality					
HYDRO-1: Development of the proposed project could substantially degrade surface and groundwater quality.	PS	HYDRO-1: Prior to the approval of building permits, the applicants shall provide the City of San Rafael with a letter from the Department of Toxic Substances Control (DTSC) indicating that the infiltration proposed by the post-construction stormwater management plans would not lead to the spread of existing groundwater contamination or interference with the effectiveness of the groundwater extraction and treatment system located adjacent to the south and southeast of the project site. If DTSC indicates that restrictions to infiltration are necessary, then the post-construction stormwater management plan shall be modified, as appropriate, to limit infiltration. For example, the pervious pavements and bioretention facilities could be underlain by a low permeability liner that would limit infiltration to the subsurface. Any changes to the post-construction stormwater management plan must be approved by DTSC and the City Engineer prior to approval of building permits.	LTS	✓	✓
HYDRO-2: Changes in drainage patterns on the project site could result in localized flooding due to the exceedance of the local stormwater drainage system capacity.	PS	HYDRO-2: The project applicants shall incorporate the recommendations of the preliminary hydrology study into the project design, and shall complete a final hydrology study based on the final design of the proposed project. The final hydrology study shall verify that peak flows to individual points of drainage around the project site would be limited to at or below existing levels under the final project design, or shall provide recommendations to achieve these limits. The project applicants shall implement all of the recommendation of the final hydrology study. Prior to the issuance of a grading permit and building permit, the applicants shall demonstrate to the satisfaction of the City Engineer that the recommendations of the final hydrology and hydraulic study have been incorporated into the project grading plans and building plans.	LTS	✓	✓
Land Use and Planning					
LAND-1: The project could result in a conflict with San Rafael General Plan 2020 Policy LU-2, which specifies that new development should only occur when adequate traffic conditions and circulation improvements are available. Refer to Impacts TRANS-2, TRAN-3, and TRANS-4 (see Section 4.13, Transportation, of this DEIR). As shown for these three potential impacts, no mitigation measure would be available to reduce these impacts to less-than-significant levels. Thus, this potential impact would remain significant and unavoidable.	PS	LAND-1: No feasible mitigation measures are available, and therefore this impact would be significant and unavoidable on both a project and cumulative basis.	SU	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
Noise					
NOISE-1: Heavy equipment used in project construction could generate noise in excess of standards established in San Rafael General Plan 2020 or the noise ordinance.	PS	NOISE-1a: The BioMarin project applicant shall require use of noise-reducing measures that may include the following and that shall be described and included in applicable contract specifications: After the Whistlestop/Eden Housing project is completed and housing residents, require that the construction contractor for BioMarin Building A and BioMarin Building B not operate more than one piece of noise-generating equipment (listed in Table 4.10-10) within 40 feet of the Whistlestop/Eden Housing project. This would ensure that the 90 dBA L_{max} is not exceeded at the Whistlestop/Eden Housing project. NOISE-1b: The BioMarin and Whistlestop/Eden Housing project applicants shall require use of noise-reducing measures that may include the following and that shall be described and included in applicable contract specifications: 1. Equip internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and are appropriate for the equipment. 2. Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from noise-sensitive land uses. Muffle the stationary equipment, and enclose within temporary sheds or surround by insulation barriers, if feasible. 3. To the extent feasible, establish construction staging areas at locations that would create the greatest distance between the construction-related noise sources and noise-sensitive receptors during all project construction. 4. Use "quiet" air compressors and other stationary noise sources where technology exists. 5. Construct or use temporary noise barriers, as needed, to shield on-site construction and demolition noise from noise-sensitive areas to the extent feasible. To be most effective, the barrier should be placed as close as possible to the noise source or the sensitive receptor. Examples of barriers include portable acoustically lined enclosure/housing for specific equipment (e.g., jackhammer and pneumatic-air tools, which generate the loudest noise), temporary noise barriers (e.g., solid plywood fences or portable panel systems, minimum 8 feet in height), and/or acoustical blankets, as feasible. 6. Control noise levels from workers' amplified music so that sounds are not audible to sensitive receptors in the vicinity. 7. Prohibit all unnecessary idling of internal combustion engines. NOISE-1c: The BioMarin and Whistlestop/Eden Housing construction contractors shall develop a set of procedures that are described and included in applicable	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
		contract specifications for tracking and responding to complaints received pertaining to construction vibration and noise, and shall implement the procedures during construction. At a minimum, the procedures shall include: 1. Designation of an on-site construction complaint and enforcement manager for the project. 2. Protocols specific to on-site and off-site receptors for receiving, responding to, and tracking received complaints. The construction complaint and enforcement manager shall promptly respond to any complaints and work cooperatively with affected receptors to ensure that the source of the noise- or vibration-generating activity is discontinued or determine an acceptable schedule to resume the activity when the receptor is not present in the residence. 3. Maintenance of a complaint log that records what complaints were received and how these complaints were addressed. NOISE-1d: Nearby residents shall be informed by posting informational notices on the fence line of the construction site. The notice shall state the date of planned construction activity and include the contact information of the construction complaint and disturbance coordinator identified in Mitigation Measure NOISE-1b. The above measures shall be included in contract specifications. In addition, an independent construction monitor shall conduct periodic site inspections, but in no event fewer than four total inspections, during the course of construction to ensure these mitigation measures are implemented and shall issue a letter report to the City of San Rafael Building Division documenting the inspection results. Reports indicating non-compliance with construction mitigation measures shall be cause to issue a stop work order until such time as compliance is achieved. The combination of the four mitigation measures above would reduce the impact to a less-than-significant level.			
NOISE-2: The project's mechanical equipment could generate operational noise in excess of standards established in San Rafael General Plan 2020 or the noise ordinance.	PS	NOISE-2: The project applicants shall use mechanical equipment selection and acoustical shielding to ensure that noise levels from the installation of mechanical equipment do not exceed the exterior noise standards of 60 dBA L_{max}/50 dBA L_{eq} during daytime or 50 dBA L_{max}/40 dBA L_{eq} during nighttime at the nearest residential land uses, and do not exceed the exterior noise standards of 65 dBA L_{max}/55 dBA L_{eq} during both daytime and nighttime at the nearest commercial land uses. Controls that would typically be incorporated to attain this outcome include locating equipment in less noise-sensitive areas, when feasible; selecting quiet equipment; and providing sound attenuators on fans, sound attenuator packages for cooling towers and emergency generators, acoustical screen walls, and equipment enclosures.	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
NOISE-3: Project construction could expose persons to or generate excessive groundborne vibration levels.	PS	NOISE-3: Mitigation Measures NOISE-1a through NOISE-1d shall be implemented.	LTS	✓	✓
Public Services					
The project would not have any potentially significant impacts on public services.					
Recreation					
The project would not have any potentially significant impacts on recreation.					
Transportation					
TRANS-1: The project would generate approximately 2,453 daily vehicle trips, with 236 vehicle trips during the weekday AM peak hour and 236 vehicle trips in the PM peak hour. Most of the vehicle trips would be generated by the BioMarin project (1,863 daily, 203 AM peak hour, and 191 PM peak hour trips). The project would increase single-occupancy vehicular travel and vehicular traffic along key roadways and intersections, as well as US 101. Maintaining the existing BioMarin travel mode shares would conflict with citywide policies and programs established to manage congestion and improve mobility as documented in San Rafael General Plan 2020.	PS	TRANS-1: BioMarin, or any successive owner or lessor of the site, shall continue and expand the implementation of a Transportation Demand Management (TDM) program that focuses on reducing vehicle trips and improving traffic flow. BioMarin, or any successive owner or lessor of the site, shall generate at least 15 percent fewer vehicle trips on a daily, AM peak hour, and PM peak hour basis (i.e., 1,584 daily, 173 AM peak hour, and 162 PM peak hour trips) as compared to those projected by the project applicant. BioMarin and any successive owner or lessor of the site shall monitor, on an annual basis, all traffic generated at the site, including single-occupant vehicles, carpools, pedestrian and bicycle trips, and public transit use, to gauge success and promote appropriate measures to retain vehicle trip rates at, or below, the current trip rates. BioMarin, or any successive owner or lessor of the site, shall submit an annual TDM monitoring report to the City of San Rafael for City review. This mitigation measure shall continue in perpetuity for the project site until the 15 percent reduction is identified for three consecutive years. This mitigation measure would reduce the impact to less than significant.	LTS	✓	
TRANS-2: Project-related traffic, under Cumulative-plus-Project conditions, would contribute to continued LOS F conditions at the US 101 southbound off-ramp to Mission Avenue, increasing the volume-to-capacity (V/C) ratio of the off-ramp by 0.033 during the AM peak hour. Traffic operations and safety at the highway ramp diverge and along the off-ramp would worsen. This condition would conflict with standards provided in the Marin County Congestion Management Plan.	PS	TRANS-2: No feasible mitigation is available. This impact would be significant and unavoidable.	SU	✓	✓
TRANS-3: Project-related traffic would contribute to continued LOS E (under Baseline-Plus-Project) and LOS F (under Cumulative-Plus-Project) conditions along westbound 3rd Street between Hetherton Street and D Street during the AM peak hour, with an increase in the arterial roadway segment's	PS	TRANS-3: No feasible mitigation is available. This impact would be significant and unavoidable.	SU	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
volume-to-capacity (V/C) ratio of 0.067. This impact would result in a reduction in travel speeds that conflict with the Marin County Congestion Management Plan and San Rafael General Plan 2020 Policy C-5 (Traffic Level of Service Standards).					
TRANS-4: Under Cumulative-Plus-Project conditions, project-related traffic would worsen the service level at the 3rd Street and Tamalpais Avenue West intersection from LOS E to LOS F during the AM peak hour, with average delays increasing from 65.6 seconds to 96.7 seconds per motorist. During the PM peak hour, the intersection's service level would remain at LOS F with project-related traffic, but the project would increase average delays from 86.4 to 94.0 seconds per motorist. This impact would create conflicts with San Rafael General Plan 2020 Policy C-5 (Traffic Level of Service Standards).	PS	TRANS-4: No feasible mitigation is available. This impact would be significant and unavoidable.	SU	✓	✓
TRANS-5: The project would add construction-related vehicle trips to City of San Rafael and other jurisdictional roadways, creating temporary traffic hazards. These conditions would conflict with San Rafael General Plan 2020 Program C-4a (Street Pattern and Traffic Flow).	PS	TRANS-5: Project construction shall abide by the City of San Rafael's provisions regarding transportation and parking management during construction activities. In addition, the project applicants shall develop a demolition construction traffic management plan defining hours of operation, specified truck routes, and construction parking provisions. This plan shall be prepared by the applicants and approved prior to issuance of a building permit by the City of San Rafael Department of Public Works. The project applicants shall ensure that any parking losses associated with construction vehicles do not affect parking availability on downtown streets.	LTS	✓	✓
TRANS-6: Construction traffic would be staged and would use the roadway lanes adjacent to the site. This traffic would cause deterioration of pavement on 3rd Street, Brooks Street, 2nd Street and Lindaro Street. These conditions would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Road Design).	PS	TRANS-6: The project applicants shall improve the pavement sections of the roadways peripheral to the project site to a condition acceptable to the City Engineer. The applicants shall complete a "pre-construction" study, followed by a "post-construction" survey to determine what road improvements would be the responsibility of the applicants. These studies shall be submitted to the City Engineer for approval.	LTS	✓	✓
TRANS-7: Access to the project would be provided from six unsignalized driveways. Motorist, pedestrian, and bicyclist sight lines to and from these driveways would be constrained if parking is allowed next to the driveways or landscaping blocks views. These conditions would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Road Design).	PS	TRANS-7a: The project applicants shall maintain landscaping at project driveways to avoid sight distance conflicts. Shrubs shall not be higher than 30 inches and tree canopies shall be at least 7 feet from the ground. TRANS-7b: The City of San Rafael shall prohibit parking at least 20 feet in advance and 20 feet behind each of the project's six driveways. The combination of these two mitigation measures would reduce the impact to less than significant.	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
TRANS-8: The project would increase the number of pedestrians using nearby sidewalks and curb ramps, including at the corners of the following intersections peripheral to the project site where curb ramps are not Americans with Disabilities Act (ADA)-compliant: 3rd Street and Lindaro Street, 3rd Street and Brooks Street, 2nd Street and Brooks Street, and 2nd Street and Lindaro Street. These conditions are inconsistent with San Rafael General Plan 2020 Program C-4b (Street Design Criteria to Support Alternative Modes) and Policy C-11 (Alternative Transportation Mode Users).	PS	TRANS-8: The project applicants shall fund the design and construction of curb ramp improvements at all corners of the following intersections: 3rd Street and Lindaro Street, 3rd Street and Brooks Street, 2nd Street and Brooks Street, and 2nd Street and Lindaro Street.	LTS	✓	✓
TRANS-9: Currently a marked crosswalk, with curb ramps and pedestrian signals, is not present on the west leg of the 3rd Street and Lindaro Street intersection. The project would increase the number of pedestrians crossing 3rd Street at this location. Pedestrians walking to or from the project site may be inclined to cross the unmarked west leg instead of taking the more circuitous marked route (i.e., crosswalks across the intersection's south leg and east leg, as well as across the Walgreens driveway on the north leg). By increasing the number of pedestrians at this location, the project would worsen hazards by creating greater potential for conflicts between pedestrians and vehicles. These conditions would be inconsistent with San Rafael General Plan 2020 Program C-4b (Street Design Criteria to Support Alternative Modes) and Policy C-11 (Alternative Transportation Mode Users).	PS	TRANS-9: The project applicants shall fund the design and construction of improvements related to the provision of a crosswalk across the western leg of the 3rd Street and Lindaro Street intersection. These improvements shall include, but not be limited to, curb and roadway infrastructure work, as well as traffic and pedestrian signal modifications. They may include revisions to or removal of the driveway on the north side of the intersection. The design of these improvements would be approved by the City Engineer.	LTS	✓	✓
TRANS-10: Currently, pedestrian crossings of 3rd Street at Brooks Street are prohibited. The closest signalized crossing is located at A Street, which is about 240 feet to the west. The Whistlestop/Eden Housing project is expected to increase pedestrian crossing demands across 3rd Street at Brooks Street, as this route would offer the most direct path to and from downtown from the project site. Potential conflicts could arise as pedestrians use this unmarked location to cross 3rd Street's three westbound vehicular travel lanes. These conditions would be inconsistent with San Rafael General Plan 2020 Program C-4b (Street Design Criteria to Support Alternative Modes) and Policy C-11 (Alternative Transportation Mode Users).	PS	TRANS-10: The project applicants shall fund the design and construction of improvements related to the provision of a Pedestrian Hybrid Beacon, or other pedestrian crossing enhancements as deemed appropriate by the City of San Rafael Department of Public Works, at the 3rd Street and Brooks Street intersection. These improvements could include, but not be limited to, curb and roadway infrastructure work, as well as traffic and pedestrian signal modifications.	LTS	✓	✓

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

TABLE 2-1 SUMMARY OF POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Impact	Level of Significance Without Mitigation	Mitigation Measure	Level of Significance After Mitigation	Applies to BioMarin	Applies to Whistlestop/ Eden Housing
TRANS-11: Vehicles turning left from southbound Brooks Street to eastbound 2nd Street currently have limited visibility to eastbound vehicles at this side-street stop sign-controlled intersection due to the siting of the building at the northwest corner of the intersection. Southbound vehicles must proceed into the crosswalk on the north leg of the intersection, blocking pedestrian crossings, to increase the motorist's view of oncoming eastbound traffic. This condition would be exacerbated by the addition of project-related traffic, resulting in an increased potential for vehicle-vehicle and vehicle-pedestrian conflicts. This condition would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Roadway Design).	PS	TRANS-11: Vehicle travel on Brooks Street at 2nd Street shall be limited to one-way northbound/outbound only. Brooks Street at 3rd Street shall allow both inbound and outbound traffic to the driveway just south of the Whistlestop/Eden Housing project. The project applicants shall modify the project, as needed, to enable sufficient sight distance between westbound motorists on 3rd Street and northbound motorists, stopped behind a future marked crosswalk, on Brooks Street. Modifications may include, but not be limited to, building design changes, roadway curb extensions, or revisions to proposed hardscaping and/or landscaping. Any changes shall be approved by the City of San Rafael Department of Public Works.	LTS	✓	✓
TRANS-12: The two proposed exit driveways to Brooks Street, one from the Whistlestop/Eden Housing project and the other from the BioMarin project access road, would provide limited sight lines to Brooks Street. This condition could lead to increased conflicts between egressing vehicles and other travelers on Brooks Street, including vehicles, pedestrians, and bicyclists. This condition would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Roadway Design).	PS	TRANS-12: The project applicants shall install systems that provide vehicle-activated audible and visual warnings for vehicles egressing the driveways on Brooks Street.	LTS	✓	✓
TRANS-13: Emergency vehicles would have access to the project site via the Lindaro Street driveways, the 3rd Street driveway, and the southernmost Brooks Street driveway. The project applicants propose to install sliding gates across the 3rd Street and southernmost Brooks Street driveways. The gates could affect emergency vehicle access if emergency services personnel could not open the gates. These conditions would be inconsistent with San Rafael General Plan 2020 Program C-4a (Street Pattern and Traffic Flow).	PS	TRANS-13: The sliding gates at the 3rd Street driveway and the southern Brooks Street driveway shall be approved by the City of San Rafael Fire and Police Departments and shall enable access by emergency service providers.	LTS	✓	
Tribal Cultural Resources					
The project would not have any potentially significant impacts on tribal cultural resources.					
Utilities and Service Systems					
The project would not have any potentially significant impacts on utilities and service systems.					

PS = Potentially Significant; LTS = Less Than Significant; SU = Significant and Unavoidable

3. PROJECT DESCRIPTION

This chapter describes the BioMarin and Whistlestop/Eden Housing Project (“the project” or “the proposed project”) proposed for a 3.05-acre project site at 999 3rd Street in downtown San Rafael, California.

The project consists of two major developments that are proposed as one combined project application: (1) the BioMarin Planned Development Expansion (“the BioMarin project”), a proposal by BioMarin Pharmaceutical Inc. (“BioMarin”) to develop two buildings for research and development (R&D), office, and retail uses on an approximately 2.71-acre portion of the project site; and (2) the Whistlestop/Eden Housing Healthy Aging Center and Affordable Senior Housing Project (“the Whistlestop/Eden Housing project”), which would be developed by Whistlestop/Eden Housing on an approximately 0.34-acre portion of the project site that would be subdivided.[1]

Topics discussed in this chapter include the geographic setting and location of the project site, project characteristics relevant to the environmental analysis, project objectives, State of California regulatory context for the project, and permits and approvals required for the project.

3.1 PROJECT SITE AND SURROUNDINGS

PROJECT SITE LOCATION

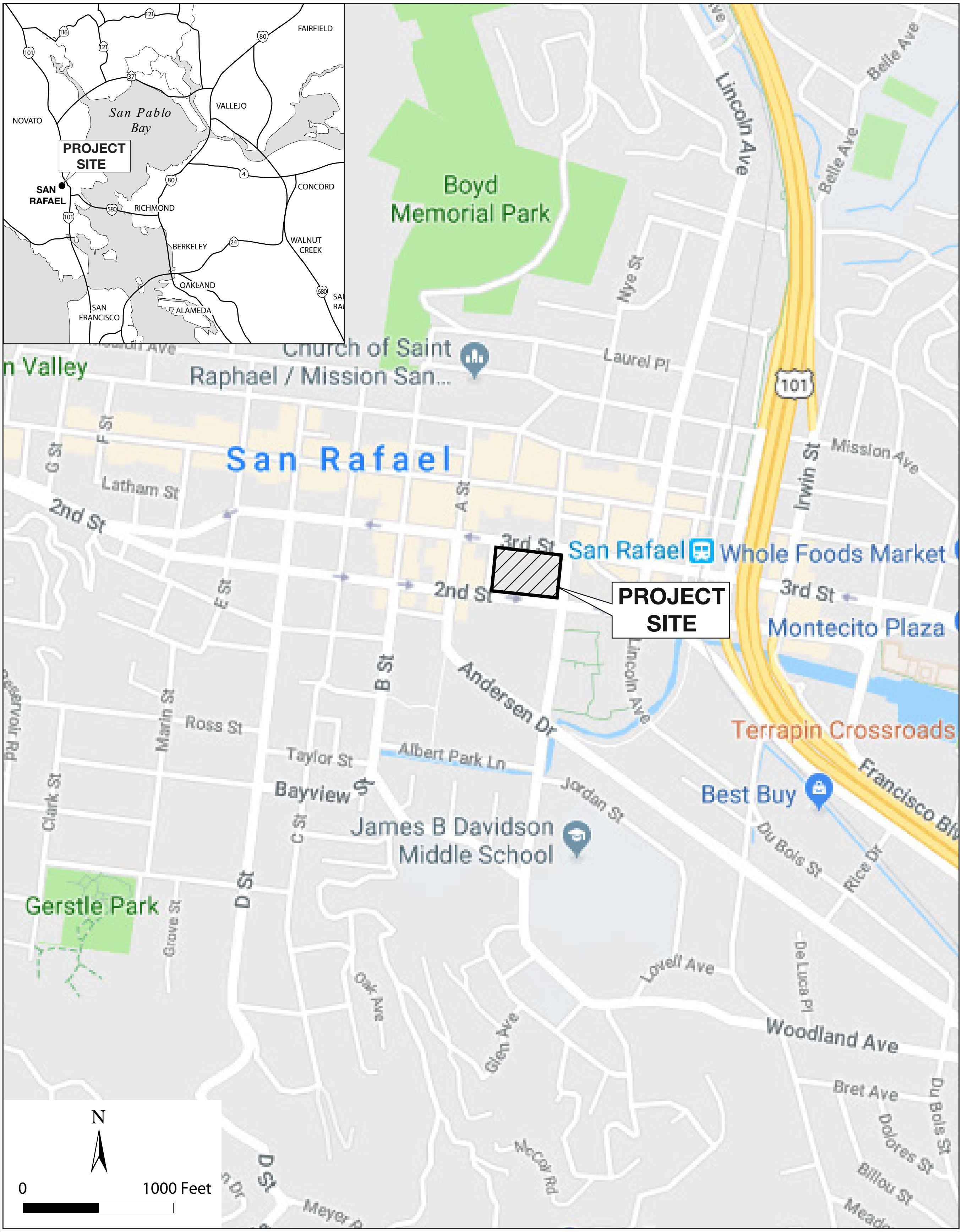
The project site is located at 999 3rd Street in downtown San Rafael. Currently, the subject property is a single, approximately 3.05-acre parcel (133,099 square feet) (Assessor’s Parcel Number [APN 011-265-01]).

The project site is located west of U.S. Highway 101 and two blocks (or a 5-minute walk) from the San Rafael Transit Center (also known as the C. Paul Bettini Transportation Center) and the Sonoma-Marin Area Rail Transit (SMART) San Rafael station. It is located immediately north of the San Rafael Corporate Center (SRCC), an approximately 15.54-acre area where BioMarin’s 400,000+-square-foot headquarters are currently located. The SRCC is a Planned Development (PD) zoning district (PD 1936).

The primary arterial roadways serving the project site are 2nd and 3rd Streets. Smaller collector streets, such as Brooks Street and Lindaro Street, intersect these one-way arterials.

The project site and surrounding areas are shown in **Figure 3-1** and **Figure 3-2**.

[1] BioMarin is providing Whistlestop with the 0.34-acre site in exchange for another parcel of land owned by Whistlestop. The land transaction is a partial land swap and a partial donation.



SOURCE: Google Maps, 2018

Figure 3-1

PROJECT AND REGIONAL LOCATION

Figure 3-2

SOURCE: Google Earth, 2018 and A. Skewes-Cox, 2018

SITE AND SURROUNDING LAND USES

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

SURROUNDING USES

The project site is located in downtown San Rafael, where the City of San Rafael's General Plan (San Rafael General Plan 2020 or the General Plan) promotes a wide variety of mixed uses and activities. Over the last several decades, San Rafael's downtown has been revitalized, with development of new buildings, redevelopment of underutilized and vacant properties, and construction of new residential units.

As shown in Figure 3-2, the project site is located directly north of BioMarin's existing SRCC campus. A Pacific Gas & Electric (PG&E) substation and multi-family residential units are located south of the project site, across 2nd Street. A commercial building and Kaiser Permanente Downtown San Rafael are located west of the project site, across Brooks Street. A parking lot and various retail establishments are located north of the project site, across 3rd Street, and various retail establishments are also located east of the project site, across Lindaro Street. Nearby commercial establishments include grocery stores and pharmacies.

The San Rafael Transit Center, located less than one-quarter mile east of the project site, has grown into a major transit hub for Marin County. The SMART rail line currently connects central San Rafael with northern Santa Rosa and the Sonoma County Airport, and a future planned extension will connect San Rafael with the Larkspur Ferry Terminus at Larkspur Landing.

Whistlestop currently operates an Active Aging Center at 930 Tamalpais Avenue, adjacent to the San Rafael Transit Center.

EXISTING GENERAL PLAN DESIGNATIONS AND ZONING

General Plan Designations

San Rafael General Plan 2020 was adopted in 2004. The Land Use Element establishes land use categories, and all proposed projects must meet density, Floor Area Ratio (FAR),[2] and other applicable development standards. The General Plan designates the project site as "Second/Third Mixed Use." This land use designation allows a gross residential density of 32 to 62 units per acre and encourages office and office-support retail and service uses. In areas east of B Street, such as the project site, residential uses are allowed as part of a mixed-use development, and limited auto-serving retail uses (such as gas stations) are also allowed.

The General Plan assigns FAR to identify appropriate intensities for commercial and industrial areas and permits FAR transfers between sites in certain circumstances. The project site is in an area where allowable FAR is 1.50.

The General Plan establishes city-wide building height limits and permits height bonuses in certain circumstances. The project site is in an area where maximum building height is 54 feet. A maximum height bonus up to 12 feet, for a total of 66 feet, is available for provision of one or more

[2] FAR is the total gross building square footage divided by the land area, exclusive of public streets. Parking areas, covered or uncovered, and non-leasable covered atriums are not included in calculating FARs.

amenities, including affordable housing, public parking, overhead crosswalks, and mid-block passageways between 4th Street and parking on 3rd Street.

The City of San Rafael is in the process of updating its General Plan. The General Plan update is referred to as "General Plan 2040." At the time of publication of this Draft Environmental Impact Report (DEIR), a draft Land Use Element and Land Use Map had not been released.

Zoning

The project site is zoned "Second/Third Streets Mixed-Use East (2/3 MUE)." The 2/3 MUE district allows general office and office-support retail and service uses, with housing encouraged for mixed-use projects. Laboratories are allowed with a conditional use permit from the Zoning Administrator. Multi-family housing is allowed as part of a mixed-use development, with an administrative use permit from the Planning Director.

The project site is immediately north of the SRCC, which is located within a Planned Development (PD) zoning district (Ordinance 1901, as amended by Ordinance 1936). The PD zoning currently allows for an office park with 473,096 square feet of building area within six office buildings approved for administrative office, general office, and R&D uses. The allowable FAR in the PD zone is 0.75, which would allow for up to 507,690 square feet of building area, and the allowable building height is 54 feet, with a 24-foot height bonus for the buildings based on public benefits provided by BioMarin. The PD zoning requires 3.3 parking spaces per 1,000 gross square feet (gsf) of building area. Within the PD zone, BioMarin currently has five existing buildings including one laboratory building, for a total existing development of approximately 400,000 square feet. In 2015, the City of San Rafael approved the addition of a four-story office building at 755 Lindaro Street and the expansion of the garage at 791 Lincoln Avenue. Once the office building is constructed, the total SRCC development would be approximately 473,000 square feet (as listed above).

PROJECT SITE OWNERSHIP AND APPLICANT BACKGROUND

BioMarin is a global biotechnology company that was founded in Marin County in 1997. BioMarin is committed to developing and bringing new treatments to market that will make a big impact on small patient populations. These patient populations are mostly children suffering from rare and ultra-rare diseases.

BioMarin purchased the project site from PG&E in 2015 to accommodate an expansion of BioMarin's existing SRCC campus located immediately south of the project site. BioMarin moved its headquarters to the SRCC in 2013 and currently owns five buildings in the SRCC, including a new research laboratory building at 791 Lincoln Avenue.

As noted above, as part of the project, BioMarin would subdivide and donate an approximately 0.34-acre (15,000-square-foot) portion of the project site to Whistlestop and Eden Housing. Whistlestop was founded in 1954 and currently operates an Active Aging Center at 930 Tamalpais Avenue, approximately one-quarter mile east of the project site. Services offered at the Active Aging Center include special needs transportation, nutrition, preventive healthcare, job training, classes and activities, multi-cultural outreach and assistance, and a comprehensive information and referral help desk. Eden Housing is a non-profit organization founded in 1968 with the intent of creating and preserving affordable housing for low-income individuals and families. Since then, Eden Housing's mission has grown to include community revitalization through an array of affordable housing development and management activities, as well as providing supportive services for residents.

3.2 EXISTING PROJECT SITE CONDITIONS

EXISTING AND PREVIOUS DEVELOPMENT

The project site is currently vacant but was originally developed as a manufactured gas plant, which operated from 1870 to 1930. The gas plant discontinued use in 1930 and was dismantled in 1960. PG&E remediated contaminated soils on the eastern 2 acres of the site from 2015 to 2017. After 2017, the project site was a largely vacant paved lot but included three unoccupied buildings on the western acre of the property. These three buildings were demolished, pursuant to demolition permits issued by the City of San Rafael, in 2018. The buildings were (1) an approximately 25,000-square-foot, two-story building constructed in 1965, formerly used as an office space; (2) an 8,300-square-foot building constructed in 1924, formerly used as a meter reader facility and warehouse (with a portion of the site previously leased for commercial parking by the Downtown San Rafael Business Improvement District); and (3) a 900-square-foot telecom building constructed in 1985.

Currently, the project site is primarily covered by asphalt pavement as part of hazardous materials remediation requirements for the site. Remediation requirements are addressed in more detail in Section 4.7, Hazards and Hazardous Materials, of this DEIR. The subject property also includes deed restrictions (July 2019) related to housing and toxic soils. These existing requirements are expected to be satisfied once the site has been remediated. Remediation efforts have been evaluated for California Environmental Quality Act (CEQA) compliance through the California Department of Toxic Substances Control (DTSC).

EXISTING LANDSCAPING AND VEGETATION

As noted above, the project site is primarily covered by asphalt pavement. Therefore, there is no native vegetation located on the project site.

3.3 PROPOSED PROJECT

PROJECT DEVELOPMENT

This section describes the major building development components of the proposed project. **Figure 3-3** shows the proposed site plan and **Table 3-1** summarizes the proposed building area.

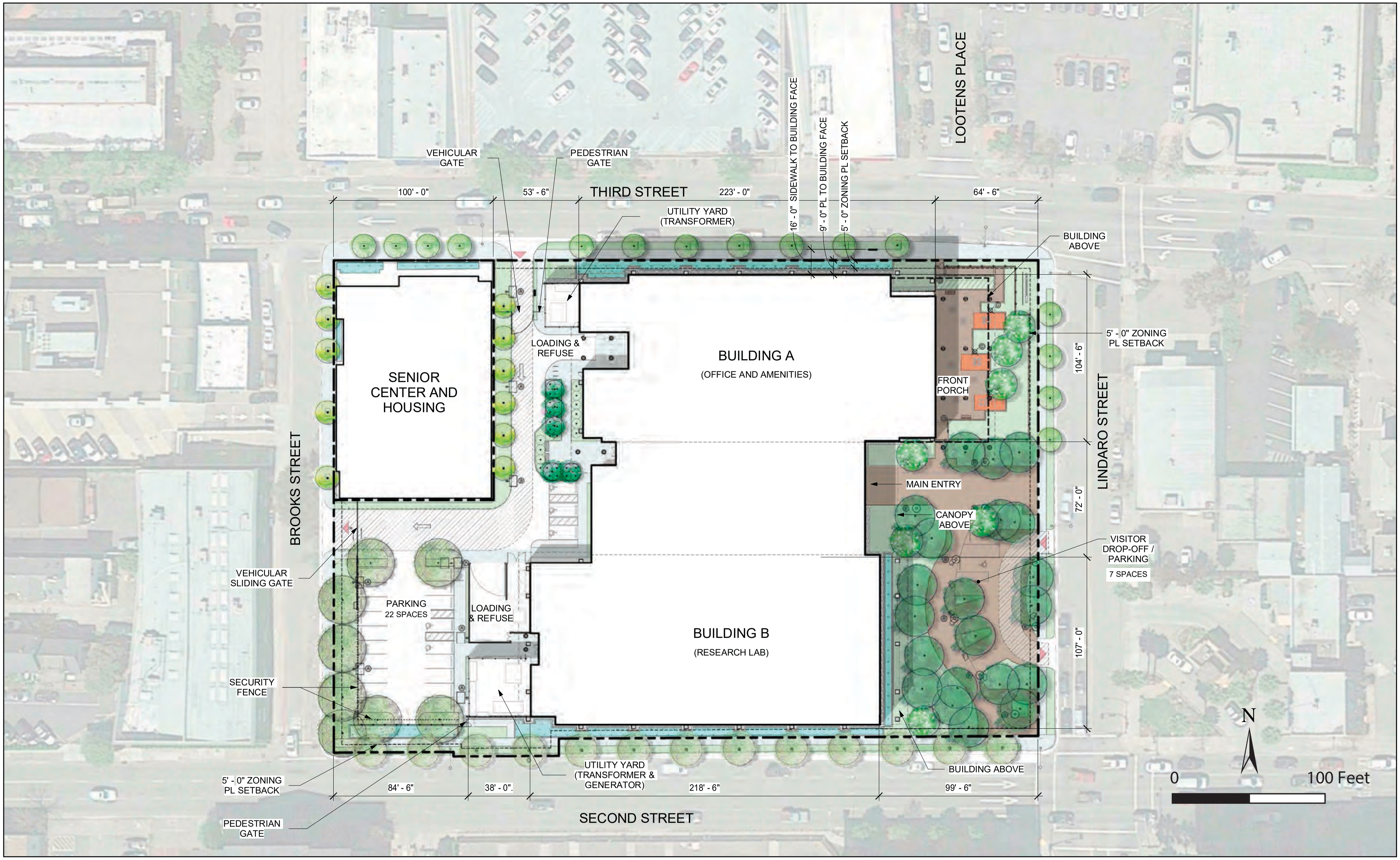


Figure 3-3

PROPOSED SITE PLAN

SOURCE: Johnson Fain, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

TABLE 3-1 SUMMARY OF PROPOSED BUILDING AREA

Project		Residential	Office	Laboratory	Amenities (Including Retail)[a]
BioMarin Building A			77,000 SF		33,000 SF
BioMarin Building B				97,000 SF	
Whistlestop/Eden Housing		67 units			18,000 SF
	Total	**67 units**	**77,000 SF**	**97,000 SF**	**51,000 SF**

Note: SF = square feet
[a] Amenities include lobbies, conference rooms, a fitness center, and dining space, and include the 3,500 SF of retail space in BioMarin Building A.
Source: Dyett & Bhatia, 2018.

Proposed Buildings and Outdoor Areas

BioMarin Project

The property owner, BioMarin, proposes to expand BioMarin's existing SRCC campus by constructing two four-story, 72-foot-tall buildings on 2.71 acres of the project site. The buildings, as measured from finished ground floor to top of the roof deck, would be 69 feet in height, but are officially considered approximately 72 feet, as measured by the 2016 California Uniform Building Code, which determines maximum height from the lowest adjacent grade 5 feet from the proposed building (at the northeast corner of the site).[3] The two buildings would contain a total of 207,000 square feet, consisting of 97,000 square feet for R&D laboratories and 110,000 square feet for offices and amenities, including 3,500 square feet of retail uses. BioMarin's buildings would each be four stories but with large floor-to-ceiling heights to accommodate infrastructure and facilities for laboratory and R&D needs.

Of the 207,000 square feet, BioMarin Building A would include approximately 77,000 square feet of office and 33,000 square feet of amenities for employees and visitors to support the BioMarin campus. Ground-floor amenities are expected to include lobbies, conference rooms, a fitness center, dining space, and approximately 3,500 square feet of retail space open to the public. In addition, BioMarin proposes to develop an adjacent landscaped plaza (approximately 6,000 square feet) that would also be open for use by the public and act as an outdoor public gathering space during daytime hours. BioMarin Building B is proposed to house 97,000 square feet of R&D laboratory space.

Whistlestop/Eden Housing Project

Whistlestop/Eden Housing would construct a third building, a six-story, 70-foot-tall integrated care senior services center and senior housing development, on a 15,000-square-foot (0.34-acre) portion of the project site at the corner of Brooks Street and 3rd Street. This building would contain

[3] Additional architectural features including mechanical enclosures and towers would extend above the maximum 72-foot height limit. In accordance with Section 14.16.120 of the San Rafael Zoning Ordinance, mechanical equipment and associated screening are excluded from the maximum height limit. Rooftop equipment would be screened according to City of San Rafael requirements.

an 18,000-square-foot "Healthy Aging Center" on the first and second floors and 67 units of affordable senior housing on the remaining floors. The total building square footage would be 74,821 square feet. The ground floor would also provide parking and required utility uses.

The Healthy Aging Center would include classrooms and meeting rooms for older adults. The Healthy Aging Center would offer improved access to affordable health care, and avenues for information and referral services and social connection.

The 67 residential units would be comprised of studios and one-bedroom units, with one two-bedroom unit provided for the manager. Each residential unit would include kitchen, bathroom, living, dining, and sleeping spaces. The units would be leased at affordable rents to seniors aged 62 and over earning less than 60 percent of the area median income. Residential amenities provided would include a community room, computer center and library, and landscaped courtyards with community gardens for seniors to grow their own vegetables and herbs.

The proposed building would house the existing services provided by Whistlestop at its Active Aging Center at 930 Tamalpais Avenue in downtown San Rafael. The 15 employees associated with the Active Aging Center would move to the new building when it is completed.

Proposed Parking

Parking for the BioMarin office and R&D uses is proposed as an amendment to existing PD zoning district requirements and would be accommodated on a campus-wide basis on adjacent BioMarin sites. Most BioMarin employees working at the project site would park at the existing BioMarin garage and surface parking south of 2nd Street, where there currently is a parking surplus. For the project site, the BioMarin project would include a visitor drop-off and parking area at the corner of 2nd Street and Lindaro Street containing 7 total spaces (including 2 Americans with Disabilities Act [ADA]-accessible spaces), and a surface parking lot containing 22 spaces (17 standard spaces and 5ADA spaces) at the corner of 2nd Street and Brooks Street.[4]

The Whistlestop/Eden Housing project's Healthy Aging Center would have 12 parking spaces located on the ground floor of the building. One of these spaces would be for the on-site residential manager. No parking would be provided for the affordable senior housing units.

PROJECT OBJECTIVES

The following are the primary project objectives as outlined by BioMarin and Whistlestop/Eden Housing:

1. Development of an underutilized vacant site in close proximity to BioMarin's existing San Rafael headquarters to accommodate BioMarin's planned expansion of its campus through the addition of a new laboratory and office space flexible in design and built in a manner that can accommodate the necessary square footage and building heights to support the R&D and laboratory infrastructure requirements needed for BioMarin's planned expansion, while also

[4] This parking would be provided at the conclusion of Phase II. With Phase I, a total of 78 surface parking spaces would be provided on the BioMarin portion of the site and could remain until Building B is completed.

accommodating the needs of Whistlestop/Eden Housing and its use of a portion of the project site for its Healthy Aging Center and affordable senior housing.

2. Provision of a new location for Whistlestop's existing Healthy Aging Center and Eden Housing's proposed senior housing that is affordable for the project and central to downtown San Rafael and public transit, and that avoids development on a site with potential historical significance that is proximate to the freeway and its associated air quality impacts.[5]

3. Development of a project that will provide enhanced pedestrian experience and safety through the connection of BioMarin's existing campus and surrounding residential communities to San Rafael's downtown corridor with the use of site setbacks and landscaping along the perimeter of the project site, as well as improved sidewalks and crosswalk design.

4. Remediation and revitalization of a brownfield site.

5. Development of signature buildings in the heart of downtown San Rafael that are reflective of the history of San Rafael and its future growth.

6. Development of a high-quality, mixed-use building comprised of a Healthy Aging Center for Whistlestop, a non-profit organization vital to the local older adult community, that will provide services for older adults in San Rafael and the greater Marin County area in a practical and cost-effective manner; and 67 affordable rental housing units for seniors in an environmentally conscious, car-free community proximately situated to public transportation and downtown businesses.

7. Promotion of San Rafael's goals of encouraging alternative modes of transportation with the donation of funds to develop of a bike lane on Lindaro Street from 3rd Street to Andersen Drive.

8. Activation of 3rd Street as a vibrant downtown corridor, in parallel to and complementing 4th Street.

9. Support for the continued growth and retention of BioMarin in San Rafael, which in turn provides local employment opportunities and significant economic benefits to the City and local businesses.

10. Support for the City of San Rafael's desire to attract and retain a growing and sophisticated work force with high-paying jobs.

11. Creation of transit-oriented development in line with the Downtown Station Area Plan's goals as well as the City of San Rafael's General Plan goals.

12. Use of larger parking structures on the perimeter of the BioMarin campus to keep the visible bulk away from major views and to reduce car trips along 2nd and 3rd Streets, while creating an environment more easily navigated by employees and visitors.

[5] The existing Whistlestop operation located at 930 Tamalpais Avenue (at 4th Street) does not include any residential units but does include activities for older adults. In 2017, a project was proposed to develop affordable housing units at that site, but it was determined that the site was not ideal for that project. Whistlestop/Eden Housing then worked with BioMarin to identify the current project site as a preferred alternative location.

PROPOSED GENERAL PLAN AMENDMENTS, ZONING CHANGES, AND DENSITY BONUSES

As part of the proposed project and as further detailed below, the existing Planned Development (PD) zoning district for the SRCC would be amended to include the portion of the project site that would contain the proposed BioMarin project. This PD amendment would allow up to 715,519 square feet of building area and a blended FAR of 0.90 across the PD zoning district, a maximum building height of 74 feet at 999 3rd Street, and modified parking ratios of 3.0 parking spaces per 1,000 gsf of office area, 1.5 spaces per 1,000 gsf of labs, and 1.0 space per 1,000 gsf of amenity area. Because the project would subdivide the 0.34-acre portion of the project site to Whistlestop/Eden Housing, this portion of the site would not be included in the amended PD zoning district; its zoning would remain 2/3 MUE. **Figure 3-4** shows the proposed amendment to the PD zoning district boundary.

Rezoning

As part of the proposed project, the 2.71-acre area where the BioMarin development would occur would be rezoned from 2/3 MUE to PD and incorporated into a new PD zoning district that also encompasses the SRCC southeast of the project site.

General Plan Amendment and PD District Amendment for Building Height

The General Plan and current base zoning of the 999 3rd Street property allow for building heights of 54 feet with a height bonus of 12 feet as identified in Exhibit 10 of the General Plan Land Use Element ("Exhibit 10") and further detailed in Section 14.16.190 of the Zoning Ordinance. The proposed project is eligible for a 12-foot height bonus based on its location in the 2/3 MUE zoning district. **Figure 3-5** shows existing allowable height bonuses based on Exhibit 10.

While the BioMarin buildings would have a proposed height of 69 feet from finished ground-level slab to the top roof deck, the proposed building heights would be approximately 72 feet as calculated from 5 feet from lowest adjacent grade to the top of the roof deck, as defined in the San Rafael Municipal Code.[6] The proposed heights of the project exceed the current 66-foot building height maximum allowed under the General Plan (54 feet with a 12-foot height bonus). As such, the project requires an amendment to the General Plan to allow for the increase in building heights.

The project includes a General Plan amendment to add the 999 3rd Street site to the list of locations in Exhibit 10 where a new height bonus would be allowed in return for provision of specified amenities and community benefits. The proposed specific addition to Exhibit 10 is shown in **Table 3-2** below.

The General Plan recognizes that flexibility is warranted when special circumstances occur. Here, a General Plan amendment to change the maximum allowable building height is necessary for the development of a biotech campus. R&D and laboratory space have greater requirements for floor

[6] The maximum physical height of the building would be approximately 72 feet. Rooftop mechanical equipment and associated screening are excluded from height calculations in accordance with Section 14.16.120 of the Zoning Ordinance.

Figure 3-4

EXISTING AND PROPOSED PLANNED DEVELOPMENT DISTRICT BOUNDARIES

SOURCE: Dyett & Bhatia, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Location	Maximum Height Bonus	Amenity (May provide one or more of the following)
Fourth Street Retail Core Zoning District	12 feet	Affordable housing Public courtyards, plazas and/or passageways (consistent with Downtown Design Guidelines) Public parking (not facing Fourth Street)
PG&E site in the Lindaro Office land use district	24 feet	Park (privately maintained park with public access, adjacent to Mahon Creek; an alternative is tennis courts tied to Albert Park.) Community facility (10,000 sq. ft. or more in size)
Second/Third Mixed Use East Zoning District	12 feet	Affordable housing Public parking Overhead crosswalks Mid-block passageways between Fourth Street and parking on Third Street
Second/Third Mixed Use West District, north of Third Street and east of C Street	18 feet	Public parking
West End Village	6 feet	Affordable housing Public parking Public passageways (consistent with Downtown Design Guidelines)
Lincoln Avenue between Hammondale and Mission Avenue	12 feet	Affordable Housing See NH-120 (Lincoln Avenue)
Marin Square	12 feet	Affordable housing
North San Rafael Town Center	24 feet	Affordable housing
Citywide where allowed by zoning.	12 feet	Hotel [1]
(1) See policy LU-20 (Hotels, Motels and Inns)		

SOURCE: City of San Rafael, 2019

Figure 3-5

ALLOWED HEIGHT BONUSES FROM LAND USE ELEMENT

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

TABLE 3-2 PROPOSED MODIFICATIONS TO GENERAL PLAN EXHIBIT 10: HEIGHT BONUSES

Location	Maximum Height Bonus	Amenity (May Provide One or More of the Following)
Fourth Street Retail Core Zoning District	12 feet	Affordable housing Public courtyards, plazas and/or passageways (consistent with Downtown Design Guidelines) Public parking (not facing Fourth Street)
999 3rd Street	*20 feet*	*Affordable housing (minimum 60 units)* *Privately owned public plaza (5,000 SF or more in size)* *Community facility (e.g., senior center, 10,000 SF or more in size)* *Pedestrian crossing safety improvements at adjacent intersections* *Donation of funds for development of bike lanes*

Notes: SF = square feet
Proposed new amenity is shown in *italics*.
Source: Dyett & Bhatia, 2018.

to floor heights (17 feet to 19 feet) than those of a traditional office building (13 feet to 14 feet) due to programmatic and equipment-related requirements. The project site is also located in a flood zone, and the ground-level slab of the proposed buildings must be raised to meet Federal Emergency Management Agency (FEMA) requirements. The proposed maximum height of 72 feet would accommodate efficient four-story R&D laboratory buildings and the specialized infrastructure they require, as well as the elevation of the ground floor at the low point of the site, in order to meet the standards for flood protection and stormwater management. The proposed General Plan amendment to allow a 20-foot height bonus would be specific to the project site and would not change the height allowances or public benefits for the main SRCC parcels.

The project also includes an amendment to the Building Height in the existing PD zoning district. The PD text amendment that accomplishes this change is to amend the “Building Height Development Standard” from “54 feet” to “54 feet, plus a 20-foot building height bonus.”

The Whistlestop/Eden Housing project would remain in the 2/3 MUE zoning district. It would not be rezoned for inclusion in the PD district and therefore would not be affected by this change. The density bonus provisions for the Whistlestop/Eden Housing project allow the proposed 4-foot height exception being requested.

General Plan Amendment and Zoning Ordinance Amendment for FAR

The General Plan and Zoning Ordinance (Section 14.16.150) allow for a maximum FAR of 1.5 on the project site, which equates to approximately 200,000 square feet of new development allowed on the site. With its donation of land to the Whistlestop/Eden Housing project and resulting smaller land area square footage for its own project, the BioMarin project would require an FAR of 1.75. However, in the context of an expanded SRCC, the overall FAR in the PD district with the BioMarin project would only be 0.90.

The project includes a proposed General Plan amendment to blend the maximum FAR across the expanded BioMarin campus so that it is 0.90 (blended), which would allow the BioMarin project to be constructed as proposed with the Whistlestop/Eden Housing project located at the northwest corner of the site (see **Table 3-3** below). The General Plan amendment would amend Exhibit 6 in the Land Use Element. The corresponding map in Section 14.16.150 of the Zoning Ordinance (Title 14 of the Municipal Code) would also be amended. This change is shown in **Figure 3-6.**

TABLE 3-3 ALLOWABLE DEVELOPMENT AT BIOMARIN'S PROPOSED EXPANDED SRCC CAMPUS WITH BLENDED FAR

Description	Site Area (SF)	Maximum Allowable FAR	Allowable Development (Building SF)
BioMarin's Existing San Rafael Corporate Center (SRCC) Campus	676,922	0.75	507,690
999 3rd Street – Entire Project Site	133,099	1.5	199,648
Total	**810,021**		**707,338**
999 3rd Street – Whistlestop/Eden Housing site (removed from calculation)	(15,000)		
BioMarin's Proposed Expanded SRCC Campus (BioMarin's existing SRCC campus + the BioMarin project)	795,021	0.90	715,519

Note: SF = square feet
Source: Dyett & Bhatia, 2018.

The applicant is proposing the following proposed provision to be added at the end of General Plan Policy LU-9, Intensity of Nonresidential Development:

> *d. Within a Downtown Planned Development, a blended floor area ratio (FAR) may be used to establish the maximum allowable floor area for nonresidential development. The maximum floor area allowed for subareas of the PD, calculated using the ratios shown in Exhibit 6, can then be combined and allocated among buildings within the PD without regard to the specific FAR for an individual building site, provided that the total allowable floor area for the PD is not exceeded.*[7]

The Whistlestop/Eden Housing project would not be rezoned for inclusion in the PD district and would not be affected by this change.

Density Bonus

The State of California requires cities to grant a density bonus for projects that include affordable housing units. A developer may receive a density bonus from 5 percent to 35 percent based on the percentage of affordable units and level of affordability provided with the project. The law also includes incentives or concessions, such as reduced building setbacks or increased building heights.

[7] Note: This proposed General Plan provision could apply to areas other than the project site. This EIR does not attempt to address the implications of applying a blended FAR elsewhere, as doing so would be speculative. It is expected that if a blended FAR is used for other future projects, the environmental review of those projects would address the potential impacts as necessary.

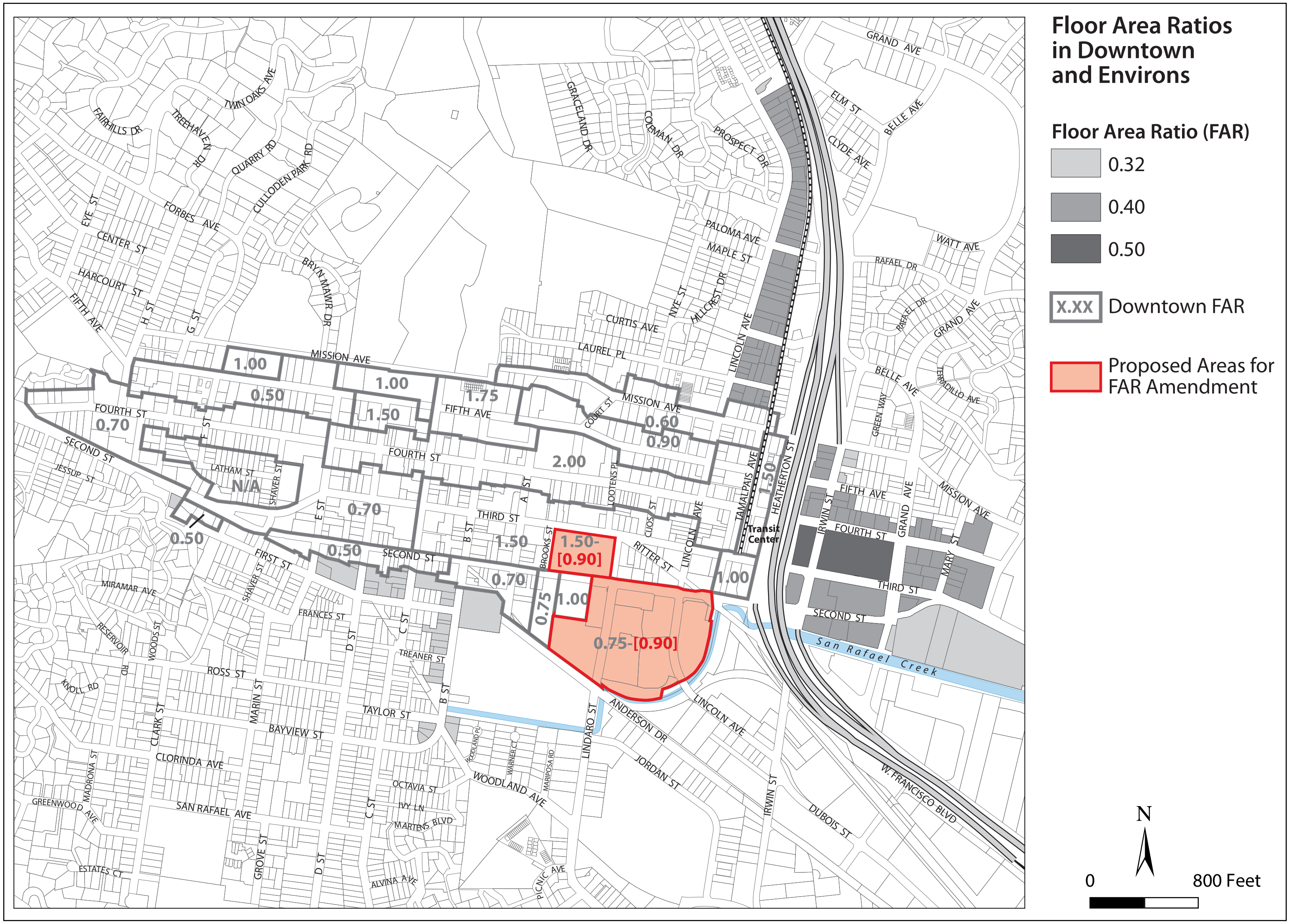


Figure 3-6

PROPOSED MODIFICATION TO GENERAL PLAN

SOURCE: Dyett Bhatia, 2019

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

The Whistlestop/Eden Housing project is eligible for a density bonus, three concessions, and waivers of development standards under State of California Density Bonus Law and corresponding provisions of the San Rafael Municipal Code because this project proposes 100 percent affordable housing units. Whistlestop/Eden Housing proposes to use the density bonus, two concessions, and one waiver of development standards to build the project.

Proposed Density Bonus and Concessions

The current 2/3 MUE zoning for the project site requires 600 square feet of lot area per dwelling unit, which would allow for 25 units on the 15,000-square-foot lot area (i.e., the 0.34-acre Whistlestop/Eden Housing portion of the project site), or 221 units on the 3.05-acre project site as a whole. Whistlestop/Eden Housing is requesting approval of 67 housing units, equivalent to about 224 square feet of lot area per dwelling unit for the 15,000-square-foot (0.34-acre) portion of the project site. Pursuant to Government Code Section 65915(f), a "base" 35 percent density bonus may be applied to the allowed maximum residential density, resulting in a "base" total of 34 units (1.35 times 25 units). To reach the 67 units proposed for this building, a concession under the State of California Density Bonus Law is also requested.

Because 100 percent of the units would be for low-income people aged 62 or older, the project qualifies for three concessions (Government Code Section 65915[d][2] and San Rafael Municipal Code Table 14.16.030-1) (City of San Rafael, 2018). Consistent with the San Rafael Municipal Code, Whistlestop/Eden Housing has provided a project pro-forma that demonstrates that the concessions would result in identifiable and actual cost reductions for the project, including construction and operating costs as addressed in the San Rafael Municipal Code, Section 14.16.030(H)(3)(b)(v). Whistlestop/Eden Housing proposes to use the density bonus and one concession to build at the proposed density, as well as one concession to build at the proposed height.

The current 2/3 MUE zoning allows for a maximum building height of 54 feet at the project site. The Whistlestop/Eden Housing project qualifies for a 12-foot height bonus for affordable housing under the City's Zoning Ordinance due to the provision of affordable senior housing. The proposed building height is 70 feet, exceeding the 66 feet allowed by right (54 feet plus 12 feet bonus). Whistlestop/Eden Housing would use an additional concession under the State of California Density Bonus Law to allow for the additional 4 feet in building height.

Proposed Waiver of Development Standards

The Whistlestop/Eden Housing project also proposes using one development standard reduction to reduce parking requirements. The application of the State of California Density Bonus Law to the parking requirements is detailed under "Density Bonus for Whistlestop/Eden Housing Parking" below.

PD District Amendment for BioMarin Parking

Existing Parking

BioMarin's existing SRCC campus is served by 1,346 parking spaces in surface lots and parking structures, as shown in **Table 3-4** below. The existing development of 400,700 square feet requires

TABLE 3-4 PROPOSED PARKING FOR BIOMARIN'S PROPOSED EXPANDED SAN RAFAEL CORPORATE CENTER (SRCC) CAMPUS

	Building Square Footage (gsf)				Number of Parking Spaces			
Item	**Office**	**Lab**	**Amenities**	**Total**	**Office**	**Lab**	**Amenities**	**Total**
Proposed Parking Ratios (Required Number of Parking Spaces per 1,000 gsf)					**3.0**	**1.5**	**1.0**	
Required Parking (Calculations Based on Building Square Footage)								
Existing Buildings								
750 Lindaro Street (Building A)	82,842	–	5,000	**87,842**	248	–	5	**253**
781 Lincoln Avenue (Building B)	71,039	–	–	**71,039**	213	–	–	**213**
770 Lindaro Street (Building C)	78,360	–	5,000	**83,360**	235	–	5	**240**
790 Lindaro Street (Building D)	71,919	–	–	**71,919**	216	–	–	**216**
791 Lincoln Avenue (Building E)	–	86,540	–	**86,540**	–	130	–	**130**
Future Development								
755 Lindaro Street	72,396	–	–	**72,396**	217	–	–	**217**
999 3rd Street (BioMarin Building A)	77,000	–	33,000	**110,000**	231	–	33	**264**
999 3rd Street (BioMarin Building B)	–	97,000	–	**97,000**	–	146	–	**146**
Subtotal	*453,556*	*183,540*	*43,000*	*680,096*	*1,360*	*276*	*43*	*1,679*
999 3rd Street Parking Exemption[a]	(43,697)	(55,507)	(18,896)	(118,100)	(131)	(83)	(19)	**(233)**
Total Required Parking	**409,859**	**128,033**	**24,104**	**561,996**	**1,229**	**193**	**24**	**1,446**
Parking Supply[b]								
Existing Parking								1,346
755 Lindaro Surface Lot[c]								(68)
788 Lincoln Garage (Phase II)								256
788 Lincoln Surface Lot								26
999 3rd Street Surface Lot[d]								29
Total Parking Supply								**1,589**
Parking Surplus								**143**

[a] Downtown Parking District exempts first 1.0 of FAR from parking requirements as addressed in Section 14.18.060 of the City's Municipal Code.
[b] For calculations of existing parking supply, see Table 6 of applicant's Project Description dated December 6, 2018.
[c] As a result of the construction of the office building at 755 Lindaro, existing parking is reduced by 68 spaces, leaving 185 surface lot parking spaces.
[d] After construction of BioMarin Building B at 999 3rd Street, surface parking would be reduced from 75 spaces to 29 spaces.
Source: Dyett & Bhatia, 2018.

1,322 parking spaces based on currently applied parking ratios.[8] Thus, the campus has an excess of 24 parking spaces, a surplus that can be seen in existing parking occupancy rates and the number of vacant parking spaces at peak times. A recently approved proposal by BioMarin for a new office/laboratory building at 755 Lindaro Street also included an expansion of the existing 788 Lincoln Avenue parking structure to serve the parking requirement that was approved for that building.

Proposed Parking Ratios (PD District Amendment)

The proposed parking scenario anticipates that the future office and R&D development on the project site would be approximately 47 percent research laboratories (97,000 gsf), 37 percent office (77,000 gsf), and 16 percent campus amenities (33,000 gsf). The project site is located within the Downtown Parking District designated by the City of San Rafael Municipal Code; as a result, the first 1.0 of FAR is exempt from parking requirements. The first 1.0 of FAR of non-residential development equates to roughly 118,099 square feet of exempted space (for the BioMarin portion of the parcel only). If BioMarin were not combined with the existing SRCC campus, the parking requirement for this new project at 999 3rd Street would result in a parking requirement of 293 parking spaces.[9] Once both Building A and B of BioMarin's project are constructed, a total of 29 parking spaces for BioMarin would be provided on the site, leaving a shortfall of 264 parking spaces if the site's parking needs were not combined with availability of parking on other SRCC sites.

Assuming the project is combined as part of the SRCC campus with an approved blended FAR of 0.90, BioMarin would only be required to provide a total of 1,446 parking spaces for the entire SRCC campus. Proposed parking for the full development of BioMarin's proposed expanded SRCC campus is also shown in Table 3-4.

BioMarin proposes setting parking ratios that are specific to each building type and function for the expanded PD district. These proposed functionally based ratios support the realistic use of parking at a biotech campus, the continued success of BioMarin's Transportation Demand Management (TDM) program, and the General Plan's goal of expanding alternatives to single-occupancy vehicles for local and regional mobility. The parking program is also informed by annual parking utilization studies conducted by Fehr & Peers since 2016. These studies have suggested that on average approximately 50 percent of parking spaces at BioMarin's facilities are vacant on a daily basis, with a 40 percent vacancy rate during peak hours. These ratios are based on both benchmarks (discussed below) and BioMarin's actual use of these spaces.

BioMarin maximizes the efficient use of its R&D lab spaces by locating most scientist offices in adjacent office buildings. As a result, if a flat parking ratio is applied to offices and labs, it will over-estimate parking needs by failing to take into consideration that most labs are used by the same employees situated in adjacent office buildings. Minimum parking is provided for the lab buildings.

[8] The existing square footage does not include the permitted but unbuilt office building at 755 Lindaro Street and the garage expansion at 791 Lincoln Avenue.

[9] The parking requirement for just BioMarin at this new site assumes elimination of 1.0 FAR from required parking. Thus, the 207,000 square feet of building area minus the 118,099-square-foot lot area results in 88,901 square feet requiring parking at a ratio of 3.3 spaces per 1,000 square feet. For the 88,901 square feet, this would be 293 parking spaces.

Additionally, campus amenity spaces such as exercise space/gym, dining areas, and large conference rooms are also used by the same employees assigned to offices and labs, thus requiring minimal additional parking.

To reduce the double counting of parking needs while offering an overall conservative amount of parking, BioMarin proposes the following parking ratios for each building type:

- Office: 3.0 parking spaces per 1,000 gsf of building area
- R&D Labs: 1.5 parking spaces per 1,000 gsf of building area
- Amenities: 1.0 parking space per 1,000 gsf of building area

Accordingly, BioMarin is proposing the following amendment for Development Standard #4 of the PD district:

> 3.0 parking spaces per 1,000 gross square feet of ~~building area~~ office buildings, 1.5 spaces per 1,000 gross square feet of lab buildings, and 1.0 spaces per 1,000 gross square feet of campus amenities.

Density Bonus for Whistlestop/Eden Housing Parking

For the Whistlestop/Eden Housing project, the San Rafael Municipal Code requires 0.75 parking spaces per dwelling unit for senior housing projects. The current zoning does not require visitor parking to be provided on-site. The Whistlestop/Eden Housing project proposes zero spaces per residential unit, with the exception of one space to be reserved for the on-site resident property manager. This proposed reduction would be a waiver of a development standard provided for under the State of California Density Bonus Law.

For the non-residential uses included in the Whistlestop/Eden Housing project, three parking spaces per 1,000 square feet of building area are required based on the requirements in the San Rafael Municipal Code Section 14.18.040 (for Downtown locations). However, the project site is within the Downtown Parking District, which discounts the first 1.0 of FAR (equivalent to 15,000 square feet for the proposed affordable housing building) and only requires parking for 3,000 square feet. Therefore, the non-residential parking required would be reduced to 10 parking spaces. Twelve parking spaces are proposed to be provided on the ground floor of the building. One parking space would be for the resident manager.

ARCHITECTURAL FEATURES

BioMarin Project

The proposed building design of the BioMarin project would use corner and cantilever elements that frame the site. Buildings would be clad with glass to maximize natural light and views outward from the site. Window overhangs on south facades would create shading over windows and glass areas. An architectural "shading skin" is proposed on the east and west facades to protect these areas from heat gain.

BioMarin Building A and BioMarin Building B would each be 69 feet (four stories) in height from finished ground floor to top of roof deck, however, these buildings would be closer to 72 feet, as measured by the 2016 California Uniform Building Code. BioMarin Building A would have approximately 262 feet of frontage on 3rd Street and 180 feet of frontage on Lindaro Street. BioMarin Building B would have approximately 244 feet of frontage on 2nd Street and 109 feet of frontage on Lindaro Street.

The preliminary design includes extra-tall floorplates of 17 feet to accommodate the specific needs of BioMarin laboratory spaces. Additional architectural features including mechanical enclosures and towers would extend above the maximum 72-foot height. Rooftop equipment would be screened according to City of San Rafael requirements.

The BioMarin project would provide a setback and green space along Lindaro Street to address pedestrian scale and provide a focal entry to the site. A visitor drop-off and parking area at the corner of 2nd Street and Lindaro Street is designed to provide a clear entry to the building. An architectural cantilever feature for Building A at the corner of Lindaro Street and 3rd Street would create a "front porch" of open space used for employee activities. This open area is designed to connect the site to downtown. A mid-level rooftop space between the BioMarin buildings and the Whistlestop/Eden Housing project and the additional setback on the upper floor of BioMarin Building A are proposed to set back the BioMarin buildings from the senior residences and to provide natural light.

Both BioMarin buildings would be set back from 2nd Street and 3rd Street to help create a pedestrian scale and would provide a landscaped street edge. A proposed rooftop deck between the buildings (above the first floor) would be used for employee gatherings and daytime activities including seating for eating periods. Both buildings would be oriented with the long east/west axis of the project site to maximize energy savings. **Figure 3-7** provides a schematic of BioMarin Building A as seen from 3rd Street. **Figures 3-8** and **3-9** provide elevations for the BioMarin buildings.

Whistlestop/Eden Housing Project

The Whistlestop/Eden Housing project design is a contemporary/traditional building form consisting of a base, a middle, and a top. The building's two-story base would be dominated by divided horizontal windows, with decorative mullions (see the building rendering in **Figure 3-10**). The four residential floors would have vertically proportioned and scaled massing, with the corner mass highlighted by a change in material and color. The entrance and lobby created by an arcaded walk would allow for a ramp to the raised floor elevation above the area's base flood elevation. The lobby would have a glass storefront entry that would extend through each floor of the building, providing natural light to the lobby. The building would be designed to meet Green-Point Rated or Leadership in Energy and Environmental Design (LEED) standards of sustainability, with reduced energy and water use. Elevations for the Whistlestop/Eden Housing project can be seen in **Figures 3-11** and **3-12**.

ENERGY EFFICIENCY FEATURES

Energy Efficiency Features Included in BioMarin Project

The design of the proposed BioMarin project is intended to meet State of California Title 24 energy conservation requirements. The building exterior would consist of a curtain wall system with an

Figure 3-7

SCHEMATIC FOR BIOMARIN BULDING A
(AS SEEN FROM 3RD STREET AND LINDARO STREET)

SOURCE: Johnson Fain, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

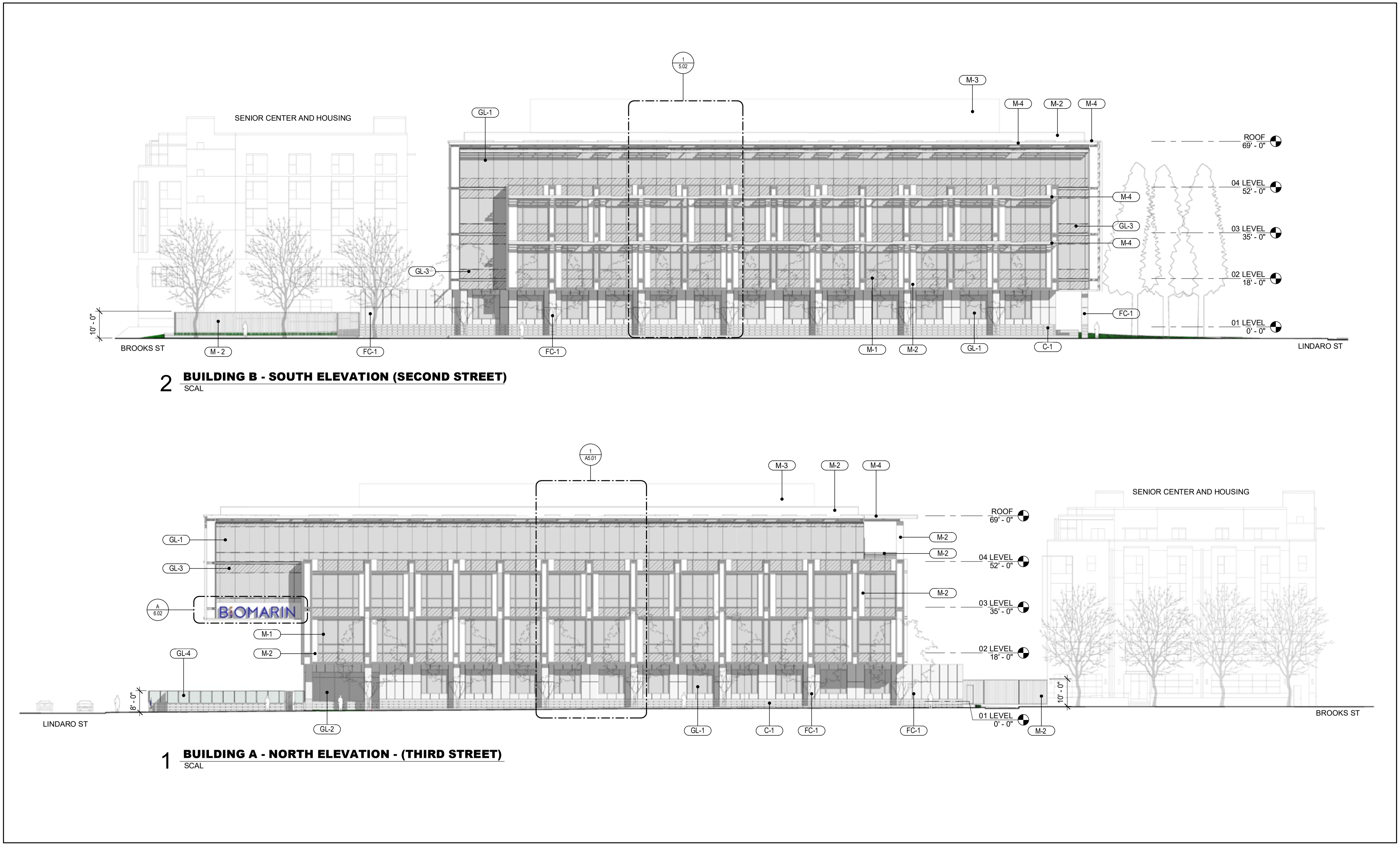
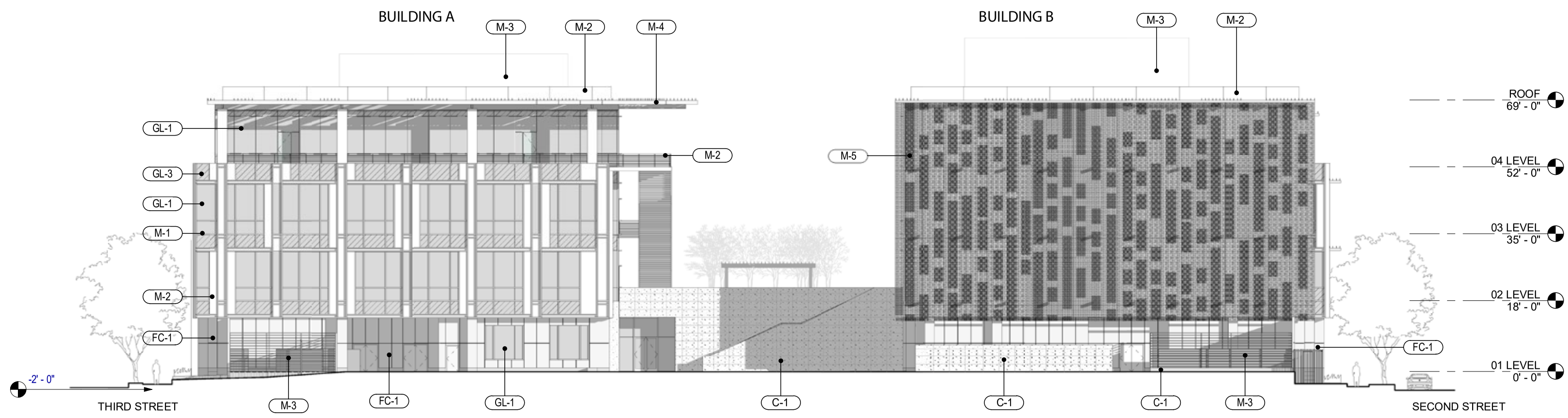


Figure 3-8

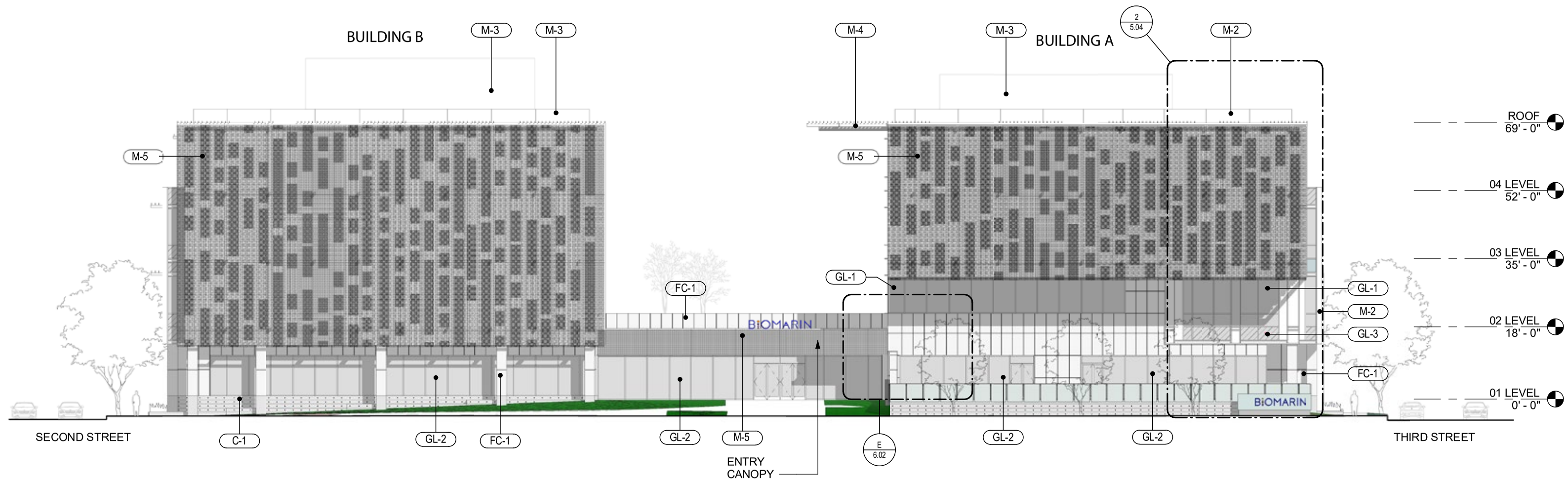
SOURCE: Johnson Fain, 2018

SOUTH AND NORTH ELEVATIONS FOR BIOMARIN BUILDINGS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING



2 WEST ELEVATION - (BROOKS STREET)



1 EAST ELEVATION - (LINDARO STREET)

Figure 3-9

SOURCE: Johnson Fain, 2018

EAST AND WEST ELEVATIONS FOR BIOMARIN BUILDINGS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Figure 3-10

SCHEMATIC OF WHISTLESTOP/EDEN HOUSING BUILDING
(AS SEEN FROM CORNER OF BROOKS STREET AND 3RD STREET)

SOURCE: Van Meter Williams Pollack, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Figure 3-11

NORTH (3RD STREET) ELEVATION FOR WHISTLESTOP/EDEN HOUSING BUILDING

SOURCE: SOURCE: Van Meter Williams Pollack, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Figure 3-12

SOURCE: Van Meter Williams Pollack, 2018

WEST (BROOKS STREET) ELEVATION FOR WHISTLESTOP/EDEN HOUSING BUILDING

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

energy-efficient, dual-paned glazing system. A perforated metal screen would be provided on the east and west facades to help reduce heat gain and glare, thereby reducing the energy demand of electrical and mechanical loads. An exterior shade trellis would be provided on the south façade to shade the façade as well as the rooftop patio. Exterior finishes at the ground and rooftop patio levels have been selected to provide permeability through both paving and ground covering (BioMarin and Whistlestop/Eden Housing, 2019).

Additional energy-saving elements included in the proposed BioMarin project include the following (BioMarin and Whistlestop/Eden Housing, 2019)**:**

- High-performing envelope including sun and head shading proposed in design.
- Efficient heating, ventilation, and air conditioning (HVAC) and domestic hot water design; fan and duct layouts that incorporate low static and efficient motor designs; condensed domestic and space heating hot water boilers.
- LED lighting throughout, with occupancy and daylighting sensors.
- Heat recovery systems for high ventilation areas.
- Energy Star and efficient lab equipment; consolidated equipment areas to reduce total plug load infrastructure.

Energy Efficiency Features Included in Whistlestop/Eden Housing Project

Energy-saving elements in the proposed Whistlestop/Eden Housing project would include the following (BioMarin and Whistlestop/Eden Housing, 2019)**:**

- Exterior sunshades.
- Exterior envelope designed to meet Title 24 requirements.
- Efficient heating, ventilation, and air conditioning (HVAC) and solar thermal domestic hot water design.
- Efficient LED lighting; sensor lighting.
- Energy Star appliances in residential and common kitchens.

Possible Future Solar Roof Systems

All buildings in the proposed project would be designed to accommodate solar roof systems at some point in the future. Proposed roof designs account for these possible future systems.

SITE ACCESS AND CIRCULATION

Parking and Loading Areas

While parking for the BioMarin project would be accommodated on a campus-wide basis on adjacent BioMarin sites, the project site would include on-site parking. Prior to development of BioMarin Building B, the project site would include 78 surface parking spaces for the BioMarin project (see **Figure 3-13**, which illustrates Phase I of the project). After development of BioMarin Building B, the BioMarin project would have a total of 29 surface parking spaces. Twenty-two surface parking spaces (17 standard spaces and 5 ADA-accessible spaces) would be located at

SOURCE: Johnson Fain, 2018

Figure 3-13

PHASE I SITE PLAN

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

the southwest corner of the project site. Cars using these surface parking spaces would enter from 3rd Street, travel south to the parking area, and exit onto Brooks Street. The BioMarin project would also include a visitor drop-off and parking area with a total of 7spaces (5 standard spaces and 2 ADA-accessible spaces) at the corner of 2nd Street and Lindaro Street.

The Whistlestop/Eden Housing project would include 12 ground-floor parking spaces for employees and guests. One of these spaces would be for the resident on-site manager. Cars would have access to these spaces via ingress and egress points on Brooks Street. A van service (Whistlestop Wheels Paratransit, which would provide connections to transit) would have access at the ground-floor interior parking area.

Loading and refuse areas would be adjacent to an internal “alley.” Garbage trucks would enter the project site from 3rd Street and exit on Brooks Street.

Vehicular Access

Access to the proposed project would be provided from six unsignalized driveways. One-way driveways on Lindaro Street would provide access to the east side of the BioMarin project, and a one-way entrance driveway from 3rd Street and an exit driveway to Brooks Street would provide access to the west side of the BioMarin project. In the Whistlestop/Eden Housing project, parking on the building’s ground floor would have access from one-way driveways on Brooks Street.

Emergency Vehicle Access

The proposed project would not include emergency services or overnight hospital-related uses. As such, there is no dedicated emergency response access area. In case of emergency, emergency vehicles would have access to the project site using the Lindaro Street driveways, the 3rd Street driveway, and the southernmost Brooks Street driveway. The 3rd Street driveway and Brooks Street driveway would be gated.

Pedestrian and Bicycle Access

Pedestrians would have access to the BioMarin project from Lindaro Street. The crosswalk at 2nd Street and Lindaro Street would be an important pedestrian connection for the proposed project, because it would connect the project site to BioMarin’s existing SRCC campus and the existing BioMarin parking garages to be used by BioMarin staff at the project site. Pedestrian access to the Whistlestop/Eden Housing project would be from 3rd Street. Four bicycle racks are planned at BioMarin on Lindaro Street and a bicycle storage room accommodating up to 34 bicycles is planned on the first floor of Building A. For Whistlestop/Eden Housing, four bicycle racks are proposed for the 3rd Street side of the building, and a bicycle storage room for six bicycles would be available on the first floor.

Transit Access

The project would have access to existing bus service provided at the San Rafael Transit Center on Tamalpais Avenue approximately two blocks (800 feet) east of the project site. A total of 13 Marin Transit routes, eight Golden Gate Transit routes, and one Sonoma County Transit route currently serve the transit center. Greyhound also serves the center, as do airport bus companies and taxis. The transit center is well equipped with shelters and benches. The Golden Gate Bridge, Highway and Transportation District is developing plans to build a new transit center that would be better able to accommodate buses and trains.

The SMART San Rafael station is also located approximately two blocks or 950 feet east of the project site. The train provides service to cities and other destinations to the north, including Novato, Petaluma, Santa Rosa, and the Sonoma County Airport. SMART operates 34 daily weekday trains and 10 daily trains on weekends and holidays. Weekday trains operate every 30 minutes in each direction from about 5:30 to 10:00 AM and 3:30 to 9:30 PM, with limited midday service. Construction work is underway on the SMART Larkspur extension.

Delivery Access

BioMarin Building A and BioMarin Building B would have delivery access off 3rd Street. The loading areas and delivery access are designed to accommodate turning movements of anticipated 10-foot-by-35-foot delivery trucks.

Transportation Demand Management Program

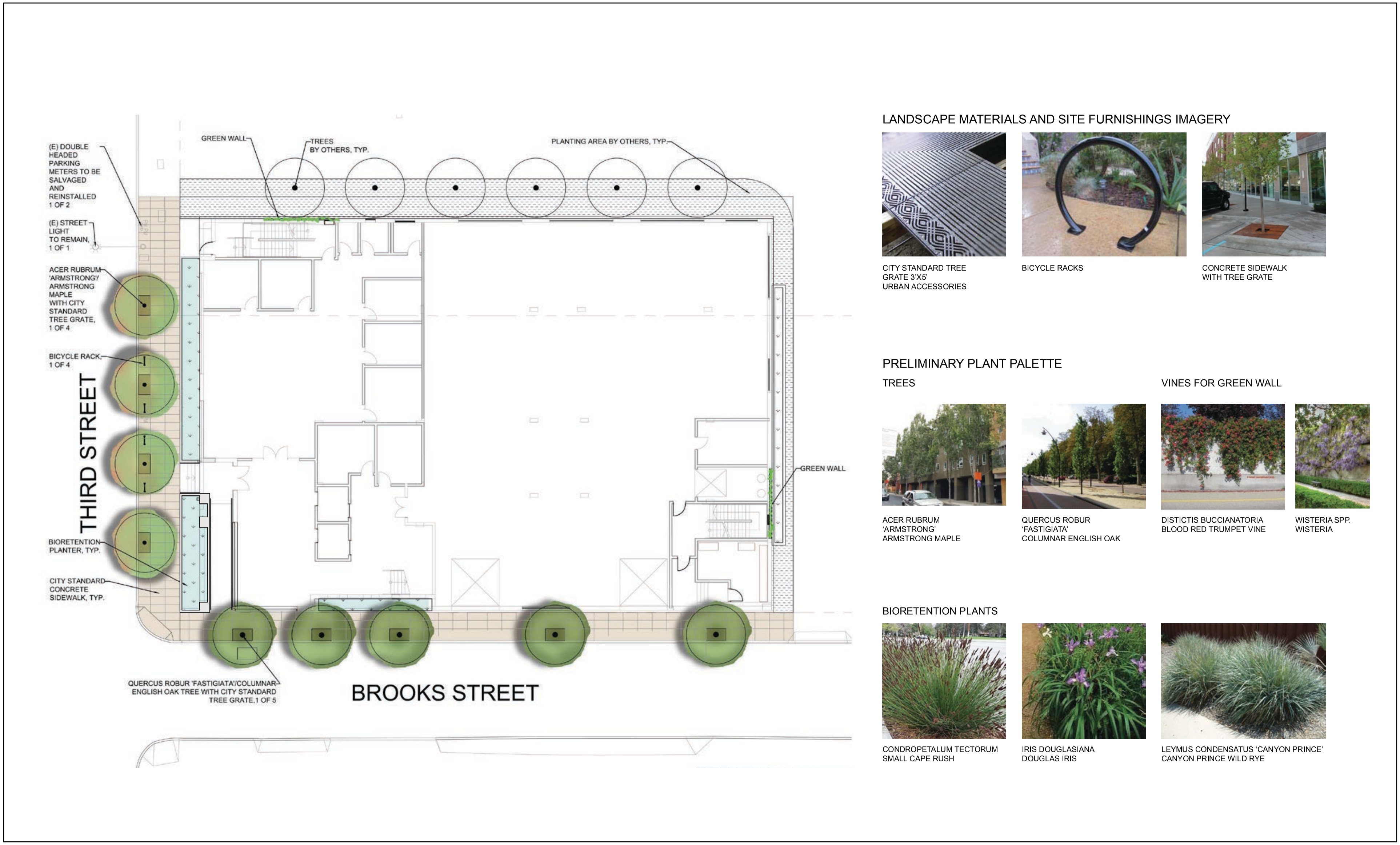
The current TDM program for BioMarin's existing SRCC campus provides for flexible work hours, working from home or from satellite offices (telecommuting), supporting employees for carpool and vanpool through an internal website with easy access to external resources, and options to support employees' use of public transportation. Additionally, BioMarin's existing SRCC campus provides large secure bike storage areas and shower facilities to support and encourage bicycle commuting. Campus and nearby downtown amenities such as food and services minimize the need for daytime driving and, therefore, individual cars on campus.

LANDSCAPE CONCEPT

Current zoning requirements applicable to the project site require that at least 10 percent of the site be landscaped. Proposed landscape plans are shown in **Figures 3-14** and **3-15.**

Landscaping with shrubbery and trees would be provided along the 3rd Street frontage in the 5-foot front yard setback. Four Armstrong maple trees would be planted along 3rd Street and five English oak trees would be planted along Brooks Street. A bioretention planted area would abut the north edge of the Whistlestop/Eden Housing project along 3rd Street, planted with low shrubbery such as Douglas iris and small Cape rush. Tree grates would be provided at the base of new street trees. A "green wall" would be provided on the east side of the Whistlestop/Eden Housing building and six additional trees (expected to be Columnar English Oak trees) would be planted on this side of the building.

For the BioMarin project, street trees would be planted along 3rd Street, Lindaro Street, and a limited number on 2nd Street. Street trees would include Armstrong maples on 3rd Street and Lindaro Street, and Columbia London Plane trees. Internal to the project site, additional trees would be planted within the interior surface parking area at the south end of the site. These would include Coast live oak trees. Additional trees would be planted at the eastern edge of the site in the visitor drop-off/parking area and the northeast plaza area. These would include Kousa dogwoods,

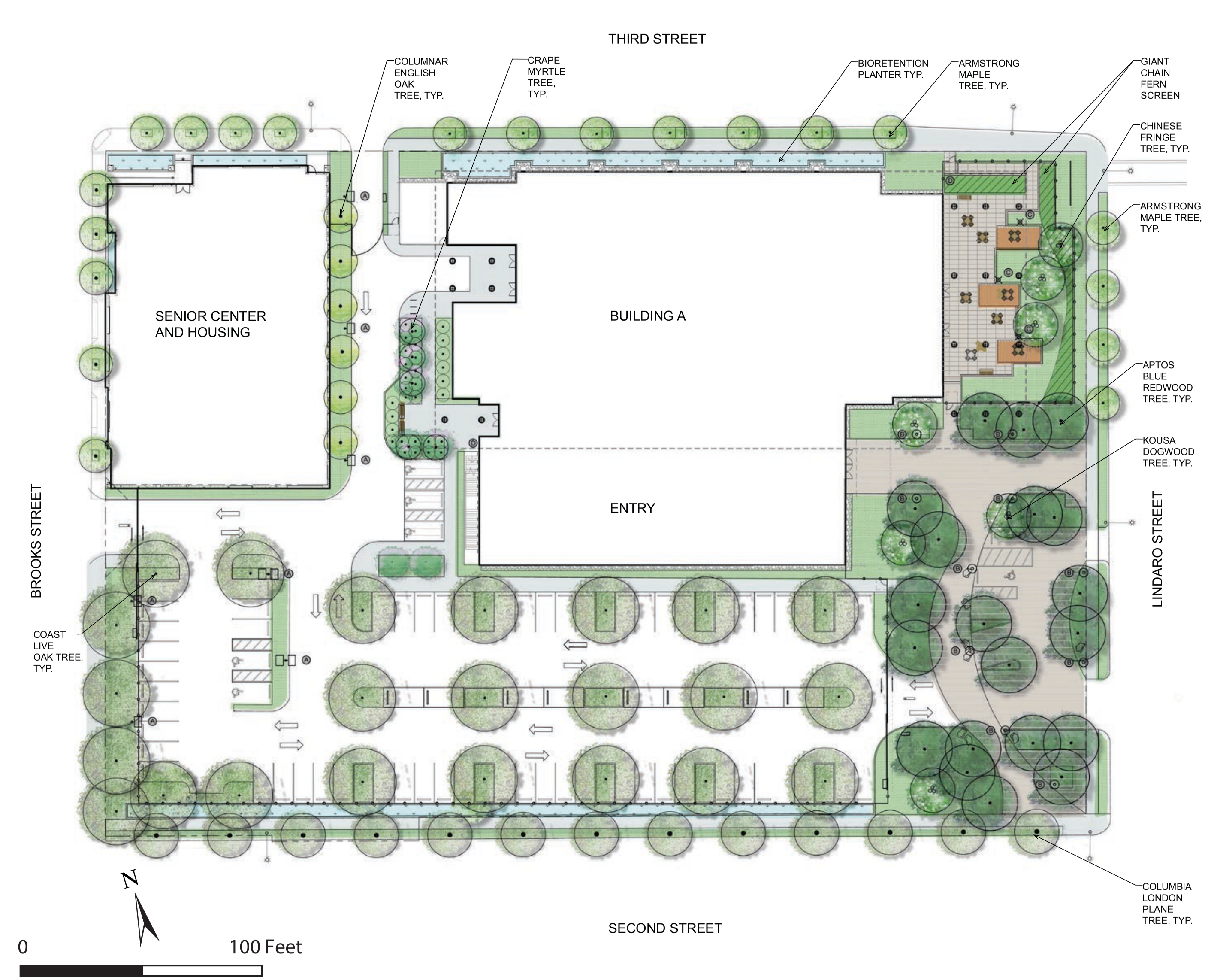


SOURCE: MPA Design, 2018

Figure 3-14

CONCEPTUAL LANDSCAPE PLAN FOR WHISTLESTOP/EDEN HOUSING

AMY SKEWES~COX
ENVIRONMENTAL PLANNING



PLANTING NOTES FOR GROUND LEVEL

1. LANDSCAPE ZONES, NOT INCLUDING REDWOOD FOREST, SHALL RECEIVE BETWEEN12-18" OF IMPORTED TOPSOIL.
2. REDWOOD FOREST SHALL RECEIVE 24" OF IMPORTED LOAMY SANDY SOIL.
3. BIORETENTION PLANTING TO RECEIVE 18" OF IMPORT BIORETENTION SOIL MIX.
4. TOTAL LANDSCAPE AREA IN SQUARE FEET FOR PHASE 1 GROUND FLOOR IS APPROXIMATELY17,651 SF WITHIN THE PROPERTY LINE.

SOURCE: MPA Design, 2018

Figure 3-15

LANDSCAPING PLAN FOR PHASE I OF BIOMARIN PROJECT

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Aptos Blue Coast redwood trees, and Chinese fringe trees. Crape myrtle trees would be planted at the western edge of BioMarin Building A near the alley. Construction of BioMarin Building B would require removal of surface parking area trees in the location of the building, but landscaping would remain otherwise unchanged (see Figure 3-15).

For the Whistlestop/Eden Housing project, an approximate 1,500-square-foot landscaped courtyard (above the second floor) would provide the landscaping required to meet the San Rafael Municipal Code.

The proposed project would reduce landscape water demand by installing permeable paving that adds water to the subsoil for all landscape trees east of the new buildings. The project site would also be furnished with complete automatic remote-control irrigation system with Model Water Efficient Landscape Ordinance (MWELO)-compliant irrigation flow sensors, valves, and controllers. Equipment would be compatible with any future reclaimed water source.

SIGNAGE

The proposed project would include an updated signage program that would be consistent with BioMarin's branding and color scheme and would be subject to approval by the City of San Rafael. The signage program would include specific wayfinding and informational signage consistent with the BioMarin theme. Illuminated signage stating "BioMarin" would be located on both Lindaro Street at the northeast corner of the site and on 3rd Street on the north side of BioMarin Building A, as shown in Figure 3-7. The number "999" would be illuminated in large numbers on the east elevation of Building A at the height of the second floor. Signage on the BioMarin buildings would be provided at the entrance of the building at the northwest corner of the site.

LIGHTING CONCEPT

For the BioMarin project, illumination would be provided by 20-foot-tall light-emitting diode (LED) driveway and parking lot lights west of BioMarin Buildings A and B, and in the west and south parking lots. The south parking lot would only exist until Building B is developed. The visitor lot and main entry plaza east of the buildings would be illuminated by 16-foot-tall LED fixtures. The loading dock and entry located on the west side of BioMarin Building A would be illuminated with down lights in the building overhang.

For the Whistlestop/Eden Housing project, lighting would primarily be internal lighting for the Healthy Aging Center, public use spaces, garage, and residential units. Some external lighting would be mounted on the building to help light the adjacent sidewalk areas. The interior lighting would be high-efficacy LED lighting, complying with Title 24 requirements. Daylight sensors, occupancy sensors, and watt stoppers would also be provided at the senior services areas as required. The proposed lighting would be contained within the building and/or mounted on the building exterior facades. The front entry stairs and ramp would be lit from the ceiling soffit above.

The sidewalks along 2nd Street, 3rd Street, Lindaro Street, and Brooks Street would remain illuminated by the existing "cobra head" City street lights. The ramped walkway to the public right-of-way on 3rd Street would be illuminated with LED wall/step lights built into the retaining walls. The raised plaza east of BioMarin Building A would be illuminated with light bollards and down lights in the building overhang.

Additionally, the roof garden would be illuminated with a combination of LED bollard lights, down lights in the overhead structure at each building entrance, and stair railing lights. The trellis structure would have integral overhead strip lighting.

GRADING AND UTILITIES

Excavation Volumes and Off-Haul of Soil

The project site is relatively flat and was recently paved in connection with PG&E's remediation. About 1,370 cubic yards of off-haul of soil is anticipated to be required in connection with development of the proposed project as shown in the proposed grading plan.

Utilities

For the BioMarin project, a new on-site gas service would be installed to provide gas to the buildings, and a new on-site generator would be installed for emergency power use. The following additional utility connections are proposed for the BioMarin project:

- A fire water connection into the existing 6-inch line running along 3rd Street;
- Stormwater connections into the existing 24-inch line running along 3rd Street;
- A sewer connection into the existing 12-inch sewer line running along 3rd Street;
- A domestic water connection to existing 6-inch water line along 3rd Street; and
- A backflow preventer at the northwest corner of BioMarin Building A.

For the Whistlestop/Eden Housing project, PG&E would provide a new gas underground connection/service. A transformer would be provided to serve the building without affecting electrical facilities in the vicinity. The following additional utility connections are proposed for the Whistlestop/Eden Housing project:

- A fire water connection into the existing 6-inch line running along 3rd Street;
- Stormwater connections into the existing 24-inch line running along 3rd Street;
- A sewer connection into the existing 12-inch sewer line running along 3rd Street;
- A 6-inch water main extension for domestic water from the southwest corner of the Whistlestop/Eden Housing site, connecting to the existing 6-inch water line along 3rd Street;
- A new electrical transformer at the southwest corner of the site, next to the electrical room;
- A new gas meter location at the southwest corner of the site; and
- A back-flow preventer at the southwest corner of the building, and a fire water back flow preventer at the northeast corner of the building. Both locations would be within alcoves, providing screening and unobstructed sidewalk access.

Storm Drainage and Stormwater Control Concept

The project site is currently paved with asphalt. Development of the proposed project would not increase impervious surface area compared to baseline conditions.

Development of the project site requires implementation of stormwater quality BMPs, and compliance with Construction General Permit Order No. 2009-009-DWQ, including preparation of a Storm Water Pollution Prevention Plan (SWPPP). The proposed project would also comply with the City of San Rafael Urban Runoff Pollution Prevention Ordinance requirements, including implementation of construction-phase BMPs to prevent discharge of construction wastes or contaminants from entering the storm drain system or watercourse and any permanent structural controls required as a condition of approval.

The proposed project includes stormwater quality facilities, including pervious concrete pavers and numerous bioretention facilities within both the BioMarin project and the Whistlestop/Eden Housing project, including bioretention facilities that would collect roof water (see **Figure 3-16**). All trees installed in the bioretention areas would be based on Low-Impact Development (LID) standards or approved by the City Engineer. Stormwater that collects on the project site would drain to these bioretention areas and eventually drain to the City's stormwater collection system, which carries stormwater to San Francisco Bay.

Erosion and Sediment Control

The proposed project's earthwork activities and design are intended to minimize erosion and to promote sediment control. Development would comply with BMPs, including for erosion and sediment control, and any City of San Rafael Urban Runoff Pollution Prevention Ordinance requirements for erosion and sediment control and pollution prevention during construction and operation. The proposed project would include both temporary and permanent erosion and sediment control measures in compliance with County of Marin and State Regional Water Quality Control Board (RWQCB) standards, including SWPPP requirements. The proposed project's erosion and sediment control measures include but are not limited to directing storm water runoff to streets or inlets, and ultimately to the City-maintained storm drain system; using erosion control blankets (or equivalent) and fiber rolls; and using storm inlet protection throughout the project site.

CONSTRUCTION ACTIVITIES AND TIMING

Construction of the project would occur over an approximately 8- to 10-year period, beginning in approximately 2020 and concluding in approximately 2028. Depending on market conditions, construction is anticipated to occur as follows:

<u>Phase I</u>:

- Construction of the Whistlestop/Eden Housing project is anticipated to occur over an approximately 18-month period beginning in 2021 and concluding in 2022.
- Construction of BioMarin Building A is anticipated to occur over an approximately 18-month period beginning in 2022 and concluding in 2023.

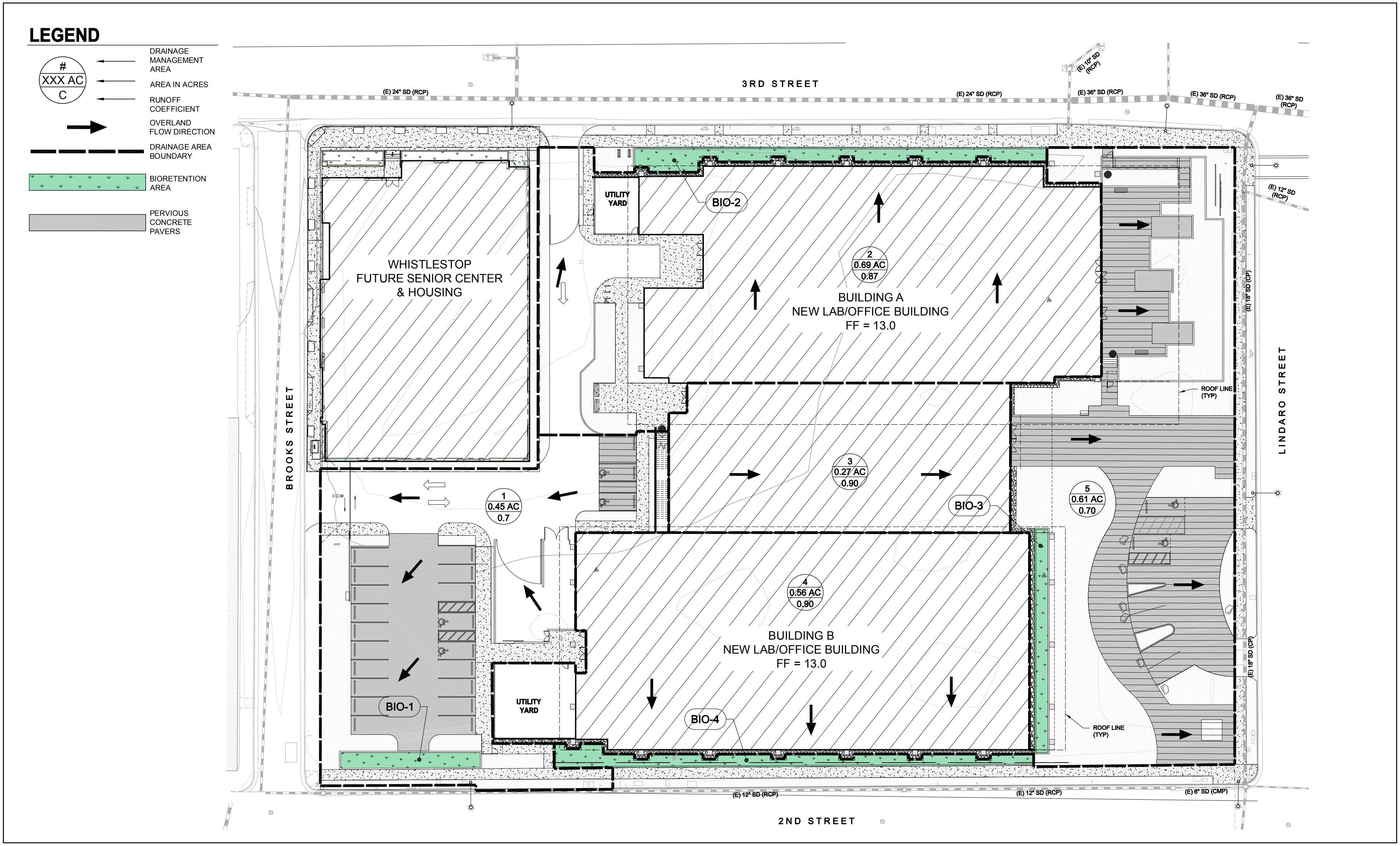


Figure 3-16

CONCEPTUAL STORMWATER MANAGEMENT PLAN

SOURCE: CSW|ST2, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Phase II:

- Construction of BioMarin Building B is anticipated to occur over an approximately 24-month period beginning in 2026 and concluding in 2028.
- Construction techniques may include use of deep foundation alternatives, such as drilled piers and torque-down piles.

Construction would comply with San Rafael Municipal Code Section 8.13.050, which limits construction activity to 7:00 AM to 6:00 PM, Monday through Friday, and 9:00 AM to 6:00 PM on Saturday. Exceptions can occur if a request is made and approved by the Chief Building Official. No construction is allowed on Sundays or holidays.

ON-SITE EMPLOYEES AND RESIDENTS

The Whistlestop/Eden Housing project would have approximately 80 residents (in a total of 67 units) and 17 employees who would work at the Healthy Aging Center, Monday through Friday from 8:00 AM to 5:00 PM, Monday through Friday. Ten of these employees would move from the existing Whistlestop building on Tamalpais Avenue.

The BioMarin project would have up to 550 employees who would work on the site generally from 8:00 AM to 5:00 PM, with some employees working outside of these standard work hours. Of the approximately 550 employees, about 140 employees would use the R&D areas, 400 employees would be in the office areas, and 10 employees would be in the retail area. There would not be nighttime shifts for employees. Public use could occur in the retail space on the site (3,500 square feet) and the public plaza area. It is estimated that additional members of the public could use the BioMarin retail space during various times of the day.

3.4 PROJECT ENTITLEMENTS AND APPROVALS

LEAD AGENCY

The City of San Rafael is the Lead Agency responsible for preparing this DEIR in accordance with CEQA Guidelines Section 15051.This DEIR provides CEQA clearance for discretionary actions required to authorize development of the proposed project. As the CEQA Lead Agency, the City of San Rafael would make decisions on the following discretionary actions (and other considerations and approvals):

- Certification of the Final Environmental Impact Report (FEIR), including findings required by CEQA;
- Approval of the Mitigation Monitoring and Reporting Plan (MMRP); and
- Project approval, including project entitlements.

CITY-REQUIRED PROJECT APPROVALS AND PERMITS

Applications have been submitted to the City of San Rafael for (1) Major Environmental and Design Review Permit for the new R&D and senior housing buildings; (2) a rezoning to revise the PD zoning that applies to the SRCC; (3) PD district, General Plan, and Zoning Ordinance text and map amendments to allow for changes to maximum building heights and maximum FAR; and (4) a Use Permit to allow modification as described below. The proposed project may also require approvals and permits from local, state, and federal agencies.

The proposed project requires the following zoning entitlements and land use approvals from the City of San Rafael:

- Subdivision of the project site to create a separate 0.34-acre parcel for Whistlestop/Eden Housing.
- Project approval of proposed density bonus concessions.
- A General Plan amendment to allow for a maximum building height of 74 feet on the project site. The General Plan amendment includes a modification of the height bonus specific to dedication of public benefits.
- A General Plan amendment and Zoning Ordinance amendment to modify the FAR of the project site and the adjoining SRCC to allow for a 0.90 FAR across the PD district.
- Rezoning to expand the existing PD district that applies to the SRCC to encompass the 2.71-acre portion of the project site not being developed by Whistlestop/Eden Housing (see Figure 3-4).
- A PD amendment to modify building height, FAR, and parking requirements and development standards for the SRCC PD district.
- A Major Environmental and Design Review Permit for the new R&D and senior housing buildings.
- A Use Permit to allow phasing of the project, laboratory uses for the new development, and residential uses in a commercial (2/3 MUE) zoning district.
- Sign program.

While not required, BioMarin has also applied to enter a Development Agreement with the City.

RESPONSIBLE AND TRUSTEE AGENCIES

Under CEQA Guidelines Section 15381, "Responsible Agencies" include "all public agencies other than the Lead Agency which have discretionary approval power over the project." Under CEQA Guidelines Section 15386, a "Trustee Agency" is a "state agency having jurisdiction by law over natural resources affected by the project which are held in trust for the people of the State of California." Currently, there are no federal agencies that are anticipated to have permitting authority over the proposed project. State and other agencies that could potentially issue permits or approvals for the proposed project and therefore may also consider this EIR in their review and decision-making processes include, but are not limited to, the following:

- California Department of Toxic Substances Control (DTSC).
- San Francisco Bay Regional Water Quality Control Board (RWQCB) (Construction General Permit).

- Bay Area Air Quality Management District (BAAQMD) (Authority to Construct, Permission to Operate permits).
- Marin Municipal Water District (MMWD), PG&E, and AT&T (review and approval of new or modified utility systems and/or expanded services).

3.5 REFERENCES

BioMarin and Whistlestop/Eden Housing, 2019. "List of Needed Material for EIR," final as of April 2.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.*

City of San Rafael, 2018. Municipal Code.

Dyett & Bhatia, 2018. Project Description: *BioMarin Planned Development Expansion and Whistlestop Healthy Aging Center and Affordable Senior Housing*, 999 3rd Street San Rafael.

Luk and Associates, 2018. *Preliminary Grading Plan,* Drawing C-4.1 of Application Packet, August.

Miller Pacific Engineering Group, 2018. *Geotechnical Feasibility Report: BioMarin Office Buildings, 999 3rd Street, San Rafael, California,* August 24.

4. ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION MEASURES

This section addresses project-related impacts within the following 15 topic categories:

- Aesthetics
- Air Quality
- Cultural Resources
- Energy
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Public Services
- Recreation
- Transportation
- Tribal Cultural Resources
- Utilities and Service Systems

Other topics specified in Appendix G of the CEQA Guidelines are not addressed further in the DEIR, for the following reasons:

- **Biological Resources.** The topic of biological resources is not addressed, given the urbanized nature of the project site and the fact that no critical biological resources are located on the site.
- **Agriculture and Forestry Resources.** The topic of agriculture and forestry resources and mineral resources would not apply, given the urbanized nature of the project site.
- **Population and Housing.** The topic of population and housing is not discussed because no housing would be displaced by the project, and growth-inducing impacts are addressed in Chapter 6, CEQA Considerations.
- **Schools and Libraries (Public Services).** Due to the nature of the project, Section 4.11, Public Services, does not address project impacts on schools or libraries. The proposed mix of uses (senior housing, offices, research and development) would not create a significant student population, and therefore the project would not be expected to create a need for new or altered school facilities. In addition, standard school impact fees would apply to the project, which would mitigate any impacts. Similarly, the project would not be expected to create a need for new or altered library facilities, since (1) the project's residential population would be relatively small and would have on-site resources, and (2) the project's non-residential (employee) population would not be expected to create a substantial demand for libraries.
- **Wildfire.** Wildfire impacts are addressed in Section 4.7, Hazards and Hazardous Materials, but not as a separate topic due to the site's urban location, which is not in a designated Wildland-Urban Interface area.

Each of the 15 topic sections in this DEIR presents information in four parts, as described below. When specific other significance criteria would not apply to the project, this is identified in the individual section of Chapter 4.

INTRODUCTION

This section addresses the overall issues covered for the topic and the approach used in the analysis.

ENVIRONMENTAL SETTING

This section briefly describes elements of the project setting relevant to a discussion of impacts in the topic category.

REGULATORY FRAMEWORK

This section describes federal, state, and local regulations applicable to the topic.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section identifies potential impacts based on the identified significance criteria. Potentially significant impacts are numbered and summarized in **bolded** text, followed by text that describes the impact in more detail. Mitigation measures (indented text) that can reduce such impacts follow this discussion; these measures are labeled with a number that corresponds to the number of the impact. A statement regarding the level of significance of each impact after mitigation follows the mitigation measure for that impact. The term "PS" stands for "potentially significant" and "LTS" stands for "less than significant." The term "SU" stands for "significant and unavoidable."

4.1 AESTHETICS

INTRODUCTION

This section discusses the existing visual conditions at the project site and vicinity and addresses the potential aesthetic impacts of the proposed project. The potential impacts relate to the possibility of increased light and glare, the visual compatibility of the proposed development with surroundings, and the potential impacts on viewsheds with an emphasis on public viewing locations. This visual impact analysis is based on field observations at the project site and vicinity in March 2019 and a review of the project visual simulations, which are included below.

ENVIRONMENTAL SETTING

Regional Setting

The project site is located within the downtown area of the City of San Rafael in central Marin County. San Rafael is bisected by US Highway 101 and is the most populated city of Marin County. The city sits to the northeast of Mt. Tamalpais (elevation of 2,574 feet above mean sea level), which forms the dominant visual feature from many locations in this portion of Marin County along the U.S. Highway 101 corridor. The city has generally level topography in the downtown area edged by rolling hills to the south and north of downtown. San Rafael Creek, one prominent waterway located south of the site, ultimately flows to San Pablo Bay which adjoins San Francisco Bay.

The downtown area of San Rafael is fully developed with commercial and residential uses, with buildings ranging in size from one story to five or six stories. The streets are laid out in a grid pattern, with the two main east-west streets that edge the project site being 2nd Street and 3rd Street. These streets connect eastern San Rafael with the nearby Town of San Anselmo to the west. Vegetation in the downtown area consists primarily of introduced street trees and limited landscaping in public open spaces.

The largest nearby open space area is Boyd Memorial Park located about four blocks north of the project site. This park is heavily vegetated and located on a steep south-facing slope above the Mission San Rafael. Robert Dollar Drive provides access through the center of Boyd Memorial Park. Because of the topography of Boyd Memorial Park, views of the site are possible from this location. Another nearby park is Albert Park which is about 0.2 miles south of the project site in a level portion of the City. Due to intervening buildings, no views of the project site are possible from Albert Park.

Project Site Setting

Existing Visual Features of Project Site

The project site is currently paved and undeveloped. Previous buildings on the site were removed, as were facilities associated with the Pacific Gas & Electric Company (PG&E) gas manufacturing facility. The site has undergone cleanup for hazardous waste materials and consequently was paved and had monitoring devices installed.

Street trees at the southern end of the site (2nd Street) include 15 Chinese pistache that are about 10 to15 feet in height and in poor condition, many with broken limbs. No street trees are planted at the eastern end of the site on Lindaro Street or along the north side of the site on 3rd Street. Small areas of low shrubbery planting can be found at the northeast and northwest edges of the site. Three street trees are located adjacent to the site on Brooks Street. These include one mature Chinese pistache and two small beech trees at the southwest edge of the site.

Views of Project Site from 2nd Street and 3rd Street

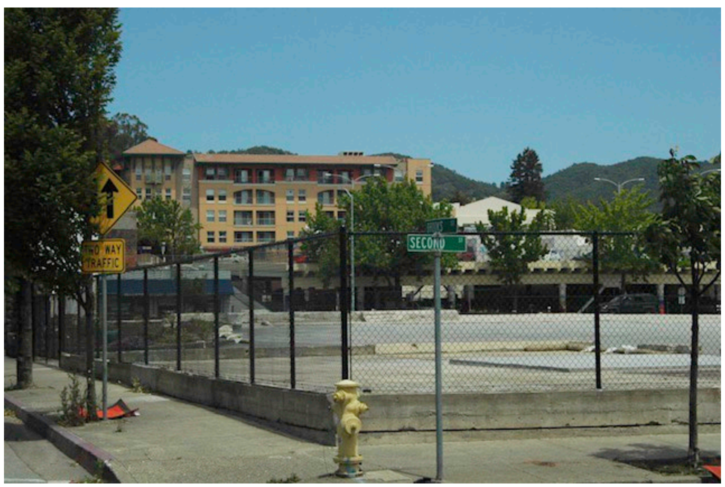
Motorists on 2nd Street travel one-way in an eastward direction. The view from 2nd Street is shown in **Figure 4.1-1(a)** where one looks northeast across the vacant site near Brooks Street toward the low San Rafael hills in the background. Street trees along the southern boundary of the site are visible adjacent to the street, and two-story buildings are visible in the background. From this vantage point, large expanses of sky are visible due to the lack of development on the site. As one approaches Brook Street on 2nd Street, the black cyclone fencing around the site becomes more visible (see **Figure 4.1-1b)**. Views to grass and oak/bay covered hills in the background take on more prominence from this vantage point. Commercial buildings in the background of this viewpoint location are generally one and two stories in height. Traffic along 3rd Street can be seen in the mid-ground.

From the corner of Brooks Street and 2nd Street, looking north (see **Figure 4.1-1c**), one sees cyclone fencing around the paved site in the foreground. The background view is dominated by the six-story Rafael Town Center apartment complex that has ground-floor commercial uses. This building is two blocks directly north of the project site, north of one- and two-story commercial buildings, including a two-story parking structure directly north of the site. Farther east on 2nd Street, one looks north across the site toward Boyd Memorial Park and Mountain Park in the background (see **Figure 4.1-1d**). As in Figure 4.1-1c, the Rafael Town Center building is a dominant part of this viewshed. The bell tower of the Church of Saint Raphael/Mission San Rafael Arcangel, a prominent visual feature in downtown San Rafael, is visible in the far-left edge of this image. A more wide-angle view from Lindaro and 2nd Street (see **Figure 4.1-2a**) takes in the site in the foreground, with Boyd Memorial Park in the background and two major multi-story buildings—the Bank of America Financial Center and the Rafael Town Center—in the mid-ground. The church bell tower can be seen just to the right of the Bank of America Financial Center. When looking farther west from this location, one can see the vacant project site plus the existing street trees planted along 2nd Street at the southern edge of the site within the sidewalk right-of-way (**Figure 4.1-2b**)

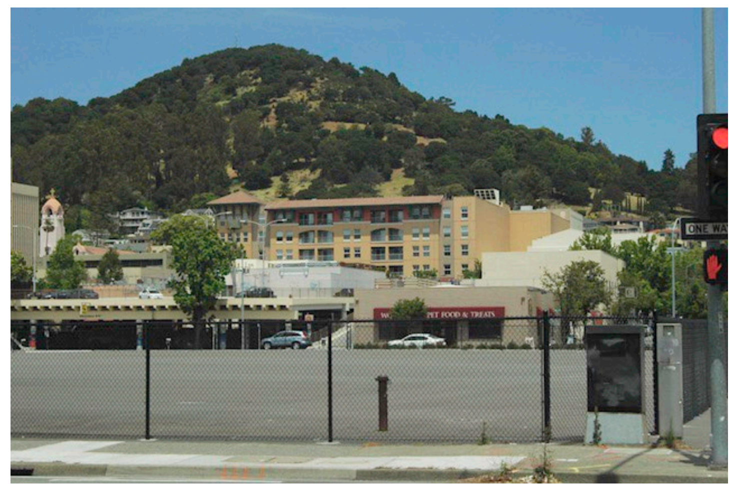
On 3rd Street, motorists travel in the westbound direction only (with three lanes of travel). From this vantage point near Lindaro Street, one looks across the vacant site to a view of Mt. Tamalpais in

a. View east from 2nd Street near Brooks Street. Site in middle of image.

b. View northeast across site from 2nd Street near Brooks Street, with site in foreground and San Rafael hills in background.



c. View north across site from corner of Brooks Street and 2nd Street, with 4th Street residential project in background (at Courthouse Square)

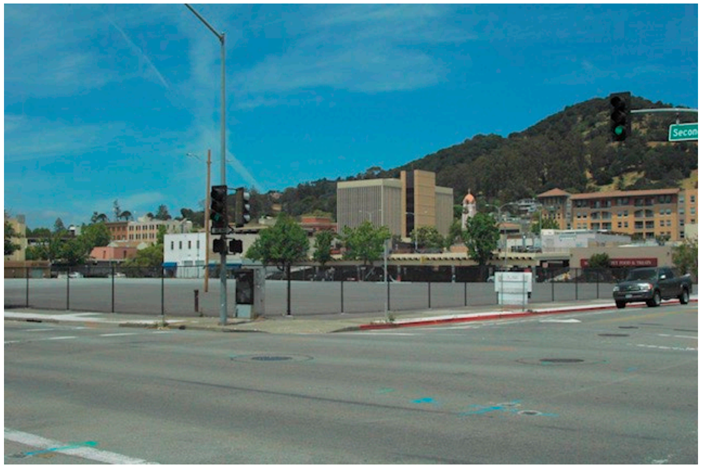


d. View northwest across site from 2nd Street/Lindaro Street intersection. Mission San Rafael Arcangel bell tower visible at left side of image.

Figure 4.1-1

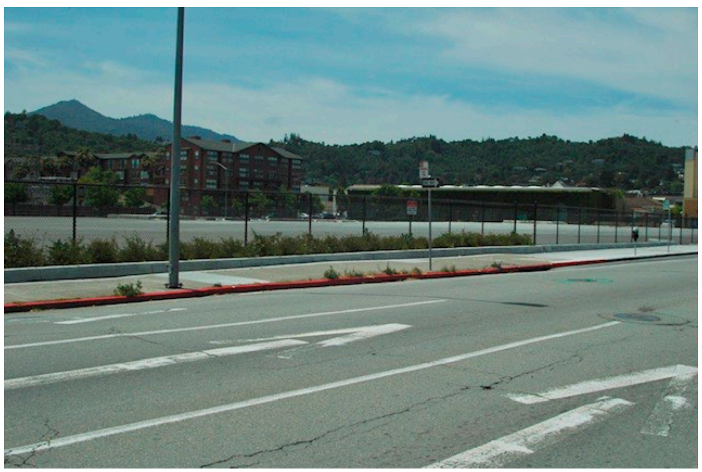
VIEWS OF SITE FROM 2ND STREET

AMY SKEWES~COX
ENVIRONMENTAL PLANNING



a. View looking northwest across site toward hills of Boyd Memorial Park and downtown San Rafael. Site is in foreground, surrounded by fencing.

b. View west from Lindaro Street at 2nd Street. Street trees edge the southern end of the block-long site.



c. View southwest from 3rd Street near Lindaro Street. Mount Tamalpais visible in background behind the four-story Lofts at Albert Park Apartments just south of site.

d. View southwest from 3rd Street across site in foreground with apartment complex and Mount Tamalpais in background.

Figure 4.1-2

VIEWS OF SITE FROM 2ND STREET AND 3RD STREET

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

the background (see **Figure 4.1-2c**). Given the existing lack of site development in this central location of San Rafael, there is an uninterrupted view of the mountain that is not seen in many parts of the downtown. The five-story Lofts at Albert Park Apartments and wooded hills that separate San Rafael from Ross/Kentfield are visible in the mid-ground of this view corridor. With no development on the site, views of the sky can also be expansive. A closer view, as seen in **Figure 4.1-2d**, takes in more of the detail of the Lofts at Albert Park Apartments, with Mt. Tamalpais forming a strong backdrop as seen from 3rd Street. Wooded hillsides form the mid-ground.

When looking directly south from 3rd Street, one sees a portion of the Lofts at Albert Park Apartments on the right side of the image (see **Figure 4.1-3a**) and the PG&E electric transmission towers in the center and right of the image.

Views of Project Site from Boyd Memorial Park

Downtown San Rafael is visible from the public open space of Boyd Memorial Park located north of the site and north of downtown. From the upper elevations of the park, one looks down onto the center of town where the project site and the nearby San Rafael Corporate Center are visible as shown in **Figure 4.1-3b**. From this location, a number of multi-story buildings of the downtown are visible such as the Bank of America Financial Center (right side of image) and the Rafael Town Center (left side of image). The wooded hills of south San Rafael can be seen as a prominent background image from this location.

Light and Glare

Sources of light and glare near and within the project site are primarily vehicles on public roadways, lighting from adjacent commercial and residential development, lighting in parking lots and along public streets, and lighting from the existing Albert Park baseball field. Vehicle headlights on public roadways emit temporary lighting in their direction of travel. One light pole is located in the middle of the site which was placed there by PG&E. It is turned on each night for nighttime security.

REGULATORY FRAMEWORK

Federal and State Regulations

No federal regulations related to visual quality would pertain to the project.

The State of California has a formal program related to scenic highways. The California Scenic Highway Program, established in 1963, identifies and designates certain highways along which adjoining land uses and features require special conservation treatment. The responsibility for the management of a program is left to local cities and counties. Highways shown as “eligible” for listing are believed to have outstanding scenic values. Once a highway is listed in California Streets and Highways Code Sections 263.1 through 263.8, it may be nominated for official designation by the local governing body with jurisdiction over the lands adjacent to the proposed scenic highway. A visual assessment is required, and a number of other steps must be followed. No highways are located in the immediate vicinity of the project site, and none of the roadways in the vicinity are included in the Streets and Highways Code list of eligible highways or are designated a scenic highway (California Department of Transportation, 2019).

a. View south across site from 3rd Street with apartments in background (right) and PG&E substation towers in background (left).

b. View from Boyd Memorial Park looking down on site at center of image. Foreground includes Bank of America Financial Center on right and apartment complex on left. BioMarin existing buildings within San Rafael Corporate Center visible just south of site.

Figure 4.1-3

VIEWS OF SITE FROM 3RD STREET AND BOYD MEMORIAL PARK

Local Regulations and Policies

City of San Rafael Zoning Ordinance

Under the City of San Rafael Zoning Ordinance, the project site is zoned "Second/Third Streets Mixed-Use East (2/3 MUE)." This zoning allows general office and office-support retail and service uses, with housing encouraged for mixed-use projects. Laboratories are allowed with a conditional use permit from the Zoning Administrator. Multi-family housing is allowed as part of a mixed-use development, with an administrative use permit from the Planning Director (or Planning Commission, if referred by the Planning Director).

Section 14.05.032 of the San Rafael Municipal Code identifies the development standards for the subject property, including required building setbacks, maximum building height (and applicable height bonus requirements), and landscaping requirements (City of San Rafael, 2019). For example, the code specifies a maximum building height of 54 feet in the 2/3 MUE district. There is a 5-foot front yard setback requirement but no requirement for side or rear setbacks. A minimum of 10 percent landscaped area is required.

Section 14.16.227 of the San Rafael Municipal Code has the following requirement regarding light and glare (City of San Rafael, 2019):

14.16.227 – Light and Glare

Colors, materials, and lighting shall be designed to avoid creating undue off-site light and glare impacts. New or amended building or site colors, materials and lighting shall comply with the following standards, subject to review and recommendation by the police department, public works department, and community development department:

A. *Glossy finishes and reflective glass such as glazed or mirrored surfaces are discouraged, and prohibited where it would create an adverse impact on pedestrian or automotive traffic or on adjacent structures; particularly within the downtown environs and in commercial, industrial and hillside areas.*

B. *Lighting fixtures shall be appropriately designed and/or shielded to conceal light sources from view off-site and avoid spillover onto adjacent properties.*

C. *The foot-candle intensity of lighting should be the minimum amount necessary to provide a sense of security at building entryways, walkways and parking lots. In general terms, acceptable lighting levels would provide one (1) foot-candle ground level overlap at doorways, one-half (½) foot-candle overlap at walkways and parking lots, and fall below one (1) foot-candle at the property line.*

D. *Lighting shall be reviewed for compatibility with on-site and off-sight light sources. This shall include review of lighting intensity, overlap and type of illumination (e.g., high-pressure sodium, LED, etc.). This may include a review by the city to assure that lighting installed on private property would not cause conflicts with public street lighting.*

E. *Installation of new lighting fixtures or changes in lighting intensity on mixed use and non-residential properties shall be subject to environmental and design review permit review as required by Chapter 14.25 (Design Review).*

F. Maximum wattage of lamps shall be specified on the plans submitted for electrical permits.

G. All new lighting shall be subject to a 90-day post installation inspection to allow for adjustment and assure compliance with this section.

City of San Rafael General Plan

The San Rafael General Plan 2020 (General Plan) land use designation for the site is "Second/Third Mixed Use." General Plan policies and programs that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact as related to visual issues include the following (City of San Rafael, 2017):

Policy CD-1 **City Image.** Reinforce the City's positive and distinctive image by recognizing the natural features of the City, protecting historic resources, and by strengthening the positive qualities of the City's focal points, gateways, corridors and neighborhoods.

Program CD-1c **Landscape Improvement.** Recognize that landscaping is a critical design component. Encourage maximum use of available landscape area to create visual interest and foster sense of the natural environment in new and existing developments. Encourage the use of a variety of site appropriate plant materials.

Policy CD-5 **Views.** Respect and enhance to the greatest extent possible, views of the Bay and its islands, Bay wetlands, St. Raphael's church bell tower, Canalfront, marinas, Mt. Tamalpais, Marin Civic Center, and hills and ridgelines from public streets, parks, and publicly accessible pathways.

Policy CD-7 **Downtown and Marin Civic Center.** Build upon the character of these areas by controlling land uses to clearly distinguish their boundaries; by recognizing Mission San Rafael Arcangel and St. Raphael Church, Marin Civic Center, and other buildings that help define the City's character, and requiring that these and other architectural characteristics and land uses that give these areas their identity are strengthened.

Policy CD-9 **Transportation Corridors.** To improve the function and appearance of corridors, recognize those shown on Exhibits 17 and 18 and define each corridor's contribution to the City based upon its land use and transportation function and how it is experienced by the public.

Program CD-9a **Corridor Design Guidelines.** Develop specific design guidelines for each corridor that address building massing, articulation of building facades, detailing, lighting, landscaping, street trees, and other desired infrastructure and characteristics. Include appropriate zoning code provisions

Policy CD-10 **Nonresidential Design Guidelines.** Recognize, preserve and enhance the design elements that contribute to the economic vitality of commercial areas.

Develop design guidelines to ensure that new nonresidential and mixed-use development fits within and improves the immediate neighborhood and the community as a whole.

Program CD-10a **Visual Compatibility.** Ensure that new structures are visually compatible with the neighborhood and encourage neighborhood gathering places. Guidelines may address screening of service functions, materials and detailing, screening of roof equipment, lighting, landscaping, outdoor café seating, and pedestrian amenities.

Policy CD-16 **Property Maintenance.** Provide incentives and enforcement to achieve desirable property maintenance.

Program CD-16a **Code Enforcement.** Continue code enforcement efforts for trash and litter removal and other maintenance issues in all types of property.

Policy CD-18 **Landscaping.** Recognize the unique contribution provided by landscaping, and make it a significant component of all site design.

Program CD-18a **Zoning Regulations for Landscaping.** Evaluate and amend as necessary, the Zoning Ordinance's landscaping provisions to promote development with a strongly landscaped character. The intent is that individual neighborhood character be developed and maintained, architecture be softened by plant materials where appropriate, conflicting uses be buffered, parking areas be screened, comfortable outdoor living and walking spaces be created, air pollution be mitigated and developments be made water efficient through the use of a variety of site-appropriate plant material.

Policy CD-19 **Lighting.** Allow adequate site lighting for safety purposes while controlling excessive light spillover and glare.

Program CD-19a **Site Lighting.** Through the design review process, evaluate site lighting for safety and glare on proposed projects.

Program CD-19b **Lighting Plan.** Require new development and projects making significant parking lot improvements or proposing new lighting to prepare a lighting plan consistent with the Design Guidelines for review by City planning staff.

Policy CD-21 **Parking Lot Landscaping.** Provide parking lot landscaping to control heat build-up from pavement, reduce air pollution, provide shade cover for vehicles and soften the appearance of the parking lot. Emphasize the use of trees, and limit the height of shrub plantings so as to avoid creating security problems.

Program CD-21a **Parking Lot Landscaping Requirements.** Update parking lot landscape requirements to increase the screening of parking lots from the street and nearby properties. Requirements would address appropriate size and location of landscaping, necessary screening consistent with security considerations, tree protection measures, and appropriate percent of shade coverage required of parking lot trees. Include maintenance requirements in all approvals.

Program CD-21b **Parking Lot Landscape Enforcement.** Require that newly installed parking lot landscaping be maintained and replaced as needed. Assure that landscaping is thriving prior to expiration of the required 2-year maintenance bond.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this DEIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on visual resources if it would:

a) Have a substantial adverse effect on a scenic vista;

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;

c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views[1] of the site and its surroundings or, if the project is in an urbanized area, conflict with applicable zoning and other regulations governing scenic quality; or

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

The following significance criteria would not apply to the proposed project and are therefore excluded from further discussion in this impact analysis:

- *Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.* No designated state scenic highway is located within this portion of Marin County. In addition, no historic resources, trees, or rock outcroppings are located at the project site.
- *In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings, or, if the project is in an urbanized area, conflict with applicable zoning and other regulations governing scenic quality.* The project site is located within an urbanized area in the downtown of San Rafael, and therefore the portion of this criterion dealing with public views does not apply. However, impacts on public views are

[1] Public views are those that are experienced from publicly accessible vantage points.

addressed in the discussion of project consistency with scenic quality regulations (see "Less-than-Significant Impacts" below).

Less-than-Significant Impacts

Impacts on Scenic Vistas and Views

The project would not have a substantial adverse effect on a scenic vista.

The proposed project would result in major development of a 3.05-acre vacant site in downtown San Rafael. A vacant, paved full block of the downtown area would be replaced with three new multi-story buildings, with landscaping and parking areas at the perimeter.

As shown in Figures 4.1-2c and 4.1-2d, motorists using 3rd Street and heading west can now view Mt. Tamalpais in the background of this view. This mountain is an iconic element of Marin County as the tallest mountain visible from numerous locations. As seen in this view, the mountain forms the background to intervening urban development and lower hills that separate San Rafael from the Kentfield/Ross communities. Any development, including landscaping along 3rd Street, would be likely to interrupt this view. The two BioMarin buildings would be a maximum of 72 feet in height and no minor changes to the design would remove this potential impact. Their layout on the site would result in shortening this view to the immediate environs. The General Plan contemplates a maximum development height of 66 feet for this area of downtown San Rafael (54 feet base height and 12-foot additional bonus based on public benefits). Development of the site would therefore block some of these views based on buildout in accordance with the General Plan. Although the proposed project includes an amendment to the General Plan that addresses maximum building height bonuses, the additional 6 feet in height that would occur with the two proposed BioMarin buildings is not substantially different from the allowed height maximum for this site. It should also be noted that the view requires that the driver turn his/her view to the southwest (when heading west), and speeds along 3rd Street result in the view only being possible for a short period of time.

Visual simulations were completed for the proposed project from various locations (see **Figure 4.1-4**). **Figures 4.1-5** through **4.1-9** illustrate the "before" and "after" images with the project from various viewing locations.

<u>Views of Project from 3rd Street</u>

Figure 4.1-5 provides a visual simulation of the view from 3rd Street where one is looking more directly to the west. From this location, the view of Mt. Tamalpais is not visible and one sees development in the foreground and wooded hillsides in the background. From this location, Mt. Tamalpais is out of view to the left of the view corridor. However, pedestrians and vehicle passengers could likely see Mt. Tamalpais looking south across the site from areas along 3rd Street Although the project's potential impact on this view of Mt. Tamalpais for this short distance along 3rd Street cannot be reduced without a considerable change to the scale and location of the proposed on-site buildings, which would not be reasonable, the view impact is not considered significant given the allowable height development standards for the subject property.

As can be seen in Figure 4.1-5, however, the view for motorists and pedestrians on 3rd Street would be significantly changed. The modern design of the BioMarin building (Building A) would

Aerial source: Marin County 2019

1 → Simulation Viewpoint Location and Direction

Figure 4.1-4

SIMULATION VIEWPOINT LOCATIONS

SOURCE: Environmental Vision, 2019

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

a. Existing View from 3rd Street near Cijos Street looking west (VP 1)

b. Visual Simulation of Proposed Project

Figure 4.1-5

SOURCE: Environmental Vision, 2019

VISUAL SIMULATION - 3RD STREET

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

a. Existing View from 2nd Street at A Street looking east (VP 2)

b. Visual Simulation of Proposed Project

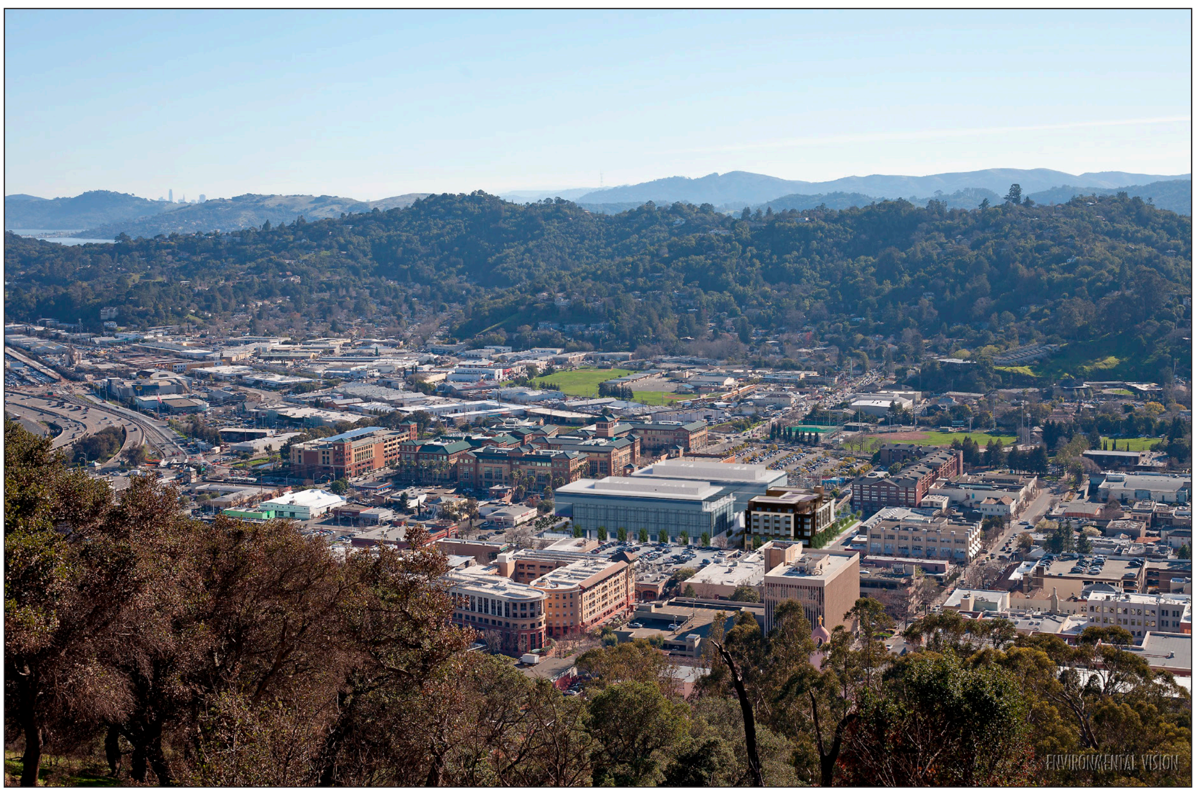
Figure 4.1-6

VISUAL SIMULATION - 2ND STREET

SOURCE: Environmental Vision, 2019

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

a. Existing View from Robert Dollar Drive trail in Boyd Memorial Park looking south (VP 3)



b. Visual Simulation of Proposed Project

Figure 4.1-7

SOURCE: Environmental Vision, 2019

VISUAL SIMULATION - BOYD MEMORIAL PARK

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

a. Existing View from Southbound Highway 101 looking southwest (VP 4)

b. Visual Simulation of Proposed Project

Figure 4.1-8

VISUAL SIMULATION - HIGHWAY 101

SOURCE: Environmental Vision, 2019

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Figure 4.1-9

SOURCE: Van Meter Williams Pollack, 2019

VIEW OF PROJECT LOOKING EAST ON 3RD STREET

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

include large wall expanses that are angular and very light in color. Portions of these façades would have no variation in color. The only "pattern" visible in this image is the metal screening proposed for the project's eastern façade. The east elevation includes a setback for the lower two floors. The large overhang would occur at a height of about 35 feet and would be about 37.5 feet in depth. This overhang would provide shade for the plaza area just outside the 3,500 square feet of retail space. The plaza area is proposed to be open for public use during daytime hours. A portion of the north-facing 3rd Street façade would protrude, as shown in Figure 4.1-5. Street trees would be planted on this north side of the BioMarin buildings.[2]

Views of Project from 2nd Street

For the view from 2nd Street, as can be seen in Figure 4.1-6, the image and scale of the BioMarin Building B would be similar to Building A (seen from 3rd Street). Building B would have metal screening on the west elevation, with limited setbacks along the southern façade. The project would introduce a massive new building into this view corridor for motorists and pedestrians on 2nd Street, blocking existing sky views. Building B would be significantly taller than the commercial building just to the west; but it would be similar in scale to existing BioMarin buildings and the apartment complex to the south. Columbia London Plane trees would be planted along the south side of the site within the sidewalk median, replacing the existing Chinese pistache trees in this location.

Views of Project from Boyd Memorial Park

When viewed from uphill locations at Boyd Memorial Park, the new buildings would fit into the overall urban fabric of the downtown area, as can be seen in Figure 4.1-7. From this location, no significant views of the nearby hills or more distant locations such as the San Francisco skyline (seen in left of image in Figure 4.1-7) or Marin hills would be interrupted.

Views of Project from U.S. Highway 101

From U.S. Highway 101, the project would introduce a significantly new built element into San Rafael's downtown, as can be seen in Figure 4.1-8.[3] Views across the roof of the existing Whistlestop building (foreground of view) now take in large areas of wooded hillsides. Views of portions of these hills would be blocked by the new buildings with the introduction of large expanses of white façades. The two new buildings would stand independently in this portion of downtown, with large spaces between the new buildings and other multi-story downtown buildings such as the existing BioMarin building on the left and other buildings on the right. The white façades would contrast significantly with the predominantly earth tones of roofs and walls of existing buildings. It should be noted that this view of downtown would be very short-term given the speed at which motorists travel and the fact that the view would require that drivers turn away from

[2] It should be noted that the visual simulations show plantings identified in the project landscape plans as those plants would appear at eight years of growth.

[3] The visual simulation from U.S. Highway 101 does not include the proposed Seagate residential development to be located on the corner of 3rd Street and Tamalpais Avenue. This 120-unit building would be 73 feet in height and would be similar in scale to the proposed project. The end result would be that from this location, the three major multi-story buildings that would be visible would be the existing BioMarin building, the proposed Seagate project, and the proposed BioMarin and Whistlestop/Eden Housing project.

the direction of travel. Passengers would be the most likely to see this view when traveling south on U.S. Highway 101.

Visual Impact of Whistlestop/Eden Housing Building

From all of the above visual simulation locations, the Whistlestop/Eden Housing building would not be a strong visual element. The main location from which this new building would be seen would be from Boyd Memorial Park, where the darker colors of this building would contrast with the white of the BioMarin buildings (see Figure 4.1-7). The overall scale of the three buildings would be visually compatible. The scale of the Whistlestop/Eden Housing building would be compatible with nearby buildings since it would be approximately 100 feet by 150 feet. The 70-foot height of the Whistlestop/Eden Housing project would be slightly higher than the Lofts at Albert Park Apartments just to the south of 3rd Street, but would not be visually incompatible with this nearby residential use. When seen by pedestrians on 3rd Street looking east (not a view seen by motorists since this is a one-way street heading west), the Whistlestop/Eden Housing building would have varied colors and setbacks that would visually break the building into multiple planes (see Figure 4.1-9). The top floor would be set back, resulting in the building mass being reduced from this viewing location. The colors of the building would include light browns, dark browns, tans, and black accent trim. Window sizes would vary and would have both a vertical and horizontal emphasis. The bottom two floors of windows would be predominantly horizontal in orientation, while upper windows for residences would be square with mullions.

Visual Impact of BioMarin Buildings

The scale of the BioMarin buildings in comparison to existing downtown buildings is quite large, as seen in Figure 4.1-7. The east/west length of the project site block is 460 feet between Brooks Street and Lindaro Street. Buildings A and B would each be 220 feet long, occupying 48 percent of the length of the entire block. This scale would be significantly greater than the overall scale of buildings surrounding the project site. The largest buildings of this scale are generally parking structures immediately to the north (City lot), south (BioMarin parking), and northwest (corner of 3rd Street and A Street), and existing BioMarin buildings to the southeast. The proposed BioMarin buildings would be larger than the nearby Walgreens building (to the northeast), Kaiser office building (to the west), and First Federal Savings and Loan Association building (to the northwest, at the corner of A Street and 3rd Street). In addition, these other large buildings nearby are less than four stories in height. Other large downtown buildings such as the Bank of America Building and Rafael Town Center on 4th Street are taller than four stories but are separated from the project site by one block of intervening smaller buildings. Over time, and given allowable floor area ratio (FAR), these smaller buildings could be replaced with larger ones more comparable in scale to the proposed BioMarin buildings.

The east and west façades of the BioMarin buildings would include a metal screening that is now proposed to be a random design of vertical long and short sections of a darker color, as can be seen in the proposed elevations (see **Figure 4.1-10**) and material legend (see **Figure 4.1-11**). This random pattern can be seen in Figures 4.1-5, 4.1-6, and 4.1-7.

Building A would include a public plaza (for daytime use), which would encourage neighborhood gathering. The proposed wood ceiling over this plaza (see Figure 4.1-11) would help to define its location and would add visual interest that breaks up the predominant light color scheme. Roof

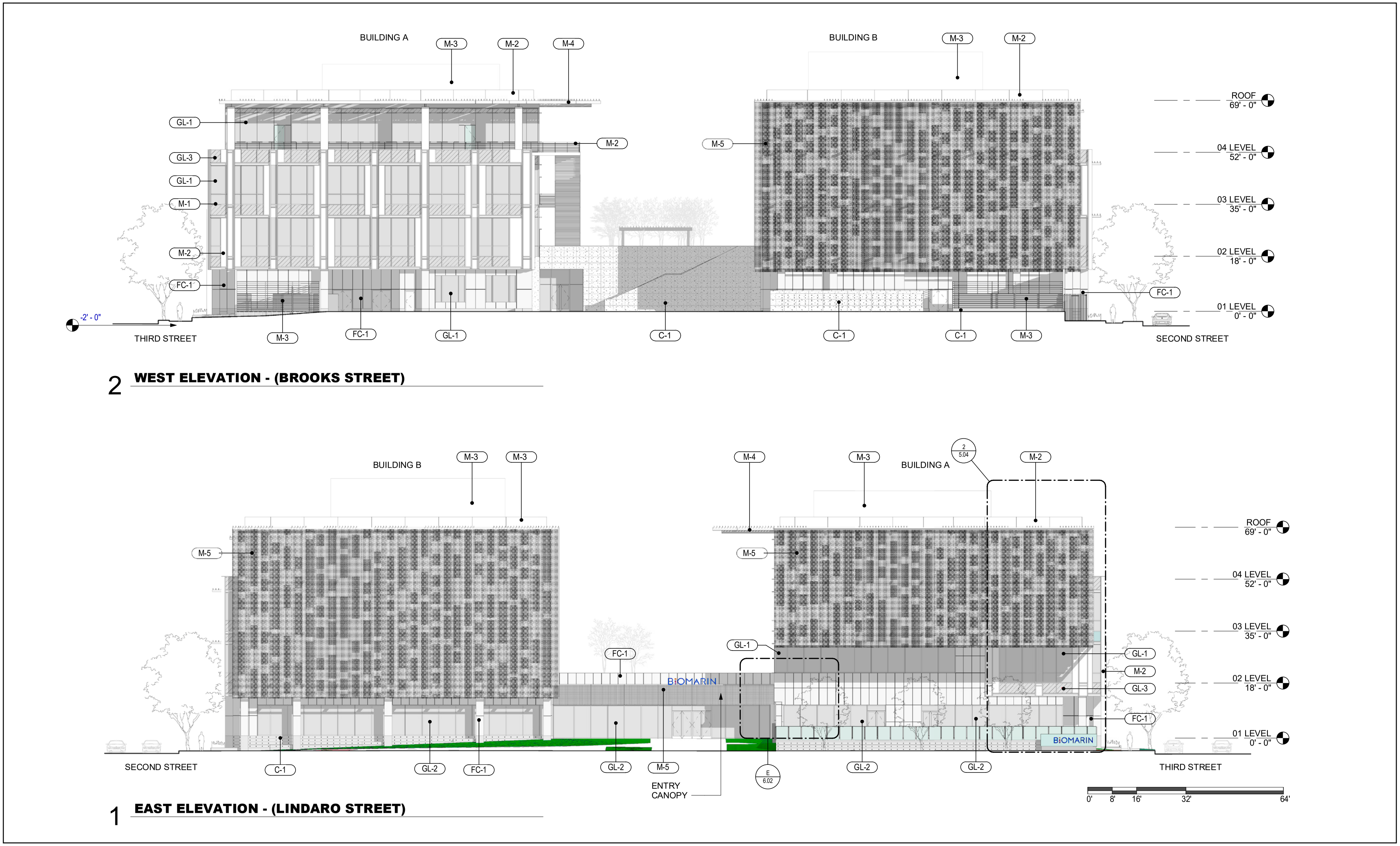


Figure 4.1-10

PROPOSED WEST AND EAST ELEVATIONS OF BIOMARIN BUILDINGS A AND B

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

GL-1	VISION GLASS	VIRACON 1" VE24-2M INSULATING HS/HS (TINTED AND FILMED)
GL-2	VISION GLASS	VIRACON 1" INSULATING HS/HS (CLEAR GLASS)
GL-3	VISION GLASS	VIRACON 1" VRE30-54 INSULATING HS/HS, SHADOW BOX
GL-4	GLASS GUARDRAIL	
M-1	EXTRUDED ALUMINUM MULLION	PPG DURANAR SUNSTORM – SATIN NICKLE
M-2	PAINTED METAL	PAINTED TO MATCH M-1
M-3	MECHANICAL PENTHOUSE LOUVERED WALL	PAINTED TO MATCH M-1
M-4	EXTENDED STEEL/ALUMINUM TRELLIS	PAINTED TO MATCH M-1
M-6	METAL SUPPORT (SHADE SCREEN)	PAINTED TO MATCH M-1
M-5	PERFORATED PANEL - SHADE SCREEN	PAINTED TO MATCH M-1
C-1	POURED IN PLACE CONCRETE	SACKED FINISH
C-2	CONCRETE PAVER	
PL-1	EXTERIOR PLASTER	SMOOTH FINISH W/ 1"ALUMINUM REGLET AT JOINTS
FC-1	FIBER CEMENT EXTERNAL WALL PANEL	VENTILATED RAINSCREEN, MAX SIZE: 10'-0" X 4'-0"
WD-1	WOOD CEILING	EXTERIOR GRADE DERAKO SYSTEM, WESTERN RED CEDAR

SOURCE: Johnson Fain, 2018

Figure 4.1-11

MATERIAL LEGEND FOR BIOMARIN BUILDINGS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

equipment would be screened by a mechanical penthouse louvered wall as shown in project elevations. Landscaping would be provided on all sides of the project and within interior portions of the site. Trees at the perimeter of the site within sidewalk areas would include 1) Columbia London Plane trees; 2) Armstrong maple trees; 3) and Coast live oaks. Interior trees, not as visible from the sidewalks, would include Crape myrtle trees, Aptos Blue Coast redwood trees, and Kousa dogwood trees. While street trees along 2nd Street and Brooks Street would be replaced with new trees, the existing trees are in poor condition and the new trees would be a better scale at maturity for the proposed building scale.

Review of Project by City of San Rafael Design Review Board

To increase compatibility with nearby downtown buildings, the City of San Rafael Design Review Board (DRB) will review the project application and make recommendations for design modifications (if needed) related to the overall scale and color of the BioMarin and Whistlestop/Eden Housing buildings. The DRB will make observations regarding the proposed project's compatibility with surrounding commercial and residential buildings and make recommendations for modifications as appropriate and in accordance with the City's Non-Residential Design Guidelines. For these reasons, the project's potential visual impacts related to scenic vistas and views would be considered less than significant.

Light and Glare Impacts

The project would not create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

Parking is proposed at the southwest corner of the site. The lighting plans for the BioMarin project show a total of five 20-foot-tall light poles proposed in this area of the site. In addition, a total of ten 16-foot-tall light poles would be located in the drop-off and parking area at the southeast end of the site. The northeast corner of the BioMarin project would have three 36-inch-tall bollards. Three 20-foot-tall light poles would also be placed between the Whistlestop/Eden Housing project and BioMarin Building A where internal vehicular circulation is proposed. The interior courtyard separating Building A from Building B would also have lighting, but this would not be as visible to the surrounding residences.

The Whistlestop/Eden Housing project would not include extensive new lighting. The existing street light on 3rd Street would remain nearby. The other exterior lighting would be incorporated into the building. These fixtures would be surface-mounted downlights on the north and west exterior walls mounted at the first-floor level, and lights in the arcaded entry at the corner of 3rd Street and Brooks Street. No bollards are proposed.

Section 14.16.227 of the San Rafael Municipal Code has lighting requirements with which the project would have to comply (City of San Rafael, 2019). Compliance with these requirements would largely mitigate the potential impacts of increased lighting from the project. Furthermore, the San Rafael DRB will review the proposed application and make recommendations for the final lighting plan. Thus, potential impacts related to light and glare would be less than significant.

In addition to conformance with Section 14.16.227 of the San Rafael Municipal Code, the following lighting recommendations are suggested for the DRB to consider to further minimize the impact of light and glare. Parking lot lighting should be shielded and cast downward to minimize “light spillage” to off-site locations and should be placed on timers so that minimal lighting occurs after 11:00 PM. Lighting of parking areas should use light-emitting diode (LED) lights in the “warm” (vs. blue range) to minimize disturbance to nearby residences. To the extent practicable, area lighting and security lighting should be controlled by the use of timed switches and/or motion detector activation to reduce energy consumption and excess lighting.

Potentially Significant Impacts

The project would not have any potentially significant impacts related to aesthetics.

Cumulative Impacts

Approved or currently pending development projects in San Rafael are shown in Figure 6-1 and listed in Table 6-1 in Chapter 6, CEQA Considerations, of this DEIR. None of these projects are in the immediate vicinity of the proposed project. In general, visual impacts take in the immediate surroundings in an urbanized area; thus, one evaluates projects that are in the immediate viewshed of the proposed project. The San Rafael Corporate Center (SRCC) expansion (Project 8 in Figure 6-1) would be visually separated from the project site by the intervening PG&E site and the BioMarin parking garage that front on 3rd Street. The new BioMarin parking garage expansion (Project 9 in Figure 6-1) would be separated from the project site by existing BioMarin buildings. Designs for the Bettini Transit Center Relocation have not yet been finalized.

The Seagate project at 703 3rd Street would possibly be the most relevant, as it would front on 3rd Street and would be two blocks east of the project site and seen by motorists on 3rd Street. The most recent submittal (City of San Rafael, 2019a) shows a 0.63-acre site (combining four parcels) with a 73-foot-tall building to house 120 apartments. Retail space would be located on the ground floor, fronting on Tamalpais Avenue. The six-story building would have the sixth floor stepped back to create private roof decks. The building would be recessed and stepped back at various locations on all sides. The overall color scheme of the Seagate project would be dark browns, dark greys, and coffee colors—a more earth-tone scheme than the proposed BioMarin buildings. The BioMarin buildings would contrast with the Seagate project. The Seagate design is by the same architect as the Whistlestop/Eden Housing project and is more similar in design and color to the Whistlestop/Eden Housing project.

No significant cumulative visual impacts are anticipated, especially with the implementation of mitigation measures recommended for the proposed project.

REFERENCES

California Department of Transportation, 2019. Website: http://www.dot.ca.gov/hq/LandArch/16_livability/scenic_highways/, accessed on February 26.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28, 2017.

City of San Rafael, 2019. Municipal Code. Website: https://library.municode.com/ca/san_rafael/codes/code_of_ordinances?nodeid=tit14zo_divivreapalsedi_ch14.16siusre_14.16.227ligl; accessed on April 17.

City of San Rafael, 2019a. Website on current projects: https://www.cityofsanrafael.org/?page_id=32061&preview=true, accessed on April 18.

4.2 AIR QUALITY

INTRODUCTION

This section describes the existing air quality conditions in the vicinity of the project site; discusses the federal, State, and local regulations and policies pertinent to air quality; assesses the potentially significant impacts to air quality as a result of implementation of the proposed project; and provides, where appropriate, mitigation measures to address those impacts. The potential impacts assessed include increases in criteria air pollutant and toxic air contaminant (TAC) emissions during both the construction and operational phases of the project. The analysis in this section was prepared in accordance with the Bay Area Air Quality Management District (BAAQMD) CEQA Air Quality Guidelines (BAAQMD, 2017a).

ENVIRONMENTAL SETTING

The project site is in the City of San Rafael, which is situated within the San Francisco Bay Area Air Basin (SFBAAB). Air basins have natural characteristics that limit the ability of natural processes to either dilute or transport air pollutants. The major determinants of air pollution transport and dilution are climatic and topographic factors such as wind, atmospheric stability, terrain that influences air movement, and sunshine. Wind and terrain can combine to transport pollutants away from upwind areas, while solar energy can chemically transform pollutants in the air to create secondary photochemical pollutants such as ozone. The following discussion provides an overview of the environmental setting with regard to air quality in the SFBAAB.

Regional Climate, Meteorology, and Topography

The Bay Area has a Mediterranean climate characterized by wet winters and dry summers. During the summer, a high-pressure cell centered over the northeastern Pacific Ocean results in stable meteorological conditions and a steady northwesterly wind flow that keep storms from affecting the California coast. During the winter, the Pacific high-pressure cell weakens, resulting in increased precipitation and the occurrence of storms. The highest air pollutant concentrations in the Bay Area generally occur during inversions, when a surface layer of cooler air becomes trapped beneath a layer of warmer air. An inversion reduces the amount of vertical mixing and dilution of air pollutants in the cooler air near the surface.

Marin County is bounded on the west by the Pacific Ocean, on the east by San Pablo Bay, on the south by the Golden Gate, and on the north by the Petaluma Gap.[1] San Rafael is located in the southeastern part of Marin County. The eastern side of Marin County has warmer weather than the western side because of its distance from the ocean and because the hills that separate eastern Marin from western Marin occasionally block the flow of the marine air. The temperatures of cities

[1] The Petaluma Gap is a geographical region in Sonoma County, California which extends in a band from the Pacific Ocean to San Pablo Bay. It is an area of low land 22 to 31 miles wide in the coast ranges of the northern San Francisco Bay Area. Fresh marine air generally blows eastward through the gap, branching into southward and northward streams which blow toward the Carquinez Strait and Santa Rosa, respectively.

next to the Bay are moderated by the cooling effect of the Bay in the summer and the warming effect of the Bay in the winter. For example, San Rafael experiences average maximum summer temperatures in the low 80 degrees Fahrenheit and average minimum winter temperatures in the low 40 degrees Fahrenheit.

While Marin County does not have many polluting industries, the air quality on its eastern side (especially along the U.S. Highway 101 corridor) may be affected by emissions from increasing motor vehicle use within and through the county. The prevailing wind directions throughout Marin County are generally from the northwest. In southeast Marin County, the influence of marine air keeps pollution levels low (BAAQMD, 2017a).

Air Pollutants of Concern

The California Air Resources Board (CARB) and U.S. Environmental Protection Agency (EPA) focus on the following air pollutants as regional indicators of ambient air quality:

- Ozone
- Suspended particulate matter—both respirable (PM_{10}) and fine ($PM_{2.5}$)
- Nitrogen dioxide (NO_2)
- Carbon monoxide (CO)
- Sulfur dioxide (SO2)
- Lead

Because these are the most prevalent air pollutants known to be harmful to human health, based on extensive criteria documents, they are referred to as “criteria air pollutants.” In the SFBAAB, the primary criteria air pollutants of concern are ground-level ozone formed through reactions of oxides of nitrogen (NO_x) and reactive organic gases (ROG), PM_{10}, and $PM_{2.5}$. In addition to criteria air pollutants, local emissions of TACs, such as diesel particulate matter (DPM), are a concern in some areas. These primary air pollutants of concern are discussed further below.

Ozone

While ozone serves a beneficial purpose in the upper atmosphere (stratosphere) by reducing ultraviolet radiation, it can be harmful to the human respiratory system and to sensitive species of plants when it reaches elevated concentrations in the lower atmosphere. Ozone is not emitted directly into the environment, but is formed in the atmosphere by complex chemical reactions between ROG and NO_x in the presence of sunlight. Ozone formation is greatest during periods of little or no wind, bright sunshine, and high temperatures. As a result, levels of ozone usually build up during the day and peak in the afternoon.

Anthropogenic sources of ROG and NO_x include vehicle tailpipe emissions and evaporation of solvents, paints, and fuels. Automobile emissions are the single largest source of ozone precursors in the SFBAAB. Short-term ozone exposure can reduce lung function in children, exacerbate respiratory infections, and produce symptoms of respiratory distress. Long-term exposure can impair lung defense mechanisms and lead to emphysema and chronic bronchitis. Ozone can also damage plants and trees and materials such as rubber and fabrics.

Particulate Matter

PM_{10} and $PM_{2.5}$ consist of extremely small, suspended particles or droplets that are 10 microns and 2.5 microns or smaller in diameter, respectively. Some sources of particulate matter, like pollen, forest fires, and windblown dust, are naturally occurring. In populated areas, however, most particulate matter is caused by road dust, combustion products, abrasion of tires and brakes, and construction activities. Particulate matter can also be formed in the atmosphere by condensation of SO_2 and ROG.

Particulate matter exposure can affect breathing, aggravate existing respiratory and cardiovascular disease, alter the body's defense systems against foreign materials, and damage lung tissue, contributing to cancer and premature death. Individuals with chronic obstructive pulmonary or cardiovascular disease, asthmatics, the elderly, and children are most sensitive to the effects of particulate matter.

Toxic Air Contaminants

TACs include a diverse group of air pollutants that can adversely affect human health. Unlike criteria air pollutants, which generally affect regional air quality, TAC emissions are evaluated based on estimations of localized concentrations and risk assessments. The adverse health effects a person may experience following exposure to any chemical depend on several factors, including the amount (dose), duration, chemical form, and any simultaneous exposure to other chemicals.

For risk assessment purposes, TACs are separated into carcinogens and non-carcinogens. Carcinogens are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per 1 million exposed individuals over a lifetime of exposure. Non-carcinogenic substances are generally assumed to have a safe threshold below which health impacts would not occur. Acute and chronic exposure to non-carcinogens is expressed as a hazard index (HI), which is the sum of expected exposure levels divided by the corresponding acceptable exposure levels. In the SFBAAB, adverse air quality impacts on public health from TACs are predominantly from DPM.

DPM and $PM_{2.5}$ from diesel-powered engines are a complex mixture of soot, ash particulates, metallic abrasion particles, volatile organic compounds, and other components that can contribute to a range of health problems. In 1998, the CARB identified DPM from diesel-powered engines as a TAC based on its potential to cause cancer and other adverse health effects (CARB, 1998). While diesel exhaust is a complex mixture that includes hundreds of individual constituents, under California regulatory guidelines, DPM is used as a surrogate measure of exposure for the mixture of chemicals that make up diesel exhaust as a whole. More than 90 percent of DPM is less than 1 micron in diameter, and thus is a subset of $PM_{2.5}$ (CARB, 2016). The estimated cancer risk from exposure to diesel exhaust is much higher than the risk associated with any other TAC routinely measured in the region.

Localized Areas of Elevated Air Pollution

In the Bay Area, stationary and mobile sources are the primary contributors of TACs and $PM_{2.5}$ emissions to local air pollution. In an effort to promote healthy infill development from an air quality perspective, the BAAQMD has prepared guidance entitled *Planning Healthy Places* (BAAQMD, 2016a). The purpose of this guidance document is to encourage local governments to address and minimize potential local air pollution issues early in the land use planning process, and to provide technical tools to assist them in doing so. Based on a screening-level cumulative analysis of mobile and stationary sources in the Bay Area, the BAAQMD mapped localized areas of elevated air pollution that potentially exceed an excess cancer risk of 100 in a million or $PM_{2.5}$ concentrations of 0.8 micrograms per cubic meter, or are within 500 feet of a freeway, 175 feet of a major roadway (>30,000 annual average daily vehicle trips), or 500 feet of a ferry terminal. As shown by the purple areas in **Figure 4.2-1**, elevated levels of $PM_{2.5}$ and/or TAC pollution may extend across the northern portion of the proposed project site due to mobile emissions along 3rd Street.

Existing Sensitive Receptors

Sensitive receptors are individuals who are more susceptible to air-quality-related health problems relative to other members of the public, such as the very young, the old, and the infirm. Sensitive land uses are places where sensitive receptors are most likely to spend their time, such as schools, convalescent homes, and hospitals. Residential areas are also considered sensitive to poor air quality because people are often at home for extended periods, thereby increasing the duration of exposure to potential air contaminants (BAAQMD, 2017a). Existing sensitive land uses near the proposed project include residential apartments and single-family homes located approximately 70 and 150 feet southwest and west of the project site, respectively.

Odors

Other air quality issues of concern in the SFBAAB include nuisance impacts from odors; objectionable odors may be associated with a variety of pollutants. According to the BAAQMD, the following odor sources are of particular concern: wastewater treatment plants, oil refineries, asphalt plants, chemical manufacturing, painting/coating operations, coffee roasters, food processing facilities, recycling operations and metal smelters (BAAQMD, 2017a). None of these types of facilities are located in proximity to the proposed project.

REGULATORY FRAMEWORK

Federal, State, and Regional Regulations

The U.S. Environmental Protection Agency (EPA) is responsible for implementing the programs established under the federal Clean Air Act, such as establishing and reviewing the National Ambient Air Quality Standards (NAAQS) and judging the adequacy of State Implementation Plans (SIPs) to attain the NAAQS. A SIP must integrate federal, State, and local plan components and regulations to identify specific measures to reduce pollution in nonattainment areas, using a combination of performance standards and market-based programs. If a state fails to enforce its SIP-approved regulations, or if the EPA determines that a state's SIP is inadequate, the EPA is required to prepare and enforce a Federal Implementation Plan to promulgate comprehensive control measures for a given SIP.

The CARB is responsible for establishing and reviewing the California Ambient Air Quality Standards (CAAQS), developing and managing the California SIP, identifying TACs, and overseeing the activities of regional air quality management districts. In California, mobile emissions sources (e.g., construction equipment, trucks, and automobiles) are regulated by the

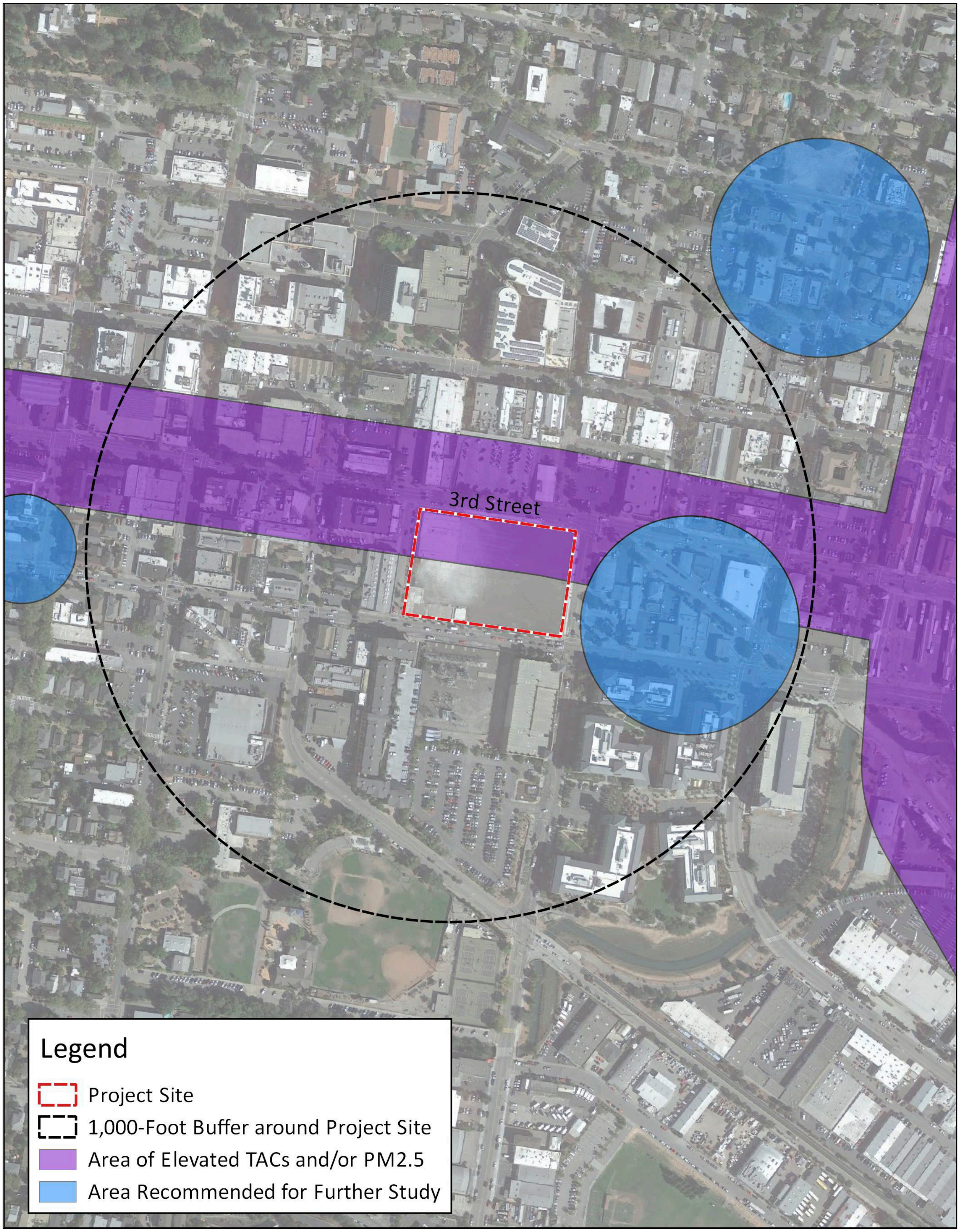


Figure 4.2-1

SOURCE: Baseline, 2019

LOCALIZED AREAS OF ELEVATED AIR POLLUTION

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

CARB, and stationary emissions sources (e.g., industrial facilities) are regulated by the regional air quality management districts.

The CAAQS and NAAQS, which were developed for criteria air pollutants, are intended to incorporate an adequate margin of safety to protect the public health and welfare. California also has ambient air quality standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. To achieve CAAQSs, criteria air pollutant emissions are managed through control measures described in regional air quality plans as well as emission limitations placed on permitted stationary sources.

In accordance with the federal Clean Air Act and California Clean Air Act, areas in California are classified as either in attainment, maintenance, or nonattainment of the NAAQS and CAAQS for each criteria air pollutant. To assess the regional attainment status, the BAAQMD collects ambient air quality data from over 30 monitoring sites within the SFBAAB. Based on current monitoring data, the SFBAAB is designated as a nonattainment area for ozone, PM_{10}, and $PM_{2.5}$, and is designated an attainment or unclassified area for all other pollutants (see **Table 4.2-1**).

Regulation of TACs, referred to as hazardous air pollutants (HAPs) under federal regulations, is achieved through federal, State, and local controls on individual sources. The air toxics provisions of the federal Clean Air Act require the EPA to identify HAPs that are known or suspected to cause cancer or other serious health effects to protect public health and welfare, and to establish National Emission Standards for Hazardous Air Pollutants. California regulates TACs primarily through the Tanner Air Toxics Act (Assembly Bill [AB] 1807) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588). The Tanner Act created California's program to identify and reduce exposure to TACs. To date, the CARB has identified over 21 TACs and adopted the EPA's list of 187 HAPs as TACs. The Hot Spots Act supplements the Tanner Act by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and facility plans to reduce these risks.

Bay Area Air Quality Management District Responsibilities

The BAAQMD is primarily responsible for ensuring that the NAAQS and CAAQS are attained and maintained in the SFBAAB. The BAAQMD fulfills this responsibility by adopting and enforcing rules and regulations concerning air pollutant sources, issuing permits, inspecting stationary sources of air pollutants, responding to citizen complaints, and monitoring ambient air quality and meteorological conditions. The BAAQMD also awards grants to reduce motor vehicle emissions and conducts public education campaigns and other activities associated with improving air quality within the SFBAAB.

The BAAQMD's CEQA Air Quality Guidelines include thresholds of significance to assist lead agencies in evaluating and mitigating air quality impacts under CEQA (BAAQMD, 2017a). The BAAQMD's thresholds established levels at which emissions of ozone precursors (ROG and NO_x), PM_{10}, $PM_{2.5}$, TACs, and odors could cause significant air quality impacts. The scientific soundness of the thresholds is supported by substantial evidence presented in the BAAQMD's Revised Draft Options and Justification Report (BAAQMD, 2009).

TABLE 4.2-1 AIR QUALITY STANDARDS AND ATTAINMENT STATUS

Pollutant	Averaging Time	CAAQS Concentration	CAAQS Attainment Status	NAAQS Concentration	NAAQS Attainment Status
Ozone	8-Hour	0.070 ppm	N	0.070 ppm	N
	1-Hour	0.09 ppm	N	Revoked in 2005	---
Carbon Monoxide (CO)	8-Hour	9.0 ppm	A	9 ppm	A
	1-Hour	20 ppm	A	35 ppm	A
Nitrogen Dioxide (NO_2)	1-Hour	0.18 ppm	A	0.100 ppm	U
	Annual	0.030 ppm	---	0.053 ppm	A
Sulfur Dioxide (SO_2)	24-Hour	0.04 ppm	A	0.14 ppm	A
	1-Hour	0.25 ppm	A	0.075 ppm	A
	Annual	---	---	0.030 ppm	A
Respirable Particulate Matter (PM_{10})	Annual	20 µg/m^3	N	---	---
	24-Hour	50 µg/m^3	N	150 µg/m^3	U
Fine Particulate Matter ($PM_{2.5}$)	Annual	12 µg/m^3	N	12 µg/m^3	U/A
	24-Hour	---	---	35 µg/m^3	N
Sulfates	24-Hour	25 µg/m^3	A	---	---
Lead	30-Day	1.5 µg/m^3	A	---	---
	Calendar Quarter	---	---	1.5 µg/m^3	A
	Rolling 3-Month	---	---	0.15 µg/m^3	A
Hydrogen Sulfide	1-Hour	0.03 ppm	U	---	---
Vinyl Chloride	24-Hour	0.010 ppm	U	---	---
Visibility Reducing Particles	8 Hour (10:00 to 18:00 PST)	---	U	---	---

Notes: A = Attainment; N = Nonattainment; U = Unclassified; "---" = not applicable; ppm = parts per million; µg/m^3 = micrograms per cubic meter; PST = Pacific Standard Time.
Source: BAAQMD, 2017b.

Bay Area Clean Air Plan

In accordance with the California Clean Air Act, the BAAQMD is required to prepare and update an air quality plan that outlines measures by which both stationary and mobile sources of pollutants can be controlled to achieve the NAAQS and CAAQS in areas designated as nonattainment. In April 2017, the BAAQMD adopted the 2017 Clean Air Plan: Spare the Air, Cool the Climate (2017 CAP), which includes 85 control measures to reduce ROG, NO_x, PM_{10}, $PM_{2.5}$, TACs, and greenhouse gases (GHGs) (BAAQMD, 2017c). The 2017 CAP was developed based on a multipollutant evaluation method that incorporates well-established studies and methods on quantifying the health benefits and air quality regulations, computer modelling and analysis of existing air quality monitoring data and emission inventories, and growth projections prepared by the Metropolitan Transportation Commission and the Association of Bay Area Government.

Local Regulations and Policies

San Rafael General Plan 2020

The following San Rafael General Plan 2020 (General Plan) policies and programs are related to air quality (City of San Rafael, 2017):

Policy AW-1 **State and Federal Standards.** Continue to comply and strive to exceed state and federal standards for air quality for the benefit of the Bay Area.

Program AW-1a **Cooperation with Other Agencies.** Cooperate with the Bay Area Air Quality Management District (BAAQMD) and other agencies in their efforts to ensure compliance with existing air quality regulations.

Policy AW-2 **Land Use Compatibility.** To ensure excellent air quality, promote land use compatibility for new development by using buffering techniques such as landscaping, setbacks, and screening in areas where different land uses abut one another.

Program AW-2a **Sensitive Receptors.** Through development review, ensure that siting of any new sensitive receptors provides for adequate buffers from existing sources of toxic air contaminants or odors. If development of a sensitive receptor (a facility or land use that includes members of the population sensitive to the effects of air pollutants, such as children, the elderly and people with illnesses) is proposed within 500 feet of Highway 101 or I-580, an analysis of mobile source toxic air contaminant health risks should be performed. Development review should include an evaluation of the adequacy of the setback from the highway and, if necessary, identify design mitigation measures to reduce health risks to acceptable levels.

Program AW-2b **Buffers.** Through development review, ensure that any proposed new sources of toxic air contaminants or odors provide adequate buffers to protect sensitive receptors and comply with existing health standards.

Policy AW-3 **Air Quality Planning with Other Processes.** Integrate air quality considerations with the land use and transportation processes by mitigating air quality impacts through land use design measures, such as encouraging project design that will foster walking and biking.

Program AW-3a **Air Pollution Reduction Measures.** Consider revisions to zoning regulations to require developers to implement strategies for air quality improvement described in the BAAQMD/ABAG's guide "Design Strategies for Encouraging Alternatives to Auto Use Through Local Development Review" or subsequent standards.

Program AW-3b **Smart Growth and Livable Communities Programs.** Participate in and implement strategies of Metropolitan Transportation Commission's regional "Smart Growth Initiative" and "Transportation for Livable Communities Program."

Policy AW-4 **Particulate Matter Pollution Reduction.** Promote the reduction of particulate matter pollution from roads, parking lots, construction sites, agricultural lands and other activities.

Program AW-4a **Pollution Reduction.** Through development review, ensure that any proposed new sources of particulate matter use latest control technology (such as enclosures, paving unpaved areas, parking lot sweeping and landscaping) and provide adequate buffer setbacks to protect existing or future sensitive receptors.

Policy AW-5 **Circulation Alternatives.** Promote circulation alternatives that reduce air pollution.

Policy AW-6 **Education and Outreach.** Support public education regarding air pollution prevention and mitigation programs.

Program AW-6a **Air Quality Education Programs.** Support and participate in the air quality education programs of the BAAQMD, such as "Spare the Air" days.

Program AW-6b **Benefits of Transit-Oriented Development.** Assist in educating developers and the public on the benefits of pedestrian and transit-oriented development.

Program AW-6c **Landscaping.** Continue to implement Zoning Guideline for landscaping in order to absorb pollutants.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this evaluation and based on Appendix G of the CEQA Guidelines, implementation of the proposed project would have a significant air quality impact if it would:

a) Conflict with or obstruct implementation of the applicable air quality plan;

b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard;

c) Expose sensitive receptors to substantial pollutant concentrations; or

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.

Thresholds of Significance

The BAAQMD's thresholds of significance have established levels at which emissions of air pollutants of concern (ROG, NO_x, PM_{10}, $PM_{2.5}$, and TACs) and odors could cause significant air quality impacts (BAAQMD, 2017a). The BAAQMD's thresholds of significance used in this CEQA analysis are summarized in **Table 4.2-2**.

TABLE 4.2-2 AIR QUALITY STANDARDS AND ATTAINMENT STATUS

Impact Analysis	Pollutant	Threshold of Significance
Regional Air Quality (Construction)	ROG	54 pounds/day (average daily emission)
	NOx	54 pounds/day (average daily emission)
	Exhaust PM_{10}	82 pounds/day (average daily emission)
	Exhaust $PM_{2.5}$	54 pounds/day (average daily emission)
Regional Air Quality (Operation)	ROG	54 pounds/day (average daily emission) 10 tons/year (maximum annual emission)
	NOx	54 pounds/day (average daily emission) 10 tons/year (maximum annual emission)
	Exhaust PM_{10}	82 pounds/day (average daily emission) 15 tons/year (maximum annual emission)
	Exhaust $PM_{2.5}$	54 pounds/day (average daily emission) 10 tons/year (maximum annual emission)
Local Community Risks and Hazards (Operation and/or Construction)	Fugitive dust (PM_{10} and $PM_{2.5}$)	Best management practices
	Exhaust $PM_{2.5}$ (project)	0.3 μg/m^3 (annual average)
	TACs (project)	Cancer risk increase > 10 in one million Chronic hazard index (HI) > 1.0
	Exhaust $PM_{2.5}$ (cumulative)	0.8 μg/m^3 (annual average)
	TACs (cumulative)	Cancer risk > 100 in one million Chronic hazard index > 10.0

Note: μg/m^3 = micrograms per cubic meter; PST = Pacific Standard Time.
Source: BAAQMD, 2017a.

Less-than-Significant Impacts

Consistency with the Bay Area Clean Air Plan

Based on the BAAQMD's current CEQA Air Quality Guidelines, the following criteria should be considered to determine if a project would conflict with or obstruct implementation of the 2017 Bay Area Clean Air Plan (2017 CAP):

- Does the project include applicable control measures from the air quality plan?
- Does the project disrupt or hinder implementation of any air quality plan control measures?
- Does the project support the primary goals of the air quality plan?

The 2017 CAP includes control measures that aim to reduce air pollution and GHGs from stationary, area, and mobile sources. The control measures are organized into nine categories: stationary sources, transportation, energy, buildings, agriculture, natural and working lands, waste management, water, and super-GHG pollutants (e.g., methane, black carbon, and fluorinated gases).

As described in **Table 4.2-3**, the project would be consistent with applicable control measures from the 2017 CAP. Because the project would not result in any significant and unavoidable air quality impacts related to emissions, ambient concentrations, or public exposures (see discussions below), the project would support the primary goals of the 2017 CAP. Therefore, based on the BAAQMD's CEQA Air Quality Guidelines, the project would not conflict with or obstruct implementation of the applicable air quality plan and the associated air quality impact would be less than significant.

Emissions of Criteria Air Pollutants

The BAAQMD currently recommends using the most recent version of the California Emissions Estimator Model (CalEEMod version 2016.3.2) to estimate construction and operational emissions of criteria air pollutants and precursors for a proposed project. CalEEMod uses widely accepted models for emission estimates combined with appropriate default data for a variety of land use projects that can be used if site-specific information is not available. The default data (e.g., type and power of construction equipment) are supported by substantial evidence provided by regulatory agencies and a combination of statewide and regional surveys of existing land uses. The primary input data used to estimate emissions associated with construction and operation of the proposed project are summarized in **Table 4.2-4**. A copy of the CalEEMod report for the proposed project, which summarizes the input parameters, assumptions, and findings, is provided in **Appendix B**.

<u>Criteria Air Pollutants from Construction</u>

Project construction activities would generate criteria air pollutant emissions that could potentially adversely affect regional air quality. Construction activities would include site preparation, grading, building construction, paving, and applications of architectural coatings. The primary pollutant emissions of concern during project construction would be ROG, NO_x, PM_{10}, and $PM_{2.5}$ from the exhaust of off-road construction equipment and on-road vehicles related to worker vehicles, vendor trucks, and haul trucks. In addition, fugitive ROG emissions would result from the application of architectural coatings and paving. Emissions of ROG, NO_x, PM_{10}, and $PM_{2.5}$ during project construction were estimated using the CalEEMod input parameters summarized in Table 4.2-4 and additional assumptions summarized in **Table 4.2-5**.

TABLE 4.2-3 PLAN CONSISTENCY WITH BAAQMD'S 2017 CAP

Control Measures	Proposed Project Consistency
Stationary Sources	The stationary source measures, which are designed to reduce emissions from stationary sources, are incorporated into rules adopted by the BAAQMD and then enforced by the BAAQMD's Permit and Inspection programs. Stationary sources on the project site would include an emergency diesel generator, which would be subject to the BAAQMD's permitting requirements for stationary sources. Potential venting of laboratory chemicals to the atmosphere (if any) would also be subject to the BAAQMD's permitting requirements. Therefore, the proposed project would be consistent with the stationary source control measures of the 2017 CAP.
Transportation	The transportation control measures are designed to reduce vehicle trips, use, miles traveled, idling, or traffic congestion for the purpose of reducing vehicle emissions. According to Section 4.13, Transportation, the project would generate a significant net increase in vehicle trips, and therefore would not be consistent with the transportation control measures of the 2017 CAP.
Energy	The energy control measures are designed to reduce emissions of criteria air pollutants, TACs, and GHGs by decreasing the amount of electricity consumed in the Bay Area, as well as decreasing the carbon intensity of the electricity used by switching to less GHG-intensive fuel sources for electricity generation. Since these measures primarily apply to electrical utility providers, the energy control measures of the 2017 CAP are not applicable to the proposed project. Electricity in San Rafael is supplied by Pacific Gas and Electric Company (PG&E), which supplies 70 percent of its electric power mix from a combination of renewable and greenhouse-gas (GHG) free sources (PG&E, 2018).
Buildings	The BAAQMD has authority to regulate emissions from certain sources in buildings such as boilers and water heaters, but has limited authority to regulate buildings themselves. Therefore, the building control measures focus on working with local governments that have authority over local building codes to facilitate adoption of best practices and policies to control GHG emissions. The proposed project would comply with the local building codes and indoor lighting systems would meet the minimum code efficiency requirements for Title-24 Building Energy Efficiency Standards, such as light emitting diode (LED) lighting. Therefore, the proposed project would not conflict with the building control measures of the 2017 CAP.
Agriculture	The agriculture control measures are designed primarily to reduce emissions of methane. Since the project does not include any agricultural activities, the agriculture control measures of the 2017 CAP are not applicable to the project.
Natural and Working Lands	The control measures for the natural and working lands sector focus on increasing carbon sequestration on rangelands and wetlands, as well as encouraging local governments to adopt ordinances that promote urban tree plantings. Since the project does not include the disturbance of any rangelands or wetlands, the natural and working lands control measures of the 2017 CAP are not applicable to the project.
Waste Management	The waste management measures focus on reducing or capturing methane emissions from landfills and composting facilities, diverting organic materials away from landfills, and increasing waste diversion rates through efforts to reduce, reuse, and recycle. The project would comply with local requirements for waste management (e.g., recycling). Therefore, the project would be consistent with the waste management control measures of the 2017 CAP.
Water	The water control measures to reduce emissions from the water sector will reduce emissions of criteria pollutants, TACs, and GHGs by encouraging water conservation, limiting GHG emissions from publicly owned treatment works (POTWs), and promoting the use of biogas recovery systems. Since these measures apply to POTWs and local government agencies (and not individual projects), the water control measures of the 2017 CAP are not applicable to the project.
Super GHGs	The super-GHG control measures are designed to facilitate the adoption of best practices and policies to control GHG emissions through the BAAQMD and local government agencies. Since these measures do not apply to individual projects, the super-GHG control measures of the 2017 CAP are not applicable to the project.

Source: BAAQMD, 2017c.

TABLE 4.2-4 PROJECT LAND-USE INPUT PARAMETERS FOR CALEEMOD

Project Development	CalEEMod Land-Use Type	Unit	Amount
Whistlestop/Eden Housing	Congregate Care (Assisted Living)	dwelling unit	67
		1,000 square feet	57
	Health Club	1,000 square feet	18
	Enclosed Parking Lot	parking space	12
BioMarin Building A	General Office Building	1,000 square feet	110
	Parking Lot	parking space	29
BioMarin Building B	Research & Development	1,000 square feet	97

Note: Total square footage includes amenities, such as lobbies, conference rooms, a fitness center, dining space, and 3,500 square feet of retail space in BioMarin Building A.
Source: A copy of the CalEEMod report is provided in **Appendix B**.

TABLE 4.2-5 CONSTRUCTION ASSUMPTIONS FOR CALEEMOD

CalEEMod Input Category	Assumptions and Changes to Default Data
Construction Phase and Equipment	The duration and timing of project construction is expected to occur as follows: ■ Construction of the Whistlestop/Eden Housing project is anticipated to occur over an approximately 18-month period beginning in 2021 and concluding in 2022. ■ Construction of BioMarin Building A is anticipated to occur over an approximately 18-month period beginning in 2022 and concluding in 2023. ■ Construction of BioMarin Building B is anticipated to occur over an approximately 24-month period beginning in 2026 and concluding in 2028. To streamline the analysis of construction emissions, it was assumed that all construction would begin in 2021. This is a conservative assumption because emissions from construction equipment are expected to lower over time as newer off-road equipment with lower emission standards continue to replace older equipment. CalEEMod applies default equipment usage and phase lengths based on the findings of an extensive construction survey that included over 65 construction sites. Based on the project input parameters described in Table 4.2-4, CalEEMod estimated that construction of the proposed project would be similar to a 5- to 10-acre construction site included in their survey. The corresponding default equipment usage and construction phase lengths for a project of this size were used to estimate the total hours of equipment operation (and associated emissions) required to construct the proposed project. A drill rig (for pile driving) was added to the default construction equipment list.
Material Movement	Approximately 1,400 cubic yards of soil is expected to be hauled off-site.

Note: Material movement information provided by the project sponsor. Default CalEEMod data was used for all other parameters not described.
Source: A copy of the CalEEMod report is provided in **Appendix B**.

To analyze daily emission rates during project construction, the total emissions estimated during construction were averaged over the total work days (60 months x 22 work days per month = 1,320 work days) and compared to the BAAQMD's thresholds of significance. As shown in **Table 4.2-6**, the project's estimated emissions for ROG, NO_x, and exhaust PM_{10} and $PM_{2.5}$ during construction were well below the applicable thresholds and, therefore, would have a less-than-significant impact on regional air quality.

TABLE 4.2-6 ESTIMATED CONSTRUCTION EMISSIONS (POUNDS PER DAY)

			Exhaust	
Emissions Scenario	**ROG**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**
Construction Emissions	3.0	5.3	0.2	0.2
BAAQMD's Thresholds	54	54	82	54
Exceed Quantitative Threshold?	No	No	No	No

Notes: ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter; BAAQMD = Bay Area Air Quality Management District
Source: A copy of the CalEEMod report is provided in **Appendix B**.

Criteria Air Pollutants from Operation

Project operation would generate criteria air pollutant emissions that could potentially affect regional air quality. The primary pollutant emissions of concern during project operation would be ROG, NO_x, and exhaust PM_{10} and $PM_{2.5}$ from mobile sources, energy use, area sources (e.g., consumer products and architectural coatings), and stationary sources. Project emissions were estimated at the expected full buildout of the project in 2028. Since statewide vehicle emission standards are required to improve over time in accordance with the Pavley (Assembly Bill 1493) and Low-Emission Vehicle regulations (Title 13, California Code of Regulations, and Section 1961.2), estimating emissions for the earliest year of operation at full buildout provides the maximum expected annual emissions. Emissions of ROG, NO_x, PM_{10}, and $PM_{2.5}$ during project operation were estimated using the CalEEMod input parameters summarized in Table 4.2-4 and additional assumptions summarized in **Table 4.2-7**.

TABLE 4.2-7 OPERATION ASSUMPTIONS FOR CALEEMOD

CalEEMod Input Category	**Operation Assumptions and Changes to Default Data**
Vehicle Trips	Daily trip rates for each type of land use were adjusted according to the project traffic analysis (see Section 4.13, Transportation).
Stationary Sources	A 500 kilowatt emergency diesel generator would be required for the project. It was assumed that the generator would be used for non-emergency operation up to 50 hours per year (for routine testing and maintenance).

Note: Default CalEEMod data was used for all other parameters not described.
Source: A copy of the CalEEMod report is provided in **Appendix B**.

The estimated maximum annual emissions and average daily emissions during the operational phase of the proposed project are compared to the BAAQMD's thresholds of significance in **Table 4.2-8**. The estimated emissions for ROG, NO_x, and exhaust PM_{10} and $PM_{2.5}$ during operation were below the thresholds and, therefore, would have a less-than-significant impact on regional air quality.

Exposure of Sensitive Receptors to Toxic Air Contaminants and $PM_{2.5}$

Project construction would generate DPM and $PM_{2.5}$ emissions primarily from the exhaust of off-road diesel construction equipment. Similarly, project operations would generate DPM and $PM_{2.5}$

TABLE 4.2-8 ESTIMATED OPERATION EMISSIONS AT FULL PROJECT BUILDOUT

	Maximum Annual Emissions (Tons)				Average Daily Emissions (Pounds)			
Emissions Scenario	**ROG**	**NO_x**	**Exhaust PM_{10}**	**Exhaust $PM_{2.5}$**	**ROG**	**NO_x**	**Exhaust PM_{10}**	**Exhaust $PM_{2.5}$**
Area	1.28	0.01	<0.01	<0.01	6.99	0.04	0.02	0.02
Energy	0.03	0.27	0.02	0.02	0.16	1.48	0.11	0.11
Mobile	0.34	1.08	0.01	0.01	1.89	5.89	0.07	0.07
Stationary	0.03	0.08	<0.01	<0.01	0.15	0.42	0.02	0.02
Total Emissions	1.7	1.4	0.04	0.04	9.2	7.8	0.2	0.2
Thresholds of Significance	10	10	15	10	54	54	82	54
Exceed Threshold?	No	No	No	No	No	No	No	No

Notes: ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter
Source: A copy of the CalEEMod report is provided in **Appendix B**.

emissions from testing and maintenance of an emergency generator. The emissions of DPM and $PM_{2.5}$ from diesel exhaust during project construction and operation could pose a health risk to nearby sensitive receptors. The BAAQMD recommends evaluating the potential health risks to sensitive receptors within 1,000 feet of a proposed project that could be exposed to TACs, such as DPM, and $PM_{2.5}$. Because the Whistlestop/Eden Housing building would be occupied during construction of the BioMarin buildings, future residents in the Whistlestop/Eden Housing project could also be exposed to emissions of DPM and $PM_{2.5}$ from diesel exhaust during project construction and operation.

Generation of TAC Emissions during Construction

The annual average concentrations of DPM and exhaust $PM_{2.5}$ concentrations during construction were estimated within 1,000 feet of the project using the EPA's Industrial Source Complex Short Term (ISCST3) air dispersion model. For this analysis, emissions of exhaust PM_{10} were used as a surrogate for DPM, which is a conservative assumption because more than 90 percent of DPM is less than 1 micron in diameter. The input parameters and assumptions used for estimating emission rates of DPM and $PM_{2.5}$ from off-road diesel construction equipment are included in **Appendix B**.

The exhaust from off-road equipment was represented in the ISCST3 model as a series of volume sources with a release height of 5 meters to represent the mid-range of the expected plume rise from frequently used construction equipment. Dispersion of air pollutants from off-road construction equipment was modeled using the χ/Q ("chi over q") method, such that each source has a unit emission rate (e.g., 1 gram per second for volume sources). The annual average concentration profiles from the air dispersion model were then scaled according to the ratio between the unit emission rate and the actual emission rate from each source. Actual emission rates for off-road equipment were based on the actual hours of work and averaged over the entire duration of construction. Daily emissions from construction were assumed to occur between 7:00 AM. and 6:00 PM Monday through Friday and 9:00 AM to 6:00 PM on Saturday.

A uniform grid of receptors spaced 20 meters apart with receptor heights of 1.8 meter (for ground-level receptors) was placed around the project site as a means of developing isopleths (i.e., concentration contours) that illustrate the dispersion pattern from the emissions sources. The ISCST3 model input parameters included 1 year of BAAQMD meteorological data from the Mt. Tamalpais weather station located about 5 miles southwest of the project site.

The air dispersion model was used to estimate annual average concentrations of DPM and $PM_{2.5}$ from project construction. Project construction would occur in phases over an approximately 8- to 10-year period. To streamline the analysis of potential health risks, it was assumed that construction of the entire project would occur continuously (i.e., not in phases) starting in 2021. This is a conservative assumption because emissions from construction equipment would improve over time as newer off-road equipment replaces older equipment with higher emission rates.

Two construction scenarios were modeled to evaluate potential health risks to off-site receptors and future on-site receptors. For off-site receptors, health risks over a 60-month period were evaluated based on construction emissions from the entire project. For on-site receptors associated with the Whistlestop/Eden Housing project, health risks over a 42-month period were evaluated based on construction emissions from the BioMarin project.

Based on the results of the air dispersion model (**Appendix B**), potential off-site health risks were evaluated for the maximally exposed individual resident (MEIR) on the ground floor of an apartment building located about 70 feet southwest of the project site, and potential on-site health risks were evaluated for a future MEIR located on the ground floor of the Whistlestop/Eden Housing project (see **Figure 4.2-2** for MEIR locations). The annual average concentrations of DPM and $PM_{2.5}$ at the off-site and on-site MEIRs are summarized in **Table 4.2-9**.

TABLE 4.2-9 ANNUAL AVERAGE TAC CONCENTRATIONS DURING PROJECT CONSTRUCTION

	Annual Average Concentration ($\mu g/m^3$)	
Sensitive Receptor	**DPM**	**Exhaust $PM_{2.5}$**
Off-Site Maximally Exposed Individual Resident	0.017	0.016
On-Site Maximally Exposed Individual Resident	0.027	0.026

Note: $\mu g/m^3$ = micrograms per cubic meter
Source: See **Appendix B**.

In accordance with guidance from the BAAQMD (2012a) and the Office of Environmental Health Hazard Assessment (OEHHA, 2015), a health risk assessment was conducted to calculate the incremental increase in cancer risk and chronic hazard index (HI) to sensitive receptors from DPM emissions during construction. Analysis of acute non-cancer health hazards from construction activity is not recommended by BAAQMD, nor has a reference exposure level been approved by OEHHA and CARB. The annual average concentration of DPM at the off-site and on-site MEIRs were used to conservatively assess potential health risks to all nearby sensitive receptors.

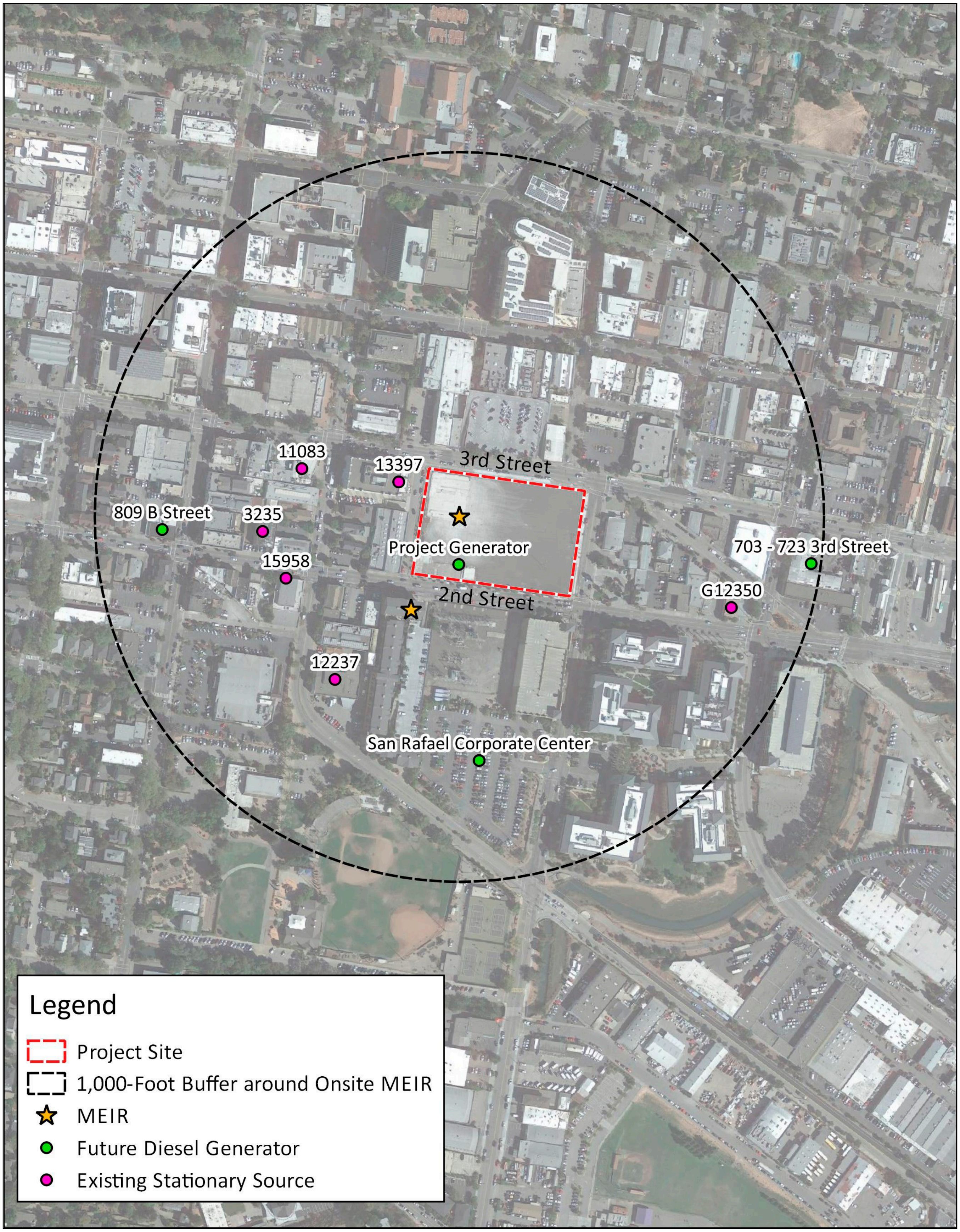


Figure 4.2-2

SOURCE: Baseline, 2019

SENSITIVE RECEPTORS AND LOCAL SOURCES OF TACs AND PM2.5

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

At the off-site MEIR location, the incremental increase in cancer risk from DPM emissions during construction was assessed for a young child exposed to DPM starting from infancy in the third trimester of pregnancy. At the on-site MEIR location, the incremental increase in cancer risk from DPM emissions during construction was assessed for an adult exposed to DPM. These exposure scenarios represent the most sensitive individuals who could be exposed to adverse air quality conditions in the vicinity of the project site. The input parameters and results of the health risk assessment are included in Appendix B.

Estimates of the health risks at the off-site and on-site MEIRs from exposure to DPM and $PM_{2.5}$ concentrations during project construction are summarized and compared to the BAAQMD's thresholds of significance in **Table 4.2-10**. The estimated excess cancer risk and chronic HI for DPM and annual average $PM_{2.5}$ concentration from construction emissions were below the BAAQMD's thresholds of significance for both the off-site and on-site MEIRs. Therefore, project construction would have a less-than-significant impact on nearby sensitive receptors. Generation of TAC Emissions during Operation

TABLE 4.2-10 HEALTH RISKS AT OFF-SITE AND ON-SITE MEIRS DURING PROJECT CONSTRUCTION

	Diesel Particulate Matter		Exhaust $PM_{2.5}$
Sensitive Receptor	**Cancer Risk (Per Million)**	**Chronic Hazard Index**	**Annual Average Concentration (μg/m³)**
Off-Site Maximally Exposed Individual Resident	6.2	<0.01	0.016
On-Site Maximally Exposed Individual Resident	0.3	<0.01	0.026
BAAQMD's Thresholds of Significance	10	1	0.3
Exceed Threshold?	No	No	No

Note: μg/m³ = micrograms per cubic meter
Source: See Appendix B.

A 500 kilowatt emergency generator would be located adjacent to the west side of BioMarin Building B (see Figure 4.2-2). To operate an emergency generator, the project would be required to comply with the BAAQMD's permit requirements for a stationary source. In accordance with BAAQMD's Regulation 2-5, New Source Review of Toxic Air Contaminants, the BAAQMD does not issue permits for generators that would result in an excess cancer risk greater than 10 in 1 million or a chronic HI greater than 1.0.

Conservatively assuming the project's emergency generator would result in the BAAQMD's maximum permissible excess cancer risk of 10 in 1 million due to emissions of DPM, the BAAQMD's Risk and Hazards Emissions Screening Calculator (Beta Version 2.0) was used to back-calculate the equivalent screening-level health risks values for chronic HI and annual average $PM_{2.5}$ concentrations (BAAQMD, 2019a). The calculator applies similar methods used to establish the emission threshold levels for TACs reported in the BAAQMD's Regulation 2-5 and includes the most recent health risk parameters recommended by OEHHA (2015). Based on the emission rate for DPM (0.0071 pounds per day) that would result in a cancer risk of 10 in 1 million, the associated fraction of $PM_{2.5}$ emissions from an emergency generator were estimated using the CARB's speciation profiles (CARB, 2018). The health risk screening values from the project's emergency generator were then refined based on the distance from the generator to the MEIRs using the BAAQMD's Diesel Internal Combustion Engine Distance Multiplier Tool (BAAQMD, 2012b). The supporting health risk calculations are included in Appendix B.

The conservative screening-level health risks to sensitive receptors associated with operation of the emergency generator are summarized and compared to the BAAQMD's thresholds of significance in **Table 4.2-11**. The estimated excess cancer risk and chronic HI for DPM and the annual average $PM_{2.5}$ concentration from operation of the emergency generator were below the BAAQMD's thresholds of significance; therefore, the project's emissions of DPM and $PM_{2.5}$ during operation of an emergency generator would have a less-than-significant impact on nearby sensitive receptors.

TABLE 4.2-11 HEALTH RISKS AT OFF-SITE AND ON-SITE MEIRS DURING PROJECT OPERATION

		Diesel Particulate Matter		Exhaust $PM_{2.5}$
Sensitive Receptor	**Distance from Generator (Feet)**	**Cancer Risk (Per Million)**	**Chronic Hazard Index**	**Annual Average Concentration (µg/m³)**
Off-Site Maximally Exposed Individual Resident	175	5.0	<0.01	<0.01
On-Site Maximally Exposed Individual Resident	125	6.4	<0.01	0.01
BAAQMD's Thresholds of Significance	---	10	1.0	0.3
Exceed Threshold?	---	No	No	No

Note: µg/m³ = micrograms per cubic meter; "---" = not applicable
Source: BAAQMD, 2016b.

Cumulative TAC Emissions

In addition to a project's individual TAC and $PM_{2.5}$ emissions during construction and operation, the potential cumulative health risks to sensitive receptors from existing and future foreseeable sources of TACs and $PM_{2.5}$ were evaluated. Based on the proximity of the on-site MEIR to two major roadways (2nd street and 3rd Street) (Figure 4.2-2), cumulative health risks were estimated at the on-site MEIR to represent the worst-case-exposure scenario for sensitive receptors in the project vicinity. The BAAQMD's online screening tools were used to provide conservative estimates of how much existing TAC sources would contribute to cancer risk, HI, and $PM_{2.5}$ concentrations. The individual health risks associated with each source were summed to find the cumulative health risk at the on-site MEIR.

Based on the BAAQMD's Stationary Source Screening Analysis Tool (BAAQMD, 2012c) and correspondence with BAAQMD staff (BAAQMD, 2019b), eight existing stationary sources of TAC emissions were identified within 1,000 feet of the on-site MEIR (see **Table 4.2-12** and Figure 4.2-2). Preliminary health risk screening values at the on-site MEIR were determined using the BAAQMD Health Risk Calculator (Beta Version 2.0), recent facility emissions data, and the BAAQMD's Gasoline Dispensing Facility Distance Multiplier Tool (BAAQMD, 2012d)..

TABLE 4.2-12 CUMULATIVE HEALTH RISKS AT THE ON-SITE MAXIMALLY EXPOSED INDIVIDUAL RESIDENT (MEIR)

Source	Source Type	Method Ref	Cancer Risk (10^{-6})	Chronic HI	$PM_{2.5}$ ($\mu g/m^3$)
Project					
Off-Road Construction Equipment	Diesel Exhaust		0.3	<0.01	0.03
Emergency Generator	Diesel Gen	1,2	8.8	<0.01	0.01
Existing Stationary Sources					
Rafael Town Center (Plant 13397)	Diesel Generator	1	0.5	<0.01	<0.01
Comcast of California (Plant 15958)	Diesel Generator	1	0.5	<0.01	<0.01
Safeway, Inc. #653 (Plant 22809)	Diesel Generator	1	<0.1	<0.01	<0.01
Steve Zappetini & Son, Inc. (Plant 3235)	Surface Coating	1	0.2	<0.01	NA
Royal Ground (Plant 22498)	Coffee Roaster	1	13.8	<0.01	0.01
Western Dealer Holding Co, LLC (Plant G12350)	Gas Station	2	0.9	<0.01	NA
Maxwell The Cleaners, Inc. (Plant 11083)	Cleaner	3	NA	NA	NA
Marin Cleaners (Plant 12237)	Cleaner	3	NA	NA	NA
Existing Mobile Sources					
Highways	Mobile	4	3.1	NA	0.07
Major Roadways	Mobile	4	14.6	NA	0.25
3rd Street (22,285 AADT)	Mobile	5,6	4.4	NA	0.05
Future Stationary Sources					
809 B Street	Diesel Generator	1	0.6	<0.01	<0.01
703 – 723 3rd Street	Diesel Generator	1	0.4	<0.01	<0.01
San Rafael Corporate Center – Lindaro Street	Diesel Generator	1	0.8	<0.01	<0.01
		Cumulative Health Risks	47	<0.1	0.4
		BAAQMD's Thresholds of Significance	100	10.0	0.8
		Exceed Thresholds?	No	No	No

Notes: $\mu g/m^3$ = micrograms per cubic meter; HI = hazard index; NA = not applicable; Ref = reference; AADT = annual average daily traffic; $PM_{2.5}$ = fine particulate matter
Health risk screening values derived using the following BAAQMD tools and methodologies:
1) BAAQMD's Health Risk Calculator (Beta Version 2.0).
2) BAAQMD's Gasoline Dispensing Facility Distance Multiplier Tool.
3) Dry cleaners are required to phase out Perchoroethylene by 2023. Therefore, dry cleaners do not need to be considered as part of the analysis per guidance from BAAQMD.
4) BAAQMD Planning Healthy Places Highway, Major Street, and Rail health risk raster files, 2014.
5) BAAQMD's Roadway Screening Analysis Calculator.
6) BAAQMD's recommended Office of Environmental Health Hazard Assessment cancer risk adjustment factor.
Source: BAAQMD, 2012c.

Preliminary health risk screening values at the on-site MEIR from exposure to mobile sources of TACs were estimated based on the BAAQMD's Bay Area modeling of health risks from highways and major roadways with an average annual daily traffic (AADT) volume greater than 30,000 vehicles per day (BAAQMD, 2014). The BAAQMD also recommends estimating health risk screening values for major roadways with an AADT volume greater than 10,000 vehicles per day. Based on review of AADT volumes reported by the Transportation Authority of Marin (TAM, 2017), there is one major roadway within 1,000 feet of the on-site MEIR (see Table 4.2-12 and Figure 4.2-2). The health risk screening values at the on-site MEIR from the major roadways were estimated using the BAAQMD's Roadway Screening Analysis Calculator (BAAQMD, 2015) and the cancer risks were adjusted using a factor of 1.374 to account for the most recent health risk parameters recommended by OEHHA.

In addition to existing TAC sources, there are three proposed development projects that may be constructed within 1,000 feet of the on-site MEIR location in the near future (Table 4.2-12 and Figure 4.2-2). Conservatively assuming all foreseeable future development would include an emergency diesel generator, and that each proposed generator would result in a maximum excess cancer risk of 10 in one million due to emissions of DPM, the BAAQMD's Risk and Hazards Emissions Screening Calculator (Beta Version 2.0) was used to estimate the equivalent screening-level health risks values for chronic HI and annual average $PM_{2.5}$ concentrations. The health risk screening values from the future generators were then refined based on the distance from each source to the on-site MEIR using the BAAQMD's Diesel Internal Combustion Engine Distance Multiplier Tool.

Estimates of the cumulative health risks at the on-site MEIR are summarized and compared to the BAAQMD's cumulative thresholds of significance in Table 4.2-12. The excess cancer risk, chronic HI, and annual average $PM_{2.5}$ concentrations at the on-site MEIR were below the BAAQMD's cumulative thresholds. Therefore, the cumulative impact on nearby sensitive receptors from TAC and $PM_{2.5}$ emissions during construction and operation of the proposed project would be less than significant.

Generation of Odors

Project construction and operation would not be expected to generate significant odors because the project would not include handling or generation of noxious materials. Therefore, project impacts related to odors would be less than significant.

Potentially Significant Impacts

Impact AIR-1: Fugitive dust emissions during project construction could adversely affect a substantial number of people. (PS)

Project excavation, grading, and material hauling activities during construction could generate fugitive dust PM_{10} and $PM_{2.5}$ emissions that could adversely affect local air quality. The BAAQMD does not have a quantitative threshold of significance for fugitive dust PM_{10} and $PM_{2.5}$ emissions; however, the BAAQMD considers implementation of best management practices (BMPs) to control dust during construction sufficient to reduce potential impacts to a less-than-significant level. More specifically, the BAAQMD recommends that all construction projects implement the Basic Construction Mitigation Measures from the BAAQMD's CEQA Air Quality Guidelines (BAAQMD, 2017a) to reduce emissions of fugitive dust (regardless of the estimated emissions). The BAAQMD's Basic Construction Mitigation Measures for controlling dust are summarized under Mitigation Measure AIR-1, below.

Mitigation Measure AIR-1: During project construction, the contractor shall implement a dust control program that includes the following measures recommended by the BAAQMD:

- *All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.*
- *All haul trucks transporting soil, sand, or other loose material off-site shall be covered.*
- *All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.*
- *All vehicle speeds on unpaved roads shall be limited to 15 miles per hour.*
- *All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.*
- *A publicly visible sign shall be posted with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Bay Area Air Quality Management District (BAAQMD) phone number shall also be visible to ensure compliance with applicable regulations.*

The above measures shall be included in contract specifications. In addition, an independent construction monitor shall conduct periodic site inspections, but in no event less than four total inspections, during the course of construction to ensure these mitigation measures are implemented and shall issue a letter report to the City of San Rafael Building Division documenting the inspection results. Reports indicating non-compliance with construction mitigation measures shall be cause to issue a stop work order until such time as compliance is achieved.

Implementation of Mitigation Measure AIR-1 would reduce potentially significant impacts of fugitive dust emissions during project construction to a less-than-significant level. (LTS)

Cumulative Impacts

The BAAQMD's thresholds of significance for criteria air pollutants were designed to represent levels above which a project's individual emissions would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions (BAAQMD, 2009). Since construction and operation of the proposed project would not exceed the BAAQMD's thresholds of significance for criteria pollutants (including ozone precursors), the cumulative impact on regional air quality would be less than significant.

The BAAQMD's project-level thresholds of significance for TACs (e.g., DPM) and $PM_{2.5}$ were also designed to determine if a project's contribution to local air pollution would be cumulatively considerable. Since emissions of DPM and $PM_{2.5}$ during construction and operation of the proposed project would not exceed the BAAQMD's cumulative thresholds of significance, the cumulative impact on local air quality would be less than significant.

REFERENCES

Bay Area Air Quality Management District (BAAQMD), 2019a. BAAQMD Health Risk Calculator (Beta Version 2.0).

Bay Area Air Quality Management District (BAAQMD), 2019b. BAAQMD's Risk & Hazard Stationary Source Inquiry Form. May 6.

Bay Area Air Quality Management District (BAAQMD), 2019c. Personal communication between Patrick Sutton, Baseline Environmental Consulting, and Areana Flores, BAAQMD, February 5.

Bay Area Air Quality Management District (BAAQMD), 2017a. California Environmental Quality Act Air Quality Guidelines, May.

Bay Area Air Quality Management District (BAAQMD), 2017b. Air Quality Standards and Attainment Status. Website: http://www.baaqmd.gov/research-and-data/air-quality-standards-and-attainment-status, accessed on April 10, 2019. Last updated January 5, 2017.

Bay Area Air Quality Management District (BAAQMD), 2017c. 2017 Clean Air Plan: Spare the Air, Cool the Climate, April 19.

Bay Area Air Quality Management District (BAAQMD), 2016a. Planning Healthy Places; A Guidebook for Addressing Local Sources of Air Pollutants in Community Planning, May.

Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator, April 16.

Bay Area Air Quality Management District (BAAQMD), 2014. BAAQMD Planning Healthy Places Highway, Major Street, and Rail health risk raster files, 2014.

Bay Area Air Quality Management District (BAAQMD), 2012a. Recommended Methods for Screening and Modeling Local Risks and Hazards, May.

Bay Area Air Quality Management District (BAAQMD), 2012b. Diesel Internal Combustion Engine Distance Multiplier Tool, June 13.

Bay Area Air Quality Management District (BAAQMD), 2012c. Stationary Source Screening Analysis Tool, May 30.

Bay Area Air Quality Management District (BAAQMD), 2012d. Gasoline Dispensing Facility Distance Multiplier Tool, June 13.

Bay Area Air Quality Management District (BAAQMD), 2009. Revised Draft Options and Justification Report; California Environmental Quality Act Thresholds of Significance, October.

California Air Resources Board (CARB), 2018. Speciation Profiles Used in ARB Modeling. PMPROF spreadsheet for particulate matter chemical profiles for source categories. Website: https://www.arb.ca.gov/ei/speciate/speciate.htm#assnfrac, accessed on January 29, 2018.

California Air Resources Board (CARB), 1998. Initial Statement of Reasons for Rulemaking; Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant, June.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Reprinted April 28, 2017.

Office of Environmental Health Hazard Assessment (OEHHA), 2015. Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, February.

Pacific Gas and Electric (PG&E), 2018. Independent Registry Confirms Record Low Carbon Emissions for PG&E., March 26.

Transportation Authority of Marin (TAM), 2017. Accept 2016 System Monitoring Report and the 2017 Congestion Management Program Report (Action), Agenda Item No. 11. Exhibit A Travel Data Summaries.

4.3 CULTURAL RESOURCES

INTRODUCTION

This section of the DEIR describes the potential impacts of the project on cultural resources. Cultural resources are sites, buildings, structures, objects, and districts that may have traditional or cultural value for their historical significance. Examples of cultural resources include pre-contact (Native American) and historic-period archaeological sites, and historic buildings and bridges of architectural significance. The California Environmental Quality Act (CEQA) requires that agencies considering projects that are subject to discretionary action shall consider the potential impacts on cultural resources that may occur from project implementation (see Section 15064.5 and Appendix G of the CEQA Guidelines).

This section describes existing cultural resources conditions at the project site and the pertinent state and City of San Rafael (City) laws and regulations related to cultural resources. Potentially significant adverse impacts that could result from project implementation are described, and mitigation measures to reduce these impacts to less-than-significant levels are identified, as appropriate.

ENVIRONMENTAL SETTING

The pre-contact, ethnographic, and historical contexts for the project site and vicinity are summarized below.

Pre-Contact and Ethnographic Settings

The pre-contact archaeological chronology for central California, and applicable to Marin County, consists of the Early Holocene (8000–3500 cal B.C.), Early Period (3500–500 cal B.C.), Lower Middle Period (500 cal B.C.–A.D. cal 430), Upper Middle Period (cal A.D. 430–1050), Initial Late Period (cal A.D. 1050–1550), and Terminal (Phase 2) Late Period (cal. A.D. 1550–1850) (Milliken et al. 2007).

One of the oldest archaeological deposits in the San Francisco Bay Area has been identified at Los Vaqueros Reservoir, east of Mount Diablo in Contra Costa County. At Los Vaqueros, an Early Holocene component was identified at archaeological site CA-CCO-696, where charcoal associated with a milling slab was dated to 7920 cal. B.C. The sparse archaeological data from Bay Area Early Holocene sites suggests a generalized, mobile hunter-gatherer adaptation characterized by milling stone equipment and wide-stemmed and leaf-shaped projectile points used for hunting. Beginning at around 3500 B.C. at the onset of the Early Period, local archaeological assemblages include stylized shell beads (often associated with human burials), mortars and pestles, and structural remains. Collectively, these assemblages indicate increased sedentism, regional symbolic integration, and trade. By the Lower Middle Period, a "major disruption in symbolic integration systems" occurred, as evidenced by stylistic changes in shell ornaments and mortuary patterns (Milliken et al., 2007:115). The use of mortars and pestles is widespread during this time, although milling slabs and hand stones persist in some areas. At around A.D. 430, at the onset of the Upper Middle Period, archaeological data indicate a westward expansion of “Meganos culture” traits into the Bay Area from the San Joaquin Delta. The Meganos culture is characterized in the archaeological record by dorsally extended burials,[1] often associated with abundant shell beads. The Late Period is characterized by introduction of the bow-and-arrow (as evidenced by arrow-sized projectile points), increased social stratification, as evidenced in grave goods, and introduction of the Kuksu cult, which unified several language groups around the Bay Area.

Locally, pre-contact archaeological sites have been identified near the bay margin/tidal marshland and include midden deposits, black/gray-colored ashy soil containing artifacts and subsistence debris indicative of intensive episodes of occupation. Nearby archaeological excavations at Native American sites provided evidence of occupation of southern Marin County dating from the Early Period at De Silva Island, during the Middle and Late periods at sites in San Rafael and Larkspur (Bieling, 2000; Stewart, 1999), and during Terminal Late Period (Schneider, 2010).

Present-day San Rafael is in the ethnographic territory of the Coast Miwok, who occupied what are now Marin and southern Sonoma Counties. The Coast Miwok language is subsumed under the Penutian language stock and includes two dialects: Western, or Bodega, and Southern, or Marin, with Southern being further divided into valley and coast (Barrett, 1908; Kelly, 1978).

Coast Miwok territories comprised one or more land-holding groups that anthropologists refer to as “tribelets.” The tribelet, a nearly universal characteristic throughout native California, consists of a principal village occupied year-round, and a series of smaller hamlets and resource gathering and processing locations occupied intermittently or seasonally (Kroeber, 1955). Tribelet population ranged between 50 and 500 persons, largely determined by the carrying capacity of a tribelet’s territory.

The traditional Coast Miwok lifeway was severely disrupted due to introduced diseases, a declining birth rate, and the impact of the mission system. Coast Miwok were transformed from hunters and gatherers into agricultural laborers who lived at the missions. Later, because of the secularization of the missions by Mexico in 1834, most of the aboriginal population gradually moved to ranchos to work as manual laborers.

Today, many Coast Miwok people still live in their ancestral territory in Marin County and continue to engage in traditional cultural practices. The Federated Indians of Graton Rancheria (FIGR) are a federally recognized tribe consisting of both Coast Miwok and Southern Pomo (whose ancestral tribal territory is in northern Sonoma County). FIGR, established in 1992, provides members with economic and educational opportunities, and seeks to preserve their traditional heritage.

Historical Setting

San Rafael History

In 1817, Mission San Rafael Arcangel, an adjunct of the Mission San Francisco de Dolores in San Francisco, was established a few blocks north of the project site in what would become the city of

[1] Dorsal extension is a common burial position in which an articulated skeleton is found on its back with the legs extended and the arms lying along the sides of the body.

San Rafael. The mission was established as a hospital for ill Native American neophytes. Following the secularization of the Mexican missions, a land grant known as Rancho San Pablo, which contained the former Mission San Rafael Arcangel, was given to Timoteo (Timothy) Murphy.

The town of San Rafael began to develop in the mid-1800s as an agricultural center for the region. After California achieved statehood in 1848, Marin County was established as one of the state's first 27 counties, and San Rafael was identified as one the county's four original townships and as the county seat.

Early on, San Rafael grew quite slowly due its lack of industry and isolation from San Francisco. The coming of the ferry and the railroad in the late 1800s changed the character of San Rafael, as commuting to San Francisco became a possibility. The area was no longer available to just a few wealthy residents and vacationers looking for good weather, but now to people of more moderate means who could work in San Francisco and permanently reside in Marin County. The population jumped from 841 people in 1870 to 2,276 in 1880.

The development of San Rafael centered around Timothy Murphy's former adobe at 4th and C Streets, which would serve briefly as the county courthouse until a new courthouse was constructed in 1872. The town was laid out in a typical block pattern, and 4th Street became the primary commercial corridor. San Rafael was formally incorporated in 1874. The rail line via ferry continued to be the only way to travel between San Francisco and San Rafael until the construction of the Golden Gate Bridge in 1937 greatly improved access.

Project Site History

Historically, the project site was associated with production of flammable gas. In 1875, a gas works was constructed on the project site, and the facility expanded over several decades. The earliest detailed map reviewed of the project site—a Sanborn Fire Insurance map published in 1887—depicts the San Rafael Gas Works and associated infrastructure at the northwest portion of the project site at the proposed location of the Whistlestop/Eden Housing project. By 1907, Sanborn maps show the gas works plant had expanded to occupy the western half of the project site, with a single residence and outbuilding at the northeast corner of the property. By 1924, the residence and outbuilding had been removed, and the gas works occupied the entire project site. The gas works discontinued its operations in 1930, and most of its infrastructure was demolished in the 1960s.

The project site is currently paved and does not contain any buildings. There are no built-environment historical resources at the project site.

Project Site Cultural Resources

To identify cultural resources—and the potential for such resources—at the project site, archival research was done and literature was reviewed. The archival research consisted of a records search at the Northwest Information Center (NWIC) of the California Historical Resources Information System. The NWIC is the official state repository of cultural resource records and reports for Marin County. Literature reviewed included geotechnical reports and mapping, and historical maps to identify the potential for subsurface pre-contact and historical archaeological deposits. The results of these tasks are summarized below.

Pre-Contact Archaeological Deposits and Human Remains

The NWIC database did not indicate that there are recorded Native American cultural resources at or adjacent to the project site.

Four Native American archaeological sites have been recorded within a 0.25-mile radius of the project.[2] The presence of these sites in the vicinity of the project site indicates a general sensitivity of the area for pre-contact archaeological sites.

Several geotechnical bore excavations were done within one block of the project site and generally confirm the mapped geology of the project site and vicinity (Miller Pacific Engineering Group, 2018:6; Witter et al., 2006). Excavations to the south of the project site across 2nd Street encountered 5 to 7 feet of fill over 5 to 14 feet of Bay Mud over shale bedrock. North of the project site across 3rd Street, excavations encountered about 10 feet of alluvium over shale bedrock. The project site has mostly been remediated as part of a 2015-2017 clean-up by PG&E. Contaminated soils were removed and replaced with clean base consistent with State Department of Toxic Substance Control (DTSC) requirements. The project site has variable depths of aggregate base, lesser amounts of drain rock, and localized areas of cement-sand slurry (Miller Pacific Engineering Group 2018: Figure 7) installed subsequent to removal of on-site contaminated soils. These fill features—ranging in depth from 2 feet to 28 feet below surface—likely overlie alluvium and Franciscan Formation bedrock at variable depths. Although previous remediation excavations would have removed any surface or near-surface archaeological deposits, the potential for buried pre-contact archaeological deposits and associated human remains underlying project site fill cannot be ruled out.

Historic-Period Archaeological Deposits

The earliest detailed map reviewed of the project site—a Sanborn Fire Insurance map published in 1887—depicts the San Rafael Gas Works and associated infrastructure at the northwest portion of the project site at the proposed location of the Whistlestop/Eden Housing project. By 1907, Sanborn maps show the gas works plant had expanded to occupy the western half of the project site, with a single residence and outbuilding at the northeast corner of the property. As mentioned earlier, by 1924, the residence and outbuilding had been removed, and the gas works occupied the entire project site. Demolition of the gas works in the 1960s and recent on-site soil remediation likely removed any subsurface historic-period features associated with the site's industrial uses dating from 1875 to 1930.

REGULATORY FRAMEWORK

Federal Regulations

No federal regulations related to cultural resources would apply to the proposed project.

[2] The locations of these sites are withheld in this document. The legal authority to restrict cultural resources information is in California Government Code Section 6254.10 and Section 6254(r), and California Code of Regulations Section 15120(d).

State Regulations

California Environmental Quality Act (CEQA)

CEQA applies to all discretionary projects undertaken or subject to approval by the state's public agencies (14 CCR Section 15002(i)). Under the provisions of CEQA, "A project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment" (14 CCR Section 15064.5(b)).

CEQA Guidelines Section 15064.5(a) defines a "historical resource" as a resource that meets one or more of the following criteria:

- Listed in, or eligible for listing in, the California Register of Historical Resources (as defined under California Public Resources Code [PRC], Section 5024.1; 14 CCR Section 4850, *et seq.*);
- Listed in a local register of historical resources (as defined at PRC Section 5020.1(k));
- Identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.1(g); or
- Determined to be a historical resource by a project's lead agency (14 CCR Section 15064.5(a)).

A historical resource consists of "Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California…Generally, a resource shall be considered by the lead agency to be 'historically significant' if the resource meets the criteria for listing in the California Register of Historical Resources" (14 CCR Section 15064.5(a)(3)).

California Register of Historical Resources

PRC Section 5024.1 established the California Register of Historical Resources (CRHR). The requirements for listing in the CRHR, including the criterion for listing and integrity requirements, are similar to those of the National Register of Historic Places (NRHP). Generally, a resource is considered by the lead agency to be "historically significant" if the resource meets the criteria for listing in the CRHR (14 CCR Section 15064.5(a)(3)). For a cultural resource to qualify for listing in the CRHR, it must be significant under one or more of the following criteria:

Criterion 1: Associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

Criterion 2: Associated with the lives of persons important in our past;

Criterion 3: Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

Criterion 4: Has yielded, or may be likely to yield, information important in prehistory or history.

In addition to being significant under one or more of these criteria, a resource must retain enough of its historic character and appearance to be recognizable as a historical resource and be able to convey the reasons for its significance (14 CCR Section 4852(c)). Generally, a cultural resource must be 50 years or older to be eligible for the CRHR (14 CCR Section 4852(d)(2)).

California Public Resources Code Section 5097.98

Section 5097.98 of the PRC states that the Native American Heritage Commission (NAHC), upon notification of the discovery of Native American human remains pursuant to Health and Safety Code Section 7050.5 (discussed below), shall immediately notify those persons (i.e., the Most Likely Descendent or "MLD") it believes to be descended from the deceased. With permission of the landowner or a designated representative, the MLD may inspect the remains and any associated cultural materials and make recommendations for treatment or disposition of the remains and associated grave goods. The MLD shall provide recommendations or preferences for treatment of the remains and associated cultural materials within 48 hours of being granted access to the site.

California Health and Safety Code Section 7050.5

Section 7050.5 of the California Health and Safety Code states that, in the event of discovery or recognition of any human remains in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the remains are discovered has determined whether or not the remains are subject to the coroner's authority. If the human remains are of Native American origin, the coroner must notify the NAHC within 24 hours of this identification. The NAHC will identify a Native American MLD to inspect the site and provide recommendations for the proper treatment of the remains and associated grave goods.

Local Regulations and Policies

San Rafael Municipal Code

<u>Historic Preservation Ordinance: Municipal Code Chapter 2.18</u>

The City's Historic Preservation Ordinance outlines procedures and specific criteria for the designation of landmarks and of structures of merit (Municipal Code Chapter 2.18—Historic Preservation). The criteria for the designation of historic landmarks and historic districts include specific findings of significance in one of the following four areas: historical, cultural importance; architectural, engineering importance; geographic importance; and archaeological importance (2.18.048 Criteria for Designation as Landmark). The ordinance also allows for the recognition of structures of merit, which may have historic, architectural, or aesthetic merit but have not been designated as landmarks and are not situated in historic districts (2.18.069 Recognition of Structures of Merit).

<u>Archaeological Resource Protection Ordinance: Municipal Code Chapter 2.19</u>

The City maintains sections of its municipal code that are intended to protect archaeological resources within the city limits (Municipal Code Chapter 2.19—Archaeological Resources

Protection). The municipal code includes maintenance of a citywide archaeological sensitivity map for planning-related purposes (2.19.020—Archaeological Sensitivity Map) and references “specific procedures and regulations [that] shall be implemented by the City to ensure the protection of archeological resources as adopted by council resolution” (2.19.030 Procedures and Regulations for Archeological Resource Protection).

San Rafael General Plan 2020

Cultural resources are considered in the Culture and Arts Element of San Rafael General Plan 2020 (General Plan). Goal 26 of the General Plan is “to have protected and maintained historic buildings and archaeological resources as part of San Rafael’s cultural heritage.” General Plan policies that were adopted for the purpose of avoiding or mitigating an environmental impact as related to cultural resources include the following:

Policy CA-13 **Historic Buildings and Areas.** Preserve buildings and areas with special and recognized historic, architectural or aesthetic value including but not limited to those on the San Rafael Historical/Architectural Survey. New development and redevelopment should respect architecturally and historically significant buildings and areas.

Policy CA-14 **Reuse of Historical Buildings.** Encourage the adaptation and reuse of historic buildings, in order to preserve the historic resources that are a part of San Rafael’s heritage.

Policy CA-15 **Protection of Archaeological Resources.** Recognize the importance of protecting significant archaeological resources by: (1) Identifying, when possible, archaeological resources and potential impacts on such resources; (2) providing information and direction to property owners in order to make them aware of these resources; and (3) implementing measures to preserve and protect archaeological resources.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

The proposed project would have a significant impact on cultural resources if it would:

a) Cause a substantial adverse change in the significance of a historical resource pursuant to CEQA Guidelines Section 15064.5;

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5; or

c) Disturb any human remains, including those interred outside of formal cemeteries.

A discussion of these criteria is included in the impact analysis below. If an impact on a historical or archaeological resource is significant, CEQA requires feasible measures to minimize the impact (14 CCR Section 15126.4 (a)(1)). Mitigation of significant impacts under the criteria listed above must lessen or eliminate the physical impact that the project would have on the resource.

Less-than-Significant Impacts

The project would have less-than-significant impacts on human remains, including those interred outside formal cemeteries. As noted above under "Pre-Contact Archaeological Resources and Human Remains," Native American human remains could be encountered below the engineered fill at the project site. Should human remains be unearthed during project construction, these would be treated in accordance with existing state laws, including California PRC Section 5097.98 and California Health and Safety Code Section 7050.5. With enforcement and implementation of these state laws, project impacts on human remains would be less than significant, and no mitigation measures are required.

Potentially Significant Impacts

Impact CULT-1: The proposed project could cause a substantial adverse change in the significance of archaeological deposits that qualify as historical resources, as defined in CEQA Guidelines Section 15064.5. Archaeological deposits could be unearthed or otherwise displaced during project ground disturbance below fill at the project site. (PS)

The proposed project includes actions that would involve ground disturbance. These actions would include grading and trenching for construction of new buildings, and various site improvements for landscaping, pathways, lighting, parking, and utilities. Deep ground-disturbing excavations conducted for the project below fill may result in an adverse change to buried archaeological deposits. Ground-disturbing excavations could result in material impairment by destroying those qualities of a resource that qualify it for listing in the CRHR.

Under CEQA, when a project could potentially affect an archaeological site, the lead agency must first determine if that deposit qualifies as a historical resource, as defined in CEQA Guidelines Section 15064.5(a). Should archaeological historical resources be identified during construction, implementation of Mitigation Measure CULT-1 would reduce impacts on historical resources to a less-than-significant level.

> *Mitigation Measure CULT-1: Should an archaeological deposit be encountered during project subsurface construction activities, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archeology contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. If the deposit is found to be significant (i.e., eligible for listing in the California Register of Historical Resources), the applicant shall be responsible for funding and implementing appropriate mitigation measures. Mitigation measures may include recordation of the archaeological deposit, data recovery and analysis, and public outreach regarding the scientific and cultural importance of the discovery. Upon completion of the selected mitigations, a report documenting methods, findings, and recommendations shall be prepared and submitted to the City for review, and the final report shall be submitted to the Northwest Information Center at Sonoma State University. Significant archaeological materials shall be submitted to an appropriate curation facility and used for public interpretive displays, as appropriate and in coordination with a local Native American tribal representative.*

The applicant shall inform its contractor(s) of the sensitivity of the project area for archaeological deposits and shall verify that the following directive has been included in the appropriate contract documents:

> *"The subsurface of the construction site may be sensitive for Native American archaeological deposits. If archaeological deposits are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any archaeological materials. Archaeological deposits can include shellfish remains; bones; flakes of, and tools made from, obsidian, chert, and basalt; and mortars and pestles. Contractor acknowledges and understands that excavation or removal of archaeological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5." (LTS)*

Impact CULT-2: The proposed project could cause a substantial adverse change in the significance of an archaeological resource, as defined in CEQA Guidelines Section 15064.5. Archaeological resources could be unearthed or otherwise displaced during project ground disturbance below fill underlying the project site. (PS)

According to the CEQA Guidelines, "When a project will impact an archaeological site, a lead agency shall first determine whether the site is an historical resource" (CEQA Guidelines Section 15064.5(c)(1)). Those archaeological sites that do not qualify as historical resources shall be assessed to determine if these qualify as "unique archaeological resources" (California PRC Section 21083.2). Archaeological deposits identified during project construction should be treated by the lead agency—in consultation with a qualified archaeologist meeting the *Secretary of the Interior's Professional Qualifications Standards for Archeology*—in accordance with Mitigation Measure CULT-1.

Mitigation Measure CULT-2: Mitigation Measure CULT-1 shall be implemented. (LTS)

Cumulative Impacts

For cultural resources, the scope for assessing cumulative impacts encompasses other past, current, or probable future projects under review by the City. The proposed project would have a significant effect on the environment if it would contribute to a significant cumulative impact on cultural resources. For purposes of this analysis, a list approach was used to identify probable future projects within close proximity to the project site. Projects considered for this cumulative impact analysis are listed in Table 6-1 and their locations are shown on Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR.

Based on a review of project and CEQA documentation available on the City of San Rafael website, no recent past, current, or probable future projects under review by the City (see Table 6-1 for projects included as part of the cumulative analysis) include recorded archaeological historical resources, archaeological resources, or human remains. Other approved or probable future projects near the project site, as shown in Figure 6-1, are located near known archaeological sites, and ground disturbance associated with these projects could result in potentially significant impacts on unidentified archaeological sites and associated human remains unearthed during ground disturbance. However, impacts on these resources accidentally discovered during implementation of these projects would be mitigated to less-than-significant levels through the use of appropriate mitigation measures adopted as conditions of approval. Collectively, recent past, approved, and probable future projects that may occur in the vicinity—including the proposed project—would not result in a cumulative increase in impacts on archaeological historical resources, archaeological resources, or human remains, as these resources would be avoided or otherwise removed, analyzed, and reported (i.e., by a qualified archaeologist).

There are no built-environment historical resources at the project site, and there are no such resources adjacent to the proposed project that would be indirectly affected by temporary impacts (i.e., ground borne vibration during project construction) or permanent impacts (i.e., visual impacts to historical setting). As such, the proposed project would not contribute to a cumulative impact on built-environment historical resources.

When the City considers future development proposals, these proposals would undergo environmental review pursuant to CEQA and, when necessary, mitigation measures would be adopted as appropriate. In most cases, this environmental review and compliance with project conditions of approval, relevant policies of the General Plan, and the City's Municipal Code (Chapter 2.19—Archaeological Resources Protection and Chapter 2.18—Historic Preservation) would ensure that significant impacts on cultural resources would be avoided or otherwise mitigated to less-than-significant levels.

For these reasons, the proposed project would not result in or contribute to any significant cumulative impacts on archaeological deposits, human remains, or built-environment historical resources.

REFERENCES

Barrett, Samuel A., 1908. The Ethno-geography of the Pomo and Neighboring Indians. *University of California Publications in American Archaeology and Ethnology* 6(1). Berkeley.

Bieling, David G., 2000. *Archaeological Investigations at CA-MRN-255/H, Larkspur, Marin County, California*. San Francisco: Holman & Associates.

Kelly, Isabel, 1978. Native Languages of California. In *California*, edited by Robert F. Heizer, pp. 80-90. Handbook of North American Indians, Volume 8, William C. Sturtevant, General Editor. Washington, D.C.: Smithsonian Institution.

Kroeber, Alfred L., 1955. Nature of the Land-Holding Group. *Ethnohistory* 2:303-314.

Miller Pacific Engineering Group, 2018. *Geotechnical Feasibility Report: BioMarin Office Buildings, 999 3rd Street, San Rafael, California,* August 24.

Milliken, Randall et al., 2007. Punctuated Culture Change in the San Francisco Bay Area, in *California Prehistory: Colonization, Culture, and Complexity*, edited by T.L. Jones and K.A. Klar, pp. 99-123, Lanham, MD: Alta Mira Press.

Sanborn Map Company, 1887. *San Rafael, California.*

Sanborn Map Company, 1907. *San Rafael, Marin County, California.*

Sanborn Map Company, 1924. *San Rafael, Marin County, California.*

Schneider, Tsim Duncan, 2010. *Placing Refuge: Shell Mounds and the Archaeology of Colonial Encounters in the San Francisco Bay Area, California.* PhD dissertation, Department of Anthropology, University of California, Berkeley.

Stewart, Suzanne B., 1999. *Archaeological Test Excavations at CA-MRN-644/H, San Rafael, Marin County, California*. Rohnert Park, CA: Anthropological Studies Center.

Witter, Robert C., et al., 2006. *Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California*.

4.4 ENERGY

INTRODUCTION

This section describes the existing setting and impacts on energy services that could result from the project.

ENVIRONMENTAL SETTING

Pacific Gas and Electric Company (PG&E) provides electricity and natural gas to San Rafael, including the project site. Existing facilities serving the project site include a network of natural gas and electrical lines in the adjoining street rights-of-way. A PG&E substation is located immediately south of the project site, across 2nd Street.

PG&E is a fee-for-service provider. Electrical power conduits and natural gas lines are typically placed underground with street improvements and in new developments. PG&E is responsible for maintaining the physical infrastructure for gas and electrical distribution (Nichols-Berman, 2004).

In San Rafael and elsewhere in Marin County, renewable electricity is available from Marin Clean Energy (MCE), a public, not-for-profit electricity provider that gives all PG&E electric customers the choice of having 60 to 100 percent of their electricity supplied from renewable sources (e.g., solar, wind, bioenergy, geothermal, and hydroelectric) at competitive rates. Customers who choose MCE's "Light Green" plan receive 60 percent of their electricity from renewable sources, while those who choose the "Deep Green" plan receive 100 percent of their electricity from these sources. MCE maintains short- and long-term contracts with a variety of power suppliers. MCE customers continue to receive electricity delivery services (e.g., meter reading, power line maintenance) and all gas services from PG&E (MCE, 2019).

REGULATORY FRAMEWORK

Federal Regulations

No federal regulations related to energy would apply to the project.

State Regulations

Development on the project site would be required to comply with State of California energy conservation regulations (Energy Efficiency Standards for Residential and Nonresidential Buildings, Title 24, Part 6, of the California Code of Regulations). These regulations specify the State of California's minimum energy efficiency standards and apply to new construction of non-residential and residential buildings. The standards regulate energy consumed for heating, cooling, ventilation, water heating, and lighting. Compliance with these standards is verified and enforced through the local building permit process. The City of San Rafael reviews development plans prior to project approval to ensure that Title 24 energy conservation and efficiency standards are met and incorporated into project design.

The California Air Resources Board enforces California Code of Regulations Title 13, Section 2485 (Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling). Among other requirements, these regulations limit the idling time of diesel construction equipment to 5 minutes.

Local Regulations and Policies

San Rafael General Plan 2020

San Rafael General Plan 2020 policies that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact related to energy services and conservation consist of the following (City of San Rafael, 2017):

Policy H-19 **Energy Conservation and Sustainability.** The City of San Rafael promotes resource conservation and energy efficiency through the Sustainability Element of the General Plan. In implementing the policies and programs of the Sustainability Element, the City will also achieve its objectives for greater sustainability in residential projects.

Program H-19a **Sustainability Policies and Programs.** Refer to the Sustainability Element in the San Rafael General Plan to guide housing development and renovation. SU-4 *Renewable Energy* lays out programs to increase the supply of renewable energy. SU-5 *Reduce Use of Non-Renewable Resources* promotes efficiency in resource consumption.

Policy SU-4 **Renewable Energy.** Increase the supply of renewable energy sources. Promote and encourage residences to be resource, energy and water efficient by creating incentives and removing obstacles to promote their use.

Program SU-4d **Wind and Solar.** Consider methods to reduce barriers in the wind and solar system permit process, such as the expedited permit process for small residential rooftop solar systems.

Program SU-4g **Clean Energy Production.** Encourage options, such as photovoltaic cells, for energy production. Seek ways to provide incentives for solar and clean energy systems.

Policy SU-5 **Reduce Use of Non-Renewable Resources.** Reduce dependency on non-renewable resources.

Program SU-5c **Energy Efficiency Programs.** Develop and implement energy efficiency and conservation programs to achieve a 20% reduction in energy use by 2020, including PACE financing, stretch building codes, energy audits, upgrades upon resale, education and outreach.

Program SU-5f **Reflective Surfaces.** Encourage the use of high albedo (reflectivity) materials for future outdoor surfaces such as parking lots, roadways, roofs and sidewalks.

Policy SU-6 **Resource Efficiency in Site Development.** Encourage site planning and development practices that reduce energy demand, support transportation alternatives and incorporate resource- and energy-efficient infrastructure.

Program SU-6a **Site Design.** Evaluate as part of development review, proposed site design for energy-efficiency, such as shading of parking lots and summertime shading of south-facing windows.

Policy SU-7 **New and Existing Trees.** Plant new and retain existing trees to maximize energy conservation and carbon sequestration benefits.

Policy SU-13 **Monitor Sustainability Objectives and Indicators.** Monitor success in achieving sustainability objectives and greenhouse gas reductions.

Program SU-13b **Future Development and Capital Improvements.** Evaluate future development applications and the City's Capital Improvement Program against compliance with the Sustainability Element and the GHG Emissions Reduction Strategy.

San Rafael Climate Change Action Plan

In 2009, the City of San Rafael adopted the Climate Change Action Plan (CCAP), which includes strategies for energy conservation that aim to reduce greenhouse gas (GHG) emissions by 2020. On May 6, 2019, the City of San Rafael adopted the Final Draft Climate Change Action Plan 2030 (CCAP, 2030), which updates the 2009 CCAP and establishes additional energy conservation strategies to reduce long-term GHG emissions by 2030. Please refer to Section 4.6, Greenhouse Gas Emissions, of this DEIR for discussion of this plan (including project consistency with the plan).

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this DEIR and based on Appendix G of CEQA Guidelines, implementation of the proposed project would have a significant effect on energy services if it would:

a) Result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation;

b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency; or

c) Require or result in the relocation or construction of new or expanded electric power or natural gas facilities, the construction or relocation of which could cause significant environmental effects.

Less-than-Significant Impacts

Energy Consumption

The project would not result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources during project construction or operation.

The project would involve building construction on the project site. Energy would be consumed during both the construction and operational phases of the project. The construction phase would require energy for the manufacture and transportation of building materials, preparation of the project site, and construction of buildings and infrastructure. Once in operation, the new buildings and other development would consume energy for multiple purposes, including but not limited to building heating and cooling, lighting, appliances, and electronics. In addition, vehicle trips associated with both construction and operation would consume gasoline.

As described in Chapter 3, Project Description, of this DEIR, the project would include a variety of energy-saving elements, including energy-efficient building orientation and design features, lighting, utilities, and appliances. The Whistlestop/Eden Housing project building would be designed to meet Green-Point Rated or Leadership in Energy and Environmental Design (LEED) standards of sustainability, with reduced energy and water use.

The following discussion reviews potential energy use during construction and operation of the project. The discussion is based on an analysis conducted by BASELINE Environmental Consulting, the EIR air quality/GHG consultant. Energy use calculations prepared by BASELINE are included in **Appendix B**.

<u>Energy Use during Construction</u>

The project would be constructed over an 8- to 10-year period, beginning in about 2020 and ending in about 2028. Since construction activities would be temporary, they would not result in a long-term increase in energy consumption. The construction contractor would have a financial disincentive to waste fuel used by the construction equipment (i.e., excess fuel usage reduces profits). Therefore, it is generally assumed that fuel used during construction would be conserved to the maximum extent feasible. Furthermore, regulations enforced by the California Air Resources Board (Title 13, Section 2485 of California Code of Regulations) limit the idling time of diesel construction equipment to 5 minutes. It is anticipated that energy consumption during the construction period would be minimized to the maximum extent practical. This qualitative review therefore finds that the energy intensiveness of construction equipment and construction operations would not be inefficient.

Energy Use During Operation

The most current version of the California Emissions Estimator Model (CalEEMod version 2016.3.2) was used to evaluate energy consumed during operation of the project. Based on a combination of statewide and regional surveys, CalEEMod can be used to conservatively estimate average daily vehicle miles traveled for a range of vehicle trip types associated with project operations. CalEEMod can also be used to conservatively estimate annual electricity and natural gas consumption during project operations based on the gross square footage. The primary input data used to estimate energy use expected under full buildout of the project in 2028 are summarized in **Table 4.4-1.** A copy of the CalEEMod report, which summarizes the input parameters, assumptions, and findings, is included in **Appendix B**.

TABLE 4.4-1 PROJECT LAND-USE INPUT PARAMETERS FOR CALEEMOD

Project Development	CalEEMod Land-Use Type	Unit	Amount
Whistlestop/Eden Housing	Congregate Care (Assisted Living)	dwelling unit	67
		1,000 square feet	57
	Health Club	1,000 square feet	18
	Enclosed Parking Lot	parking space	12
BioMarin Building A	General Office Building	1,000 square feet	110
	Parking Lot	parking space	29
BioMarin Building B	Research & Development	1,000 square feet	97

Note: Total square footage includes amenities, such as lobbies, conference rooms, a fitness center, dining space, and 3,500 square feet of retail space in BioMarin Building A.
Source: A copy of the CalEEMod report is provided in **Appendix B**.

There are various energy-saving strategies that are potentially applicable to the project. For example, the California Energy Commission has estimated that the 2019 Building Energy Efficiency Standards, which will take effect on January 1, 2020, will reduce energy consumption by about 30 percent for non-residential buildings compared to the current 2016 Building Energy Efficiency Standards, due mainly to lighting upgrades (California Energy Commission, 2018). In addition, the City of San Rafael's General Plan and Climate Change Action Plan specify energy conservation and efficiency measures for new development, and pending updates of these plans will likely require similar or additional measures. Since full buildout of the project is not expected to be completed until about 2028, additional energy reduction measures will likely be introduced at the state and local levels over time. However, since more detailed information about these potential energy reductions is not currently available, it was conservatively assumed that no energy savings would result above the current standards.

Energy Consumption from Buildings

Based on the CalEEMod results, electricity and natural gas consumption from project buildings is summarized in **Table 4.4-2**. The project would be expected to use approximately 2,556 MWh of electricity and 5,557 million British thermal units (MBTU) of natural gas per year.

TABLE 4.4-2 FUTURE ENERGY CONSUMPTION FROM BUILDINGS

Project Development	Electricity (MWh/yr)	Natural Gas (MBTU/yr)
Whistlestop/Eden Housing Project	446	1,030
BioMarin Project	2,110	4,527
Total	2,556	5,557

Notes: MWh/yr = megawatt hours per year; MBTU/yr = million British Thermal Units per year.
Source: CalEEMod (**Appendix B**).

Energy Consumption by Vehicles

CalEEMod and the California's Mobile Source Emissions Factor (EMFAC) 2014 model were used to estimate mobile energy consumption. Information on vehicle trips, trip lengths, and vehicle mix was obtained from CalEEMod, and information on fuel economy and type and amount of fuel used for each vehicle category was obtained from EMFAC 2014. Total fuel consumption was calculated by summing the fuel consumption for each vehicle category. The estimated daily rates of gasoline, diesel, and electricity consumption by vehicles are summarized in **Table 4.4-3**.

TABLE 4.4-3 FUTURE ENERGY CONSUMPTION BY VEHICLES

	Gasoline (gallons/day)	Diesel (gallons/day)	Electricity (kWh/day)
Whistlestop/Eden Housing Project	110	17	62
BioMarin Project	346	54	197
Total	456	71	259

Notes: kWh/day = kilowatt hours per day.
Source: CalEEMod (**Appendix B**).

Conclusion

The project would not result in wasteful, inefficient, or unnecessary consumption of energy. While energy consumption would increase (due to the proposed new buildings and associated vehicle traffic), the net increase in overall per capita consumption would not be considered substantial, for two reasons:

1. *Downtown Infill Location.* The project would be located on a downtown infill site already served by roads, transit, and utilities. This type of infill development tends to be more energy efficient than development on less centrally located sites, as it offers opportunities for reusing existing resources and encouraging use of public transit and other alternatives to private vehicles.

2. *Energy Efficiency Measures.* The project includes energy efficiency measures and would likely be subject to additional applicable state and local requirements at the time of detailed project review. In addition, all project buildings would be designed to accommodate solar roof systems at some point in the future. As noted in the above analysis, the energy consumption estimates for the project are considered conservative, because it was assumed that no energy savings would result above current standards; therefore, the project's actual energy consumption might

be less than the estimates, since additional energy reduction measures will likely be introduced at the state and local level over time and would be included in the project. The project would be subject to City of San Rafael policies and review procedures that would ensure that the project incorporates the latest energy conservation measures.

For these reasons, the impact would be less than significant, and no mitigation is necessary.

While not required as mitigation, the project applicants may wish to consider participating in the Savings By Design Program (www.savingsbydesign.com) administered by PG&E. This energy efficiency program offers incentives for non-residential building design and construction projects that exceed building code requirements.

In addition, while not required as mitigation, the project applicants may wish to incorporate additional energy-saving measures and features into the project, including (1) additional LEED certifications (e.g., for the BioMarin buildings); (2) use of 100-percent renewable electricity, such as Marin Clean Energy (MCE) "Deep Green" or equivalent; (3) all-electric HVAC and other building systems, appliances, and equipment; (4) provision of electric vehicle charging stations; (5) provision of electrical outlets at all parking spaces; and (6) provision for collection green wastes for composting and/or energy generation (Sustainable San Rafael, 2019).

Conflict with Plans for Renewable Energy or Energy Efficiency

The project would not conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

As discussed under "Energy Consumption" above, the project applicants are proposing that the project be designed with a variety of energy-saving features, which are described in detail in Chapter 3, Project Description, of this DEIR. Through the local building permit process, the project would be required to abide by all State of California mandates for energy conservation. The project therefore would not conflict or obstruct a state or local plan for renewable energy or energy efficiency.

Construction or Relocation of Energy Facilities

The project would not require or result in the relocation or construction of new or expanded electric power or natural gas facilities, the construction or relocation of which could cause significant environmental effects.

- The project site is already served by PG&E electricity and natural gas facilities. It is generally expected that the project would connect to existing PG&E utility lines serving the site.
- For the BioMarin project, a new gas underground service would be installed for each building, with points of connection and gas meters located immediately adjacent to each building. A new electrical power underground service would be provided, with underground feeders extended from existing vaults to the project site and ending at a new pad-mounted transformer outside each building. A utility meter would be provided at each main switchboard. A transformer would be provided to serve BioMarin Building B. An on-site generator would be provided for emergency power use (BioMarin and Whistlestop/Eden Housing, 2019).

- For the Whistlestop/Eden Housing project, a new PG&E gas underground connection/service would be provided, and a new electrical transformer would be installed at the southwest corner of the site, next to the electrical room. A new gas meter would be located at the southwest corner of the site (BioMarin and Whistlestop/Eden Housing, 2019).

The necessary connections to existing PG&E service are not expected to require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity. Details on extending service to the project would be reviewed by PG&E's Building & Renovation Services team when an "Application for Service" is submitted.

Potentially Significant Impacts

The project would not have any potentially significant impacts related to energy services.

Cumulative Impacts

For electrical and natural gas service, the geographic scope for assessing cumulative impacts is PG&E's northern and central California service area.

Despite annual statewide increases in energy consumption, the net increased energy demand from the project, combined with other past, present, and probable future projects, would not result in a significant cumulative impact, for the following reasons:

- Urbanized portions of San Rafael, including the project site, are already served by gas and electricity infrastructure, and the net increased energy demand from probable future projects, relative to the regional service area, would be minimal and would not require expanded or new energy facilities as a direct result of project development. As discussed in the project-specific analysis above, the proposed project would not result in any significant impacts on energy services. In addition, the project would be a relatively dense project located in an already-developed area close to other development and services; therefore, the proposed project would realize transportation-related energy savings compared to similar projects in a location at a distance from urban areas.
- The proposed project and other projects have been and would be required to comply with all standards of Title 24 of the California Code of Regulations.
- PG&E, which provides energy to the project site and vicinity, produces much of its energy from renewable sources and has plans in place to increase reliance on renewable energy sources. Because many agencies in California have adopted policies seeking increased use of renewable resources (and have established minimum standards for the provision of energy generated by renewable resources), it is expected that PG&E would continue to meet future demands for energy via a gradually increasing reliance on renewable resources, including small-scale sources such as photovoltaic panels and wind turbines, in addition to larger-scale facilities, such as wind farms. MCE also serves the San Rafael area, providing additional alternatives for renewable electricity service. Therefore, although the proposed project and other anticipated projects would be expected to increase the demand for energy-producing facilities, this increase in demand would likely be met through the development of renewable resources that would have fewer environmental effects than the development of new conventional gas- or coal-fired power plants.

Thus, the project would not result in or contribute to any significant cumulative energy service impacts.

REFERENCES

BioMarin and Whistlestop/Eden Housing, 2019. "List of Needed Material for EIR," final as of April 2.

California Code of Regulations, Title 13, Section 2485, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling.

California Energy Commission, 2018. "2019 Building Energy Efficiency Standards," March.

City of San Rafael, 2009. *City of San Rafael Climate Change Action Plan*, pages 8 and 10, April.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*, pages 61, 227, 228, 229, and 234. Amended and reprinted April 28,

Marin Clean Energy (MCE), 2019. Website: https://www.mcecleanenergy.org/faq/, accessed on April 26.

Nichols-Berman, 2004. *San Rafael General Plan 2020 General Plan Update Draft Environmental Impact Report,* page IV.5-7, February.

Sustainable San Rafael, 2019. Letter re. "BioMarin/Whistlestop EIR Scoping Comments," March 11.

4.5 GEOLOGY AND SOILS

INTRODUCTION

This section evaluates the project's potential geology and soils impacts. The setting section describes the geologic environment of the proposed project based on a site-specific geotechnical report (Miller Pacific Engineering Group, 2018), as well as maps and technical reports from United States Geological Survey (USGS), the California Geological Survey (CGS), the U.S. Department of Agriculture (USDA), and other sources. The regulatory framework applicable to geologic and seismic hazards is summarized. The potential impacts related to these hazards are analyzed, including impacts from strong ground shaking, liquefaction, differentiated settlement, and unstable or expansive soils. Appropriate mitigation measures are identified, as necessary.

ENVIRONMENTAL SETTING

Geologic Conditions

Geology

The project site is located within the Coast Ranges geomorphic province,[1] a relatively geologically young and seismically active region (CGS, 2002a; Norris and Webb, 1976). The Coast Ranges are mountain ranges (approximately 2,000 to 4,000 and occasionally 6,000 feet elevation above sea level) and valleys that trend northwest, approximately parallel to the San Andreas Fault, from near the Oregon border to southern California. The only major break in the Coast Ranges is the depression containing San Francisco Bay; the project site is located within this region. The project site is located near the northwest margin of the former marshland area west of San Rafael Creek. Geologic mapping of the San Francisco Bay region indicates that the majority of the project site is underlain by artificial fill over Bay Mud; the northwest portion of the project site is underlain by alluvial deposits (Miller Pacific Engineering Group, 2018).

Topography

The project site is relatively flat and mostly paved. Elevations at the project site range from about 8 feet above the North American Vertical Datum of 1988 (NAVD 88) at the southeast corner to about 10 to 12 feet NAVD 88 at the northwest corner (CSW/Stuber-Stroeh Engineering Group, Inc., 2018a and 2018b).

Existing Subsurface Conditions

As described in Section 4.7, Hazards and Hazardous Materials, remediation activities to address subsurface contamination were conducted on the project site between October 2015 and April

[1] A geomorphic province is a naturally defined geologic region that displays a distinct combination of features based on geology, faults, topography, and climate. Eleven geomorphic provinces are recognized in California.

2017 (Terra Pacific Group, 2018). The remedial activities involved the excavation and removal of approximately 47,000 tons of soil. Excavation depths ranged from 2 to 28 feet below the ground surface (bgs) (Terra Pacific Group, 2018). Excavation locations and depths are shown on **Figure 4.5-1.** Buried concrete foundations from former buildings on the site are present in the upper 5 feet of the western portion of the site; this area was not excavated during remediation activities (Terra Pacific Group, 2018). Excavated areas were backfilled with imported clean backfill and topsoil. Drain rock and sand-cement slurry were used for backfill in some areas where soft/wet soil conditions were encountered (Terra Pacific Group, 2018).

Soil borings and cone penetration testing completed on the project site prior to the remedial excavation and backfilling indicated subsurface conditions are generally consistent with the regional geologic mapping described above. Soil borings located along southern side of the site, encountered approximately 5 to 7 feet of fill over 5 to 14 feet of Bay Mud[2] over shale bedrock (Miller Pacific Engineering Group, 2018). Soil borings located along the northern side of the site encountered approximately 10 feet of alluvium over shale bedrock (Miller Pacific Engineering Group, 2018). A bedrock high is present in the north-central portion of the site at a depth as shallow as 9.5 feet bgs, with bedrock sloping radially to the west, south, and east (Terra Pacific Group, 2018).

Seismic Conditions

The entire San Francisco Bay Area (Bay Area) is located within the San Andreas Fault Zone, a complex of active faults (i.e., active faults show evidence of rupture within the past 11,000 years). Numerous historic earthquakes have been generated in northern California by the San Andreas Fault Zone. This level of active seismicity results in relatively high seismic risk in the Bay Area. Regional active faults in the Bay Area are shown on **Figure 4.5-2**.

The Working Group on California Earthquake Probabilities and the USGS have predicted a 22 percent probability of a Moment Magnitude (M_w)[3] 6.7 or greater earthquake on the Northern San Andreas Fault between 2014 and 2043, a 33 percent chance on the Hayward Fault, and a total probability of 72 percent that an earthquake of M_w 6.7 or greater will occur on one of the regional Bay Area faults during that time (USGS, 2016).

Soils, Geologic, and Seismic Hazards

The artificial fill soils and natural geology underlying the project site present potential hazards related to ground failure and unstable soils. Seismic hazards are generally classified in two categories: primary seismic hazards (surface fault rupture and ground shaking) and secondary seismic hazards (liquefaction and other types of seismically induced ground failure, along with

[2] Bay Mud is composed of dark olive gray organic clay, which is frequently water-saturated and highly plastic, with intermittent layers of peat.

[3] M_W, as opposed to Richter Magnitude, is now commonly used to characterize seismic events. M_W is determined from the physical size (area) of the rupture of the fault plane, the amount of horizontal and/or vertical displacement along the fault plane, and the resistance to rupture of the rock type along the fault.

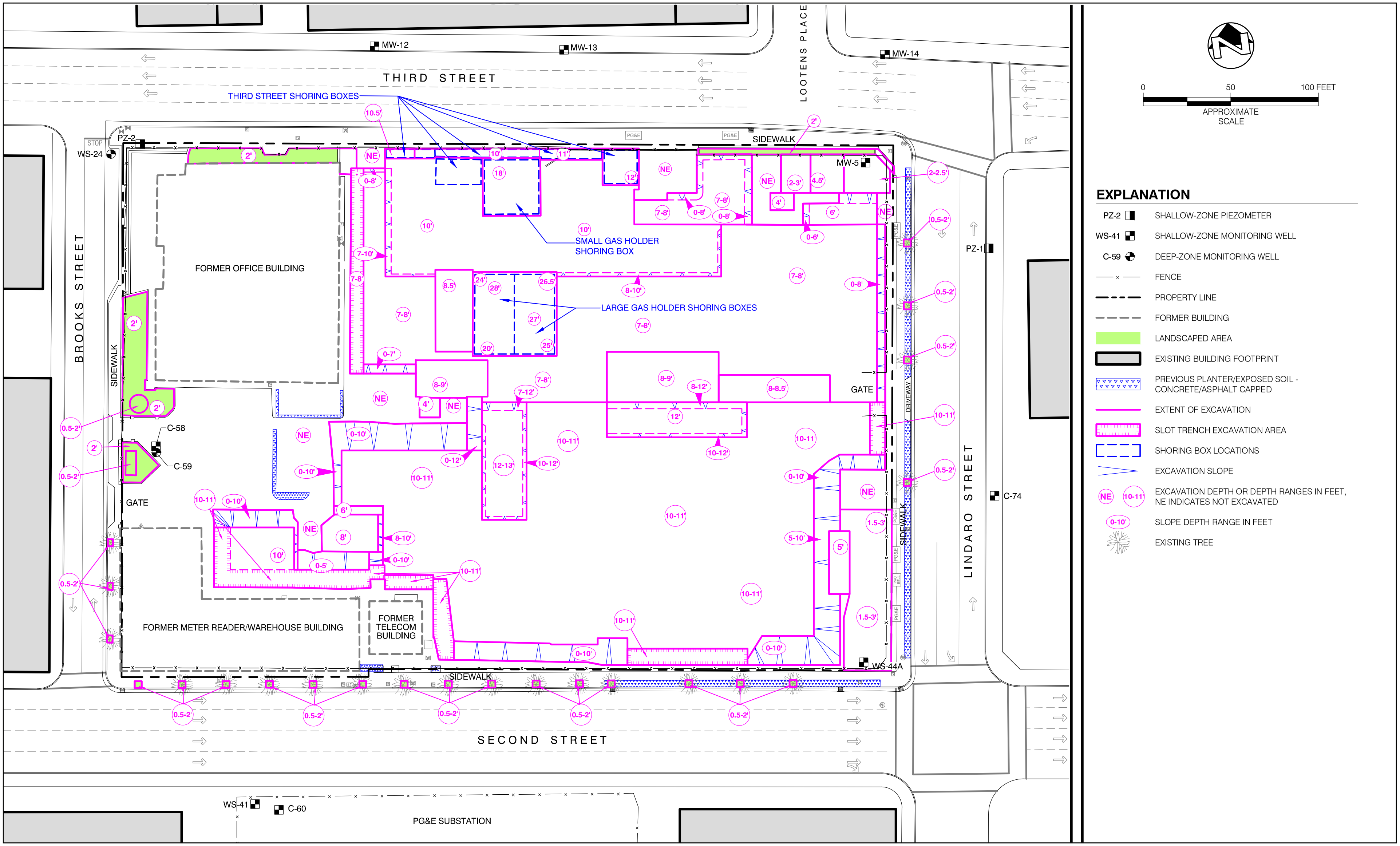


Figure 4.5-1

EXCAVATION LIMITS OF COMPLETED REMEDIATION ACTIVITIES

SOURCE: Terra Pacific Group, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

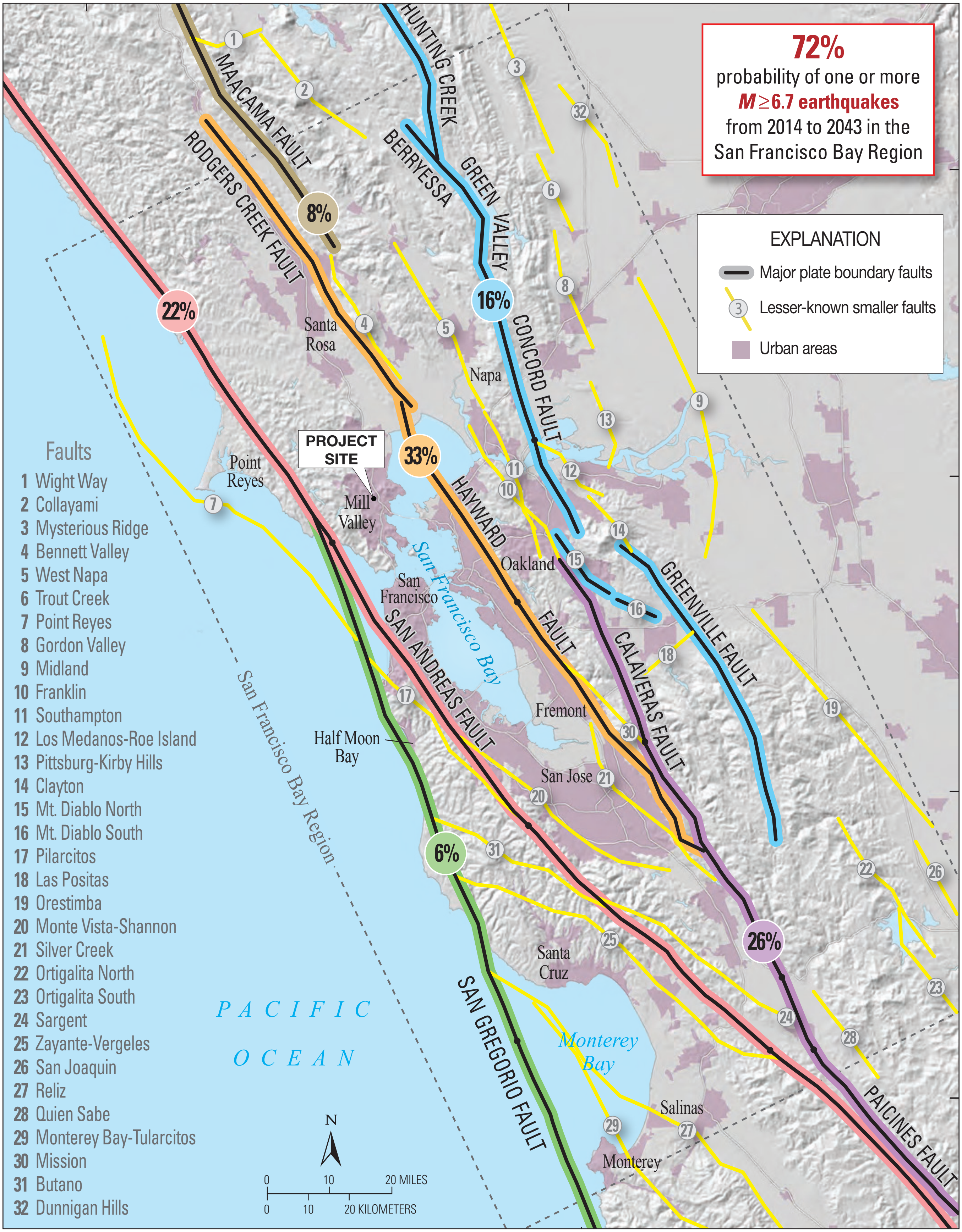


Figure 4.5-2

REGIONAL FAULTS

SOURCE: USGS, 2016

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

seismically induced landslides). These hazards are discussed below and provide the initial context for further evaluation in the impact analysis.

Surface Rupture

Surface rupture occurs when the ground surface is broken due to fault movement during an earthquake. Surface rupture generally can be assumed to occur along an active or potentially active major fault trace. No known active or potentially active faults cross the area (Miller Pacific Engineering Group, 2018). The nearest Alquist-Priolo Earthquake Fault Zone is the Hayward Fault, located about 8.4 miles east of the project site (see Figure 4.5-2).

Ground Shaking

Ground shaking is a general term referring to all aspects of motion of the earth's surface resulting from an earthquake, and is normally the major cause of damage in seismic events. The extent of ground shaking is controlled by the magnitude and intensity of the earthquake, distance from the epicenter, and local geologic conditions. The Modified Mercalli Intensity Scale (MMI) is the most commonly used scale for measurement of the subjective effects of earthquake intensity (see **Table 4.5-1**). The MMI values range from I (earthquake not felt) to XII (damage nearly total), and intensities ranging from VII to XII can cause moderate to significant structural damage.

The USGS has developed a tool to estimate the peak ground acceleration of earthquakes likely to affect a site, based on a probability of occurrence over a 50-year period. The analysis for the project site calculated an expected peak ground acceleration of 0.48g and M_w 7.1 at the site during a seismic event with a 10 percent chance of being exceeded (Miller Pacific Engineering Group, 2018). Based on probability projections, an earthquake of this magnitude (M_w 7.1) would be expected in the vicinity of the project site once every 475 years (Miller Pacific Engineering Group, 2018). This corresponds to a Modified Mercalli Intensity of VIII or greater, which could result in moderate to high levels of damage (see Table 4.5-1).

Liquefaction and Lateral Spreading

Liquefaction is the temporary transformation of loose, saturated granular sediments from a solid state to a liquefied state as a result of seismic ground shaking. In the process, the soil undergoes transient loss of strength, which commonly causes ground displacement or ground failure to occur. Because saturated soils are a necessary condition for liquefaction, soil layers in areas where the groundwater table is near the surface have higher liquefaction potential than those in which the water table is located at greater depths.

Lateral spreading is a form of horizontal displacement of soil toward an open channel or other "free" face, such as an excavation boundary. In a lateral spread failure, a layer of ground at the surface is carried on an underlying layer of liquefied material over a nearly flat surface toward a river channel or other bank. The lateral spreading hazard tends to mirror the liquefaction hazard for a site (assuming a free face is located nearby). There are no steep slopes or open faces near the project site that would allow for lateral spreading to occur.

TABLE 4.5-1 MODIFIED MERCALLI INTENSITY SCALE

Moment Magnitude (Mw)	Intensity	Effects
1.0-3.0	I.	Not felt except by a very few under especially favorable circumstances.
3.0-3.9	II.	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
3.0-3.9	III.	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing of truck. Duration estimated.
4.0-4.9	IV.	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
4.0-4.9	V.	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
5.0-6.9	VI.	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
5.0-6.9	VII.	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
6.0-7.0 and higher	VIII.	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
6.0-7.0 and higher	IX.	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
6.0-7.0 and higher	X.	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
6.0-7.0 and higher	XI.	Few, if any, (masonry) structures remain standing. Bridges destroyed. Board fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
6.0-7.0 and higher	XII.	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted.

[a] Average peak acceleration (away from source).
Source: USGS, 2019. CGS, 2002b.

USGS regional studies for the Bay Area provide information on Quaternary (a period of geologic time from about 2.6 million years ago to present) deposits and liquefaction susceptibility in the area (USGS, 2006). Based on these regional studies, mapping by the Association of Bay Area Governments (ABAG) indicates that the project site has high to very high liquefaction susceptibility, (Association of Bay Area Governments, 2019). The available subsurface data collected from nearby sites shows the soils are predominantly clayey, and the compacted backfill that was placed during the previous remediation work is likely relatively dense and not susceptible to liquefaction (Miller Pacific Engineering Group, 2018). However, several borings encountered lenses of loose to medium dense sand and gravel that may be susceptible to liquefaction (Miller Pacific Engineering Group, 2018). Previous studies for nearby sites identified some of these sandy soils as potentially liquefiable, with estimated post-liquefaction settlements of up to 1.5 inches (Miller Pacific

Engineering Group, 2018). Based on this information, the site-specific geotechnical report classified the risk of liquefaction at the project site as moderate (Miller Pacific Engineering Group, 2018).

Landslides

Slope failure can occur as either rapid movement of large masses of soil (landslide) or slow, continuous movement (creep) on slopes of varying steepness. Areas susceptible to landslides are characterized by steep slopes and downslope creep of surface materials. The project site, as well as surrounding areas, are relatively flat, and therefore not subject to landslides or other slope stability hazards.

Settlement, Seismic Densification, and Subsidence

Settlement is the lowering of the land surface elevation as a result of loading (i.e., placing heavy loads, typically fill or structures), which often occurs with the development of a site. Settlement or differential (e.g., unequal) settlement could occur if buildings or other improvements are built on low-strength foundation materials (including imported non-engineered fill) or if improvements straddle the boundary between different types of subsurface materials (e.g., a boundary between native material and fill). Settlement can also occur when seismic ground shaking causes unsaturated, loose soil particles to rearrange into a denser configuration. This is referred to as seismic densification.

Settlement and differential settlement generally occur slowly enough that its effects are not dangerous to inhabitants, but it can cause significant building damage over time. Based on the presence of varying thicknesses of fill and Bay Mud throughout the project site, the site-specific geotechnical report classified the risk of differential settlement at the project site as moderate to high (Miller Pacific Engineering Group, 2018). The risk of seismic densification to occur on the site is classified as low, because the site does not contain near-surface soils consisting of loose, granular materials (Miller Pacific Engineering Group, 2018).

Subsidence is the lowering of the land-surface elevation. The mechanism for subsidence is generally related to groundwater pumping and subsequent consolidation of loose aquifer sediments. No groundwater pumping would occur during operation of the proposed project, but groundwater pumping would occur during construction period excavation activities due to the shallow groundwater present on the project site. The primary hazards associated with subsidence are increased flooding hazards and damage to underground utilities as well as above-ground structures. Other effects of subsidence include changes in the gradients of stormwater and sanitary sewer drainage systems in which the flow is gravity-driven.

Expansive Soils

Expansion and contraction of soil volume can occur when expansive soils undergo alternating cycles of wetting (swelling) and drying (shrinking). During these cycles, the volume of the soil changes markedly. Shrink-swell potential is influenced by the amount and type of clay minerals present and can be measured by the percent change of the soil volume. Shrink-swell potential is also influenced by the location of the soils; soils below the groundwater table maintain a steady moisture content and would therefore not be subject to shrink-swell effects.

As a consequence of volume changes due to expansive soils, structural damage to buildings and infrastructure can occur if potentially expansive soils are not considered in project foundation design and during construction. The site-specific geotechnical report identified low plasticity clays in near-surface soils, and therefore classified the expansion potential of the soils as low to moderate (Miller Pacific Engineering Group, 2018).

Corrosive Soils

Soils may be classified as corrosive to metals and/or concrete. This classification depends on a variety of variables, including moisture, electrical conductivity, chloride content, pH, and dissolved salt content. Although testing for corrosion potential of soils was not performed as part of the site-specific geotechnical assessment, due to the proximity of the project site to the brackish water within nearby San Rafael Creek, the report classified soil conditions on the site as potentially corrosive.

REGULATORY FRAMEWORK

Federal and State Regulations

Federal, state, and local regulations and programs related to geology, seismicity, soils, and building safety that are applicable to the proposed project are described below.

Federal National Earthquake Hazards Reduction Program

The National Earthquake Hazards Reduction Program (NEHRP) was established by the US Congress when it passed the Earthquake Hazards Reduction Act of 1977, Public Law (PL) 95–124. In establishing NEHRP, Congress recognized that earthquake-related losses could be reduced through improved design and construction methods and practices, land use controls and redevelopment, prediction techniques and early-warning systems, coordinated emergency preparedness plans, and public education and involvement programs. The four basic NEHRP goals are:

- Develop effective practices and policies for earthquake loss reduction and accelerate their implementation.
- Improve techniques for reducing earthquake vulnerabilities of facilities and systems.
- Improve earthquake hazards identification and risk assessment methods, and their use.
- Improve the understanding of earthquakes and their effects.

Implementation of NEHRP priorities is accomplished primarily through original research, publications, and recommendations to assist and guide state, regional, and local agencies in the development of plans and policies to promote safety and emergency planning.

California Alquist-Priolo Earthquake Fault Zoning Act

The California Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972, and its main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active earthquake faults. The Alquist-Priolo Earthquake Fault Zoning Act requires the State

Geologist to establish regulatory zones (known as Earthquake Fault Zones) around the surface traces of known active faults and to issue appropriate maps. “Earthquake Fault Zones” were called “Special Studies Zones” prior to January 1, 1994. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones. No known active faults have been identified in the vicinity of the project site and therefore the project is not subject to the requirements of the Alquist-Priolo Earthquake Fault Zoning Act.

California Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (Public Resources Code, Sections 2690-2699.6) directs the Department of Conservation, California Geologic Survey to identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of the Seismic Hazards Mapping Act is to minimize loss of life and property through the identification, evaluation and mitigation of seismic hazards. The Seismic Hazards Mapping Act was passed by the legislature following the 1989 Loma Prieta earthquake. As a result, CGS geologists gather existing geological, geophysical and geotechnical data from numerous sources to produce the Seismic Hazard Zone Maps. They integrate and interpret these data regionally in order to evaluate the severity of the seismic hazards and designate as Zones of Required Investigation those areas prone to ground shaking, liquefaction, and earthquake-induced landslides. Cities and counties are then required to use the Seismic Hazard Zone Maps in their land use planning and building permit processes. The Seismic Hazards Mapping Act requires site-specific geotechnical investigations be conducted within Zones of Required Investigation to identify and evaluate seismic hazards and formulate mitigation measures prior to permitting most developments designed for human occupancy. The CGS has completed seismic hazard mapping for the portions of California most susceptible to liquefaction, ground shaking, and landslides; however, the project site is not located in an area for which seismic hazards mapping has been completed.

California Building Standards Code

The 2016 California Building Code (CBC), which refers to Part 2 of the California Building Standards Code in Title 24 of the California Code of Regulations, is based on the 2015 International Building Code and is the most current state building code. The 2016 CBC covers grading and other geotechnical issues, building specifications, and non-building structures. The City of San Rafael Municipal Code amends the most current State building codes, as indicated in Municipal Code Chapter 12.12. The City’s Building Division is responsible for reviewing plans, issuing building permits, and conducting field inspections.

The CBC requires that a site-specific geotechnical investigation report be prepared by a licensed professional for proposed developments of one or more buildings greater than 4,000 square feet to evaluate geologic and seismic hazards. Buildings less than or equal to 4,000 square feet also are required to prepare a geologic engineering report, except for one-story, wood-frame, and light-steel-frame buildings that are located outside of the Alquist-Priolo Earthquake Faults Zones. The purpose of the geotechnical investigation is to identify seismic and geologic conditions that require project mitigation, such as ground shaking, liquefaction, differential settlement, and expansive soils. Based on the conditions of the site, the building code requires specific design parameters to ensure construction of buildings that will resist collapse during an earthquake. These design parameters do not protect buildings from all earthquake shaking hazards, but are designed to reduce hazards to a manageable level.

Local Regulations and Policies

San Rafael Municipal Code

Section 12.12.010 of the San Rafael Municipal Code adopts the 2016 California Building Code, consisting of Volumes 1 and Volume 2, in its entirety, except that only the following appendices are adopted: Appendices C, H, and I, Minor City-specific amendments to the California Building Code are contained in Municipal Code Section 12.12.020.

Section 14.15.170 requires a geotechnical report to be submitted with development applications. The report should assess seismic hazards, liquefaction, landsliding, mudsliding, erosion, sedimentation and settlement and hazardous soils conditions to determine the optimum location for structures. The report should advise of special structural requirements, and evaluate the feasibility and desirability of a proposed facility in a specific location.

San Rafael General Plan 2020

San Rafael General Plan 2020 policies that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact as related to geologic and seismic safety issues include the following (City of San Rafael, 2017):

Policy S-4 **Geotechnical Review**. Continue to require geotechnical investigations for development proposals as set forth in the City's Geotechnical Review Matrix (Appendix F). Such studies should determine the actual extent of geotechnical hazards, optimum design for structures, the advisability of special structural requirements, and the feasibility and desirability of a proposed facility in a specified location.

Program S-4a **Geotechnical Review of Proposed Development.** Require soils and geologic peer review of development proposals in accordance with the Geotechnical Review Matrix to assess such hazards as potential seismic hazards, liquefaction, landsliding, mudsliding, erosion, sedimentation and settlement in order to determine if these hazards can be adequately mitigated. Levels of exposure to seismic risk for land uses and structures are also outlined in the Geotechnical Review Matrix, which shall be considered in conjunction with development review.

Policy S-5 **Minimize Potential Effects of Geological Hazards.** Development proposed within areas of potential geological hazards shall not be endangered by, nor contribute to, the hazardous conditions on the site or on adjoining properties. Development in areas subject to soils and geologic hazards shall incorporate adequate mitigation measures. The City will only approve new development in areas of identified hazard if such hazard can be appropriately mitigated.

Policy S-6 **Seismic Safety of New Buildings.** Design and construct all new buildings to resist stresses produced by earthquakes. The minimum level of seismic design shall be in accordance with the most recently adopted building code as required by State law.

Program S-6a **Seismic Design.** The minimum seismic design of structures should be in accordance with the building code, as adopted in accordance with State law.

Policy S-7 **Minimize Potential Effects of Landslides.** Development proposed in areas with existing landslides or with the potential for landslides (as identified by a registered engineering geologist or geotechnical engineer) shall not be endangered by, nor contribute to, the hazardous conditions on the site or on adjoining properties. Development in areas subject to landslide hazards shall incorporate adequate mitigation measures that have a design factor of safety of at least 1.5 for static conditions and 1.0 for pseudo-static (earthquake) conditions. The landslide mitigation should consider multiple options in order to reduce the secondary impacts (loss of vegetation, site grading, traffic, visual) associated with landslide mitigation. The City will only approve new development in areas of identified landslide hazard if such hazard can be appropriately mitigated.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

The proposed project would have a significant impact related to geology and soils if it would:

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: (1) rupture of a known earthquake fault, as delineated on the most recent Alquist–Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault; (2) strong seismic ground shaking; (3) seismic-related ground failure, including liquefaction; and (4) landslides;

b) Result in substantial soil erosion or the loss of topsoil;

c) Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property;

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater; or

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

The following significance criterion would not apply to the proposed project and is therefore excluded from further discussion in this impact analysis:

- *Have Soils Incapable of Adequately Supporting the Use of Septic Tanks or Alternative Wastewater Disposal Systems in Areas Where Sewers are not Available for the Disposal of Wastewater.* The project site is served by the San Rafael Sanitation District, which collects and transports wastewater to Central Marin Sanitation Agency for treatment. No septic tanks or alternative wastewater disposal systems are proposed, and the proposed project would have no impacts associated with septic tanks or alternative wastewater disposal systems. Therefore, this significance criterion is not discussed further in this impact analysis.

Less-than-Significant Impacts

Surface Rupture

The project would not directly or indirectly cause potential substantial adverse effects involving rupture of a known earthquake fault.

Available mapping does not identify a fault at or near the project site that would have the potential to result in surface rupture (Miller Pacific Engineering Group, 2018). In a seismically active area such as the San Francisco Bay region, a remote possibility exists for future faulting to occur in areas where no faults previously existed. Because this is unlikely to occur, the geotechnical report for the proposed project concluded that the potential for fault surface rupture at the project site is low (Miller Pacific Engineering Group, 2018). Therefore, the potential for substantial adverse impacts to occur due to surface rupture is less than significant.

Landslides

The project would not directly or indirectly cause potential substantial adverse effects involving landslides.

The project site and surrounding areas are relatively flat. The site-specific geotechnical investigation report did not identify any potential slope stability or landslide hazards associated with the proposed project (Miller Pacific Engineering Group, 2018). Therefore, the potential for the proposed project to expose people or structures to substantial adverse effects involving landslides is less than significant.

Soil Erosion or Loss of Topsoil

The project would not result in substantial erosion or the loss of topsoil.

Potential soil erosion impacts of the proposed project would be related to stormwater runoff entraining soils exposed during construction, and are analyzed in Section 4.8, Hydrology and Water Quality.

Potentially Significant Impacts

<u>Impact GEO-1</u>: During its design life, the project would likely be subject to strong ground shaking from a seismic event, seismic-related ground failure, and unstable soils, creating the potential for a significant risk to structures and human lives. (PS)

The proposed project would bring residential, office, research, and retail spaces to a currently vacant site. Based on the geography and soil characteristics of the project site, lateral spreading and seismic densification would have a low potential to occur (Miller Pacific Engineering Group, 2018). Groundwater dewatering would be temporary and limited to excavation activities associated with constructing the building foundation and installation of utilities. Due to the contamination in the subsurface, discussed in Section 4.7, Hazards and Hazardous Materials, the preferred foundation includes the use of torque down piles, driven piles, or auger displacement piles, because this foundation would limit the amount of excavation necessary and spoils generated. This would also minimize the amount of construction dewatering required. Because of the limited and localized nature of construction dewatering, the proposed project would not be anticipated to result in subsidence on- or off-site. However, the buildings developed under the proposed project could potentially experience substantial adverse impacts due to damage from seismic ground shaking, liquefaction, and differential settlement.

The proposed project would be subject to the California Building Code, as amended by the San Rafael Municipal Code Section 12.12.020. The site-specific geotechnical investigation report includes recommendations for the preliminary seismic design and foundation alternatives for the proposed project that would reduce the potential for building damage to occur from seismic ground shaking, liquefaction, and differential settlement hazards on the project site, and would ensure that the buildings are constructed by incorporating the appropriate California Building Code requirements into the design. The report notes that a design-level geotechnical investigation based on detailed geotechnical exploration, testing, and engineering analysis will be required to develop final design criteria for project design. Additionally, the report states that the geotechnical engineer must confirm that the intent of recommendations has been understood and incorporated into the project plans, and that supplemental recommendations may be prepared during the design phase, as needed. During construction, the report states that the geotechnical engineer must inspect geotechnical items relating to site grading and construction of new building foundations, including observing foundation excavations and installations, subgrade preparation and compaction, and other geotechnical-related work items.

Implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations and California Building Code design criteria, would reduce this potential impact to a less-than-significant level.

> *<u>Mitigation Measure GEO-1</u>: The project applicants shall implement all of the recommendations of the design-level geotechnical investigation, including design criteria, plan review, and construction period monitoring recommendations. Prior to the issuance of a grading permit and building permit, the applicants shall demonstrate to the satisfaction of the City Engineer that the recommendations of the design-level geotechnical investigation have been incorporated into the project grading plans and building plans. (LTS)*

Impact GEO-2: Expansive, unstable, and/or corrosive soils at the project site could result in structural damage to project facilities, creating the potential for a significant risk to structures and human lives. (PS)

The site-specific geotechnical investigation report indicates the soils on the project site have a low to medium expansion potential, and that the soils may be corrosive (Miller Pacific Engineering Group, 2018). The implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations and California Building Code design criteria, would reduce this potential impact to a less-than-significant level.

> *Mitigation Measure GEO-2: The project applicants shall implement Mitigation Measure GEO-1. (LTS)*

Impact GEO-3: The project could result in damage to, or destruction of, an as-yet unknown unique paleontological resource or site or unique geologic feature. (PS)

The project site is flat and paved and does not contain a unique geologic feature. Franciscan Formation shale bedrock underlies the Quaternary artificial fill, Bay Mud, and alluvium at the project site (Miller Pacific Engineering Group, 2018; Terra Pacific Group, 2018). The Project site has recently been remediated pursuant to the State Department of Toxic Substances Control for removal of contaminated soils associated with the historical use of the site as a gasworks plant. On-site soils were replace with artificial fill from depths of 2 to 28 feet. Recently placed artificial fill is considered to have a very low sensitivity for paleontological resources due to its already disturbed nature. However, paleontological resources may be encountered in the Bay Mud, alluvium, and bedrock. In particular, the Franciscan Complex is known to be fossiliferous, most notably for the microscopic single-celled organisms known as radiolaria, which comprise the distinctive red and green radiolarian cherts associated with the Franciscan Complex. Although less common, extinct species of vertebrate marine fossils and shellfish have also been found in the Franciscan Complex (Bailey et al., 1964:116-117).

The proposed project includes near-surface ground-disturbing activities, such as grading and trenching for construction of new buildings, and various site improvements for landscaping, pathways, lighting, parking, and utilities. As discussed above, the preferred foundation is intended to limit the amount of excavation necessary and spoils generated, and a large volume of the subsurface has already been disturbed to depth of up to 28 feet bgs due to recent remediation activities on the site. However, paleontological resources could be encountered when excavation occurs in previously undisturbed soil and bedrock. The implementation of Mitigation Measure GEO-3, which requires that excavation activities be halted should a paleontological resource be encountered and the curation of any substantial find, would reduce this impact to a less-than-significant level.

> *Mitigation Measure GEO-3: Should paleontological resources be encountered during project subsurface construction activities located in previously undisturbed soil and bedrock, all ground-disturbing activities within 25 feet shall be halted and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. For purposes of this mitigation, a "qualified paleontologist" shall be an individual with the following qualifications: 1) a graduate degree in paleontology or geology and/or a person with a demonstrated publication record in*

peer-reviewed paleontological journals; 2) at least two years of professional experience related to paleontology; 3) proficiency in recognizing fossils in the field and determining their significance; 4) expertise in local geology, stratigraphy, and biostratigraphy; and 5) experience collecting vertebrate fossils in the field.

If the paleontological resources are found to be significant and project activities cannot avoid them, measures shall be implemented to ensure that the project does not cause a substantial adverse change in the significance of the paleontological resource. Measures may include monitoring, recording the fossil locality, data recovery and analysis, a final report, and accessioning the fossil material and technical report to a paleontological repository. Upon completion of the assessment, a report documenting methods, findings, and recommendations shall be prepared and submitted to the City for review. If paleontological materials are recovered, this report also shall be submitted to a paleontological repository such as the University of California Museum of Paleontology, along with significant paleontological materials. Public educational outreach may also be appropriate.

The project applicants shall inform its contractor(s) of the sensitivity of the project site for paleontological resources and shall verify that the following directive has been included in the appropriate contract specification documents:

> *"The subsurface of the construction site may contain fossils. If fossils are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be halted and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any paleontological materials. Fossils can include plants and animals, and such trace fossil evidence of past life as tracks or plant imprints. Marine sediments may contain invertebrate fossils such as snails, clam and oyster shells, sponges, and protozoa; and vertebrate fossils such as fish, whale, and sea lion bones. Vertebrate land mammals may include bones of mammoth, camel, saber tooth cat, horse, and bison. Contractor acknowledges and understands that excavation or removal of paleontological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5." (LTS)*

Cumulative Impacts

Geologic impacts do not extend far beyond a project's boundaries because geologic and soils conditions can vary widely over a short distance and therefore potential impacts are typically confined to discrete spatial locations and do not combine to create a significant cumulative impact. The exception to this generalization would occur where a large geologic feature (e.g., fault zone, massive landslide) might affect an extensive area, or where the effects from the development of the proposed project could affect the geology of an off-site location. There are no large landslide features or fault zones present in the vicinity of the project site. Therefore, the geographic scope of cumulative impacts related to geologic hazards is the project site and the nearby cumulative projects listed in Table 6-1 and shown in Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR. The development of the proposed project and the nearby cumulative projects would not alter the geologic or seismic hazards at any off-site location. Therefore, the potential cumulative impact related to geologic hazards would be less than significant.

The geographic scope of cumulative impacts to paleontological resources includes other projects within San Rafael that would involve disturbance of soils and bedrock that potentially contain paleontological resources. The proposed project and cumulative projects within San Rafael, including the projects listed in Table 6-1 and shown in Figure 6-1, could affect unidentified paleontological resources. However, impacts on these resources accidentally discovered during implementation of these projects would be mitigated to less-than-significant levels through the use of appropriate mitigation measures adopted as conditions of approval. Collectively, the proposed project and other projects would not result in a cumulative increase in impacts on paleontological resources as these resources would be avoided or otherwise removed, analyzed, and reported (i.e., by a qualified paleontologist). Therefore, the potential cumulative impact would be less than significant.

REFERENCES

Association of Bay Area Governments (ABAG), 2019. Marin County Earthquake Hazard Map-Liquefaction Susceptibility. Available at: http://resilience.abag.ca.gov/earthquakes/marin/, accessed on April 11, 2019.

Bailey, Edgar Herbert, W.P. Irwin, and David Lawrence Jones, 1964. Franciscan and Related Rocks and Their Significance in the Geology of Western California. San Francisco: California Division of Mines and Geology.

California Geological Survey (CGS), 2002a. California Geomorphic Provinces, Note 36.

California Geological Survey (CGS), 2002b. How Earthquakes and Their Effects are Measured, Note 32.

City of San Rafael, 2017. General Plan 2020, Reprinted April 28, 2017.CSW/Stuber-Stroeh Engineering Group, Inc., 2018. Preliminary Investigation and Recommendations, FEMA Requirements, and Sea Level Rise for BioMarin, July 26.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018a. Preliminary Investigation and Recommendation, FEMA Requirements, and Sea Level Rise, July 26.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018b. Preliminary Hydrology Study, October 1.

Miller Pacific Engineering Group, 2018. Geotechnical Feasibility Report, BioMarin Office Buildings, 999 3rd Street, San Rafael, California, August 24.

Norris, Robert M. and Robert W. Webb, 1976. Geology of California, 2nd Edition. J. Wiley & Sons, Inc.

Terra Pacific Group, 2018. Remedial Action Completion Report, former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California, November 19.

United States Geological Survey (USGS), 2006. Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region. Website: http://pubs.usgs.gov/of/2006/1037/, accessed on April 11, 2019.

United States Geological Survey (USGS), 2016. Earthquake Outlook for the San Francisco Bay Region 2014-2043, USGS Fact Sheet 2016-3020. Revised August.

United States Geological Survey (USGS), 2019. Earthquake Hazard Program, Magnitude/Intensity Comparison. Website: https://earthquake.usgs.gov/learn/topics/mag_vs_int.php, accessed on April 11, 2019.

4.6 GREENHOUSE GAS EMISSIONS

INTRODUCTION

This section describes the existing greenhouse gas (GHG) conditions in the vicinity of the project site, discusses the regulations and policies pertinent to GHGs, and assesses the potentially significant impacts on the environment that could result from implementation of the proposed project. The analysis in this section was prepared in accordance with the Bay Area Air Quality Management District (BAAQMD) CEQA Air Quality Guidelines (BAAQMD, 2017a).

ENVIRONMENTAL SETTING

Climate Change and GHG Emissions

Climate change refers to change in the Earth's weather patterns, including the rise in temperature due to an increase in heat-trapping GHGs in the atmosphere. Existing GHGs allow about two-thirds of the visible and ultraviolet light from the sun to pass through the atmosphere and be absorbed by the Earth's surface. To balance the absorbed incoming energy, the surface radiates thermal energy back to space at longer wavelengths primarily in the infrared part of the spectrum. Much of the thermal radiation emitted from the surface is absorbed by the GHGs in the atmosphere and is re-radiated in all directions. Since part of the re-radiation is back toward the surface and the lower atmosphere, the global surface temperatures are elevated above what they would be in the absence of GHGs. This process of trapping heat in the lower atmosphere is known as the greenhouse effect.

An increase of GHGs in the atmosphere affects the energy balance of the Earth and results in a global warming trend. Increases in global average temperatures have been observed since the mid-20th century, and have been linked to observed increases in GHG emissions from anthropogenic sources. The primary GHG emissions of concern are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Other GHGs of concern include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), but their contribution to climate change is less than 1 percent of the total GHGs that are well-mixed (i.e., that have atmospheric lifetimes long enough to be homogeneously mixed in the troposphere) (IPCC, 2013). Each GHG has a different global warming potential (GWP). For instance, CH_4 traps about 21 times more heat per molecule than CO_2. As a result, emissions of GHGs are reported in metric tons of carbon dioxide equivalents (CO_2e), wherein each GHG is weighted by its GWP relative to CO_2.

The atmospheric concentrations of CO_2, CH_4, and N_2O have increased to levels unprecedented in at least the last 800,000 years due to anthropogenic sources. In 2010, the concentrations of CO_2, CH_4, and N_2O exceeded the pre-industrial era (before 1750) by about 39, 158, and 18 percent, respectively (BAAQMD, 2015). The Earth's mean surface temperature in the Northern Hemisphere from 1983 to 2012 was likely the warmest 30-year period over the last 1,400 years (IPCC, 2013). Earth's global surface temperatures in 2018 were the fourth warmest since 1880, which was behind those of 2016, 2017, and 2015. The past five years from 2014 to 2018 are collectively the warmest years in the modern record (NASA, 2019).

The global increases in CO_2 concentrations are due primarily to fossil fuel combustion, cement production, and land use change (e.g., deforestation). The dominant anthropogenic sources of CH_4 are from ruminant livestock, fossil fuel extraction and use, rice paddy agriculture, and landfills, while the dominant anthropogenic sources of N_2O are from ammonia for fertilizer and industry (IPCC, 2013). All emissions of HFCs, PFCs, and SF_6 are not naturally occurring and originate from industrial processes such as semiconductor manufacturing, use as refrigerants and other products, and electric power transmission and distribution (BAAQMD, 2015).

Existing GHG Emissions and Projections

In 2016, the California Air Resources Board (CARB) estimated that transportation was responsible for about 39 percent of California's GHG emissions, followed by industrial sources at about 21 percent and electrical power generation at about 16 percent (CARB, 2018). In 2015, 85 million metric tons of CO_2e were emitted from anthropogenic sources within the San Francisco Bay Area Air Basin (SFBAAB). Emissions of CO_2 dominate the GHG inventory in the SFBAAB, accounting for about 90 percent of the total CO_2e emissions reported (BAAQMD, 2017b). The 2015 GHG emissions in the SFBAAB are summarized in **Table 4.6-1**.

TABLE 4.6-1 SAN FRANCISCO BAY AREA 2015 GHG EMISSIONS INVENTORY

Pollutant	Percent	CO_2e (MMT/yr)
CO_2	90	76.5
CH_4	4	3.4
N_2O	2	1.7
HFC, PFC, SF_6	4	3.4
Total	100	85

Note: MMT/yr = million metric ton/year
Source: BAAQMD, 2017b.

The City of San Rafael's GHG emissions inventories from 2005 through 2015 are summarized in **Table 4.6-2** for various land use sectors. As indicated in Table 4.6-2, the greatest sources of GHG emissions in San Rafael are from the Transportation, Residential Energy, and Non-Residential Energy sectors. The 2015 GHG emissions decreased for each land use sector compared to 2005 and the overall GHG emissions decreased by about 16 percent between 2005 and 2015. The largest overall reductions for GHG emissions over this same period were from the Transportation, Residential Energy, and Non-Residential Energy sectors (City of San Rafael, 2018a).

Effects of GHG Emissions

According to the BAAQMD, some of the potential effects of increased GHG emissions and the associated climate change may include loss in snow-pack (affecting water supply), sea level rise, more frequent extreme weather events, more large forest fires, and more drought years. In addition, climate change may increase electricity demand for cooling, decrease the availability of hydroelectric power, and affect regional air quality and public health (BAAQMD, 2017b).

TABLE 4.6-2 CITY OF SAN RAFAEL GHG EMISSION TRENDS (METRIC TONS CO_2E)

Year	Residential Energy	Non- Residential Energy	Transportation	Waste	Water	Wastewater	Off-Road	Total Emissions
2005	89,940	90,899	268,187	15,917	2,712	1,479	4,747	473,881
2006	91,228	87,109	271,602	15,936	2,530	1,481	4,638	474,524
2007	98,666	103,757	267,332	14,597	2,982	1,491	4,529	493,352
2008	98,632	100,038	270,746	12,510	3,127	1,499	4,420	490,972
2009	95,201	89,959	262,755	10,734	2,683	1,504	4,310	467,146
2010	87,638	76,723	254,500	10,596	1,776	1,517	4,201	436,951
2011	87,209	75,500	254,862	10,334	1,478	1,525	4,175	435,082
2012	83,716	75,855	254,421	10,748	1,518	1,543	4,149	431,949
2013	80,025	74,977	252,071	10,951	1,602	1,559	4,111	425,297
2014	67,298	68,963	249,401	11,049	1,311	1,578	4,054	403,656
2015	67,850	67,931	245,746	11,498	1,166	1,588	4,053	399,832
Net Change from 2005	-22,090	-22,968	-22,441	-4,419	-1,546	109	-694	-74,049
% Change	-25%	-25%	-8%	-28%	-57%	7%	-15%	-16%

Source: City of San Rafael, 2018a.

REGULATORY FRAMEWORK

Federal Regulations

The United States (U.S.) participates in the United Nations Framework Convention on Climate Change. In 1998 under the Clinton administration, the U.S. signed the Kyoto Protocol, which would have required reductions in GHGs; however, the protocol did not become binding in the U.S. as it was never ratified by Congress. Instead, the federal government chose voluntary and incentive-based programs to reduce emissions, and has established programs to promote climate technology and science. In 2002, the U.S. announced a strategy to reduce the GHG intensity of the American economy by 18 percent over a 10-year period from 2002 to 2012. In 2015, the U.S. submitted its “intended nationally determined contribution” to the framework convention, which seeks to cut net GHG emissions by 26 to 28 percent below 2005 levels by 2025.

The U.S. Environmental Protection Agency (EPA) is responsible for enforcing the federal Clean Air Act and the 1990 amendments to it. On April 2, 2007, the U.S. Supreme Court ruled that CO_2 is an air pollutant as defined under the Clean Air Act, and that the EPA has the authority to regulate emissions of GHGs (Massachusetts, et al. v. U.S. Environmental Protection Agency, et al. [2007]

549 U.S. 497). The EPA made two distinct findings regarding GHGs under Section 202(a) of the Clean Air Act, as follows:

- **Endangerment Finding:** The current and projected concentrations of the six key well-mixed GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) in the atmosphere threaten the public health and welfare of current and future generations.
- **Cause or Contribute Finding:** The combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, they were a prerequisite for implementing GHG emissions standards for vehicles. In May 2010, the EPA in collaboration with the National Highway Traffic Safety Administration (NHTSA) finalized national GHG emission and fuel economy standards for light-duty vehicles for the model years 2012 to 2016. These standards were consistent with the standards adopted by California under the Pavley Regulations, described below (EPA, 2010). In August 2012, the EPA and NHTSA extended the national GHG emission and fuel economy standards for light-duty vehicles for the model years 2017 to 2025. Combined with the 2012 to 2016 standards, the regulation will result in vehicles emitting GHGs 50 percent less than 2010 levels in 2025 (EPA, 2012).

In August 2016, the EPA and NHTSA finalized national GHG emission and fuel economy standards for medium- and heavy-duty vehicles that would cover model years 2018 to 2027 for certain trailers and model years 2021 to 2027 for semi-trucks, large pickup trucks, vans, and all types and sizes of buses and work trucks.

State Regulations and Policies

Pavley Regulations – Assembly Bill 1493

In 2002, the California Legislature adopted Assembly Bill (AB) 1493, referred to as the "Pavley regulations," which required the CARB to develop and adopt regulations that achieve the maximum feasible and cost-effective reductions in GHG emissions from new passenger vehicles. To meet the requirements of AB 1493, the CARB approved amendments to the California Code of Regulations in 2004 that added GHG emissions standards to the State of California's existing standards for motor vehicle emissions. In 2009, the CARB adopted amendments to the Pavley regulations that reduce GHG emissions in new passenger vehicles by 30 percent from 2009 through 2016. Upon adoption of federal GHG standards by the EPA and NHTSA that preserved the benefits of the Pavley regulations, the Pavley regulations were revised to accept compliance with the federal standards as compliance with the State of California's standards in the 2012 through 2016 model years. Current regulations governing GHG emission and fuel economy standards are described below.

Advanced Clean Cars Program

On August 7, 2012, the CARB adopted a set of regulations to control emissions from passenger vehicles, collectively called the Advanced Clean Cars Program. This program was developed in coordination with the EPA and NHTSA in order to control the emission of smog-causing criteria pollutants and GHG emissions (CARB, 2019). In California, the standards are promulgated as a single coordinated package of regulations governing standards for criteria pollutant and GHG emissions, and establishing a technology mandate for zero-emission vehicles. The criteria pollutant and GHG emissions standards are consistent with the current EPA and NHTSA standards described above, and are in effect an extension of the Pavley regulations beyond 2016. The zero-emission vehicle regulation is designed to achieve the state's long-term emission reduction goals by requiring auto manufacturers to offer for sale specific numbers of the very cleanest cars available.

Renewable Portfolio Standard – Senate Bills 1078, 107, X1-2, 350, and 100

In 2002, under Senate Bill (SB) 1078, the state enacted the Renewable Portfolio Standard (RPS) program, which aims to increase the percentage of renewable energy in California's electricity mix to 20 percent of retail sales by 2017. The RPS timeline was accelerated in 2006 under SB 107 and expanded in 2011, 2015, and 2018 under SB X1-2, SB 350, and SB 100, respectively. The RPS program currently requires investor-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 33 percent by 2020 and 60 percent by 2030. In addition, SB 100 sets a planning goal that 100 percent of total retail sales of electricity in California come from eligible renewable energy resources and zero-carbon resources by December 31, 2045.

Executive Order S-3-05

In 2005, Governor Schwarzenegger issued Executive Order S-3-05, which states that California is vulnerable to the effects of climate change, including reduced snowpack in the Sierra Nevada Mountains, exacerbation of California's existing air quality problems, and sea level rise. To address these concerns, the executive order established the following statewide GHG emissions reduction targets:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

It should be noted that executive orders are legally binding only on state agencies and have no direct effect on local government or the private sector.

California Global Warming Solutions Act of 2006 – AB 32

In 2006, Governor Schwarzenegger signed AB 32, the California Global Warming Solutions Act, which requires California to reduce statewide GHG emissions to 1990 levels by 2020. In December 2008, the CARB adopted the Scoping Plan, which outlines a statewide strategy to achieve AB 32 goals. At the regional level, in response to SB 375 (see below), the Bay Area has developed a Sustainable Communities Strategy (SCS) to integrate land use and transportation planning in order to reduce future motor vehicle travel and decrease GHG emissions. In addition, the BAAQMD is implementing a wide range of programs that promote energy efficiency, reduce vehicle miles traveled (VMTs), and develop alternative sources of energy.

Low-Carbon Fuel Standard – Executive Order S-1-07

In 2007, Governor Schwarzenegger issued Executive Order S-1-07 to enact a low-carbon fuel standard (LCFS). The LCFS calls for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. It also directed the CARB to determine whether this Low Carbon Fuel Standard could be adopted as a discrete early-action measure under AB 32. The CARB adopted the Low Carbon Fuel Standard on April 23, 2009. The Low Carbon Fuel Standard was last amended January 4, 2019, in order to support the 2030 GHG emissions targets enacted through SB 32 (as discussed further below). The amended standard requires a 20 percent reduction in the carbon intensity of California's transportation fuels by 2030.

California Environmental Quality Act and Senate Bill 97

In 2007, under SB 97, the State of California acknowledged that climate change is a prominent environmental issue requiring analysis under CEQA. SB 97 directed the Governor's Office of Planning and Research to prepare, develop, and transmit to the California Natural Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, as required by CEQA. In 2009, the Natural Resources Agency adopted the State CEQA Guidelines amendments, which provide guidance to public agencies regarding the analysis and mitigation of the effects of GHG emissions in CEQA documents. The amendments became effective in March 2010. The amendments added Sections 15126.4(c) and 15064.4 (discussed further below) to the CEQA Guidelines, which specifically pertain to the significance of GHG emissions and provide guidance on measures to mitigate GHG emissions when such emissions are found to be significant.

Sustainable Communities Strategy – Senate Bill 375

In 2008, Governor Schwarzenegger signed SB 375, which aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocations to reduce vehicle emissions and help California meet the GHG reduction goals established in AB 32. Under SB 375, metropolitan planning organizations are required to incorporate an SCS into their Regional Transportation Plan. The goal of the SCS is to reduce regional VMTs and associated GHG emissions through land use planning strategies, such as promoting compact, mixed-use commercial and residential development near public transportation hubs. In accordance with SB 375, the Metropolitan Transportation Commission has incorporated the SCS into its current Regional Transportation Plan, Plan Bay Area 2040 (MTC and ABAG, 2017). SB 375 also provides incentives to developers through CEQA streamlining to encourage projects that are consistent with applicable regional plans and that achieve GHG emissions reduction targets.

Executive Order B-30-15 and Senate Bill 32

In 2015, Governor Brown issued Executive Order B-30-15, which set a statewide GHG emissions reduction target of 40 percent below 1990 levels by 2030. This target is in addition to the previous GHG emissions reduction targets established in Executive Order S-3-05 for 2010, 2020, and 2050. In September 2016, Governor Brown signed SB 32, which codifies the GHG emissions reduction target in Executive Order B-30-15.

As required by Executive Order B-30-15 and SB 32, the CARB updated the Scoping Plan to identify measures to meet the 2030 target. The revised scoping plan was adopted December 14, 2017 and builds upon the initial scoping plan initiatives used for achieving 2020 targets, such as implementation of SCSs, LCFS, and RPS. Policies target building efficiency; renewable power investment; clean and renewable fuels; vehicle emissions; walkable/bikeable communities with transit; cleaner freight and goods movement; reducing pollutants from dairies, landfills, and refrigerants; and capping emissions from transportation, industry, natural gas, and electricity sources.

Senate Bill 743

SB 743 changes the way that public agencies must evaluate the transportation impacts of projects under CEQA. The bill required revisions to the CEQA guidelines that would establish new criteria for determining the significance of a project's transportation impacts that will more appropriately balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of GHG emissions.

As required under SB 743, the Governor's Office of Planning and Research (OPR) developed potential metrics to measure transportation impacts that may include, but are not limited to, Vehicle Miles Traveled (VMT), VMT per capita, automobile trip generation rates, or automobile trips generated. The new metric would replace the use of delay and level of service (LOS) as the metric to analyze transportation impacts under CEQA. OPR recommends different thresholds of significance for projects depending on land use types. For example, residential and office space projects must demonstrate a VMT level that is 15 percent less than that of existing development in the region as a reasonable criterion for determining whether the mobile-source GHG emissions associated with the project are consistent with statewide GHG reduction targets. With respect to retail land uses, any net increase of VMT may be sufficient to indicate a significant transportation impact.

Title 24 Building Efficiency Standards

The State of California regulates energy consumption under Title 24 Building Standards Code, Part 6 of the California Code of Regulations (also known as the California Energy Code). The Title 24 Building Energy Efficiency Standards were developed by the California Energy Commission and apply to energy consumed for heating, cooling, ventilation, water heating, and lighting in new residential and non-residential buildings. The California Energy Code is updated every three years, with the most recent iteration (2016) effective as of January 1, 2017, and the next version (2019) planned to go into effect on January 1, 2020. The California Energy Commission's long-term vision is that future updates to the California Energy Code will support zero-net energy for all new single-family and low-rise residential buildings by 2020 and new high-rise residential and nonresidential buildings by 2030.

Title 24 California Green Building Standards Code

Title 24 Building Standards Code, Part 11 of the California Code of Regulations is referred to as the California Green Building Standards Code (CALGreen Code). The purpose of the CALGreen Code is to improve public health, safety, and general welfare by enhancing the design and construction of buildings through the use of building concepts having a positive environmental impact and encouraging sustainable construction practices in the following categories: (1) planning and design, (2) energy efficiency, (3) water efficiency and conservation, (4) material conservation and resource efficiency, and (5) environmental air quality.

Local Regulations and Policies

BAAQMD Climate Protection Program

The BAAQMD is the regional government agency that regulates sources of air pollution within the nine Bay Area counties. The BAAQMD established a climate protection program to reduce pollutants that contribute to global climate change and affect air quality in the San Francisco Bay Area Air Basin (SFBAAB). The climate protection program includes measures that promote energy efficiency, reduce VMTs, and develop alternative sources of energy, all of which assist in reducing emissions of GHGs and in reducing air pollutants that affect the health of residents. The BAAQMD also seeks to support current climate protection programs in the region and to stimulate additional efforts through public education and outreach, technical assistance to local governments and other interested parties, and promotion of collaborative efforts among stakeholders.

BAAQMD 2017 Clean Air Plan

The BAAQMD and other air districts prepare clean air plans in accordance with the state and federal Clean Air Acts. In April 2017, the BAAQMD adopted the 2017 Clean Air Plan: Spare the Air, Cool the Climate (2017 CAP), which is a comprehensive plan to improve Bay Area air quality and protect public health through implementation of a control strategy designed to reduce emissions and ambient concentrations of harmful pollutants. The 2017 CAP also includes measures designed to reduce GHG emissions.

City of San Rafael Climate Action Plan

In 2009, the City of San Rafael adopted the Climate Change Action Plan (CCAP) in response to AB 32, the California Global Warming Solutions Act. The CCAP includes strategies for transportation, waste reduction, land use, energy conservation, and sequestration that aim to reduce GHG emissions by 25 percent below 2005 levels by 2020. The intention of these strategies is to set a path toward reducing GHG emissions by 80 percent below 2005 levels by 2050. The CCAP was updated in 2011 to allow the City to use the CCAP as a quantified GHG Reduction Strategy and streamline the analysis of future projects under CEQA.

On May 6, 2019, the City adopted the Final Draft Climate Change Action Plan 2030 (CCAP 2030), which is an update the 2009 CCAP and establishes a new interim target of reducing GHG emissions by 40 percent below 1990 levels by 2030, and outlines the steps that residents, businesses, and the City can take to reach that goal. The CCAP 2030 has been prepared pursuant to CEQA Guidelines Section 15183.5 and is considered a Qualified Greenhouse Gas Reduction Plan for streamlining CEQA analysis.

City of San Rafael Green Building Ordinance

In January 2014, the City of San Rafael updated its Green Building Ordinance to comply with the State's CALGreen Code for new residential and non-residential development projects. All newly constructed residential and non-residential buildings must be designed to include the green building measures specified as mandatory in the CalGreen Code and detailed in the application checklists.

San Rafael General Plan 2020

The Sustainability Element of San Rafael General Plan 2020 contains numerous policies that would either directly or indirectly help to reduce GHG emissions. The following General Plan policies and programs are directly related to GHG emissions:

Policy SU-12 **Monitor Sustainability Objectives and Indicators.** Monitor success in achieving sustainability objectives and greenhouse gas reductions.

Program SU-12a **Monitor Sustainability Indicators and Greenhouse Gas Inventory.** Periodically update the community and municipal greenhouse gas inventories, monitor changes in the identified sustainability indicators and periodically update the Climate Change Action Plan to achieve greenhouse gas reduction goals.

Program SU-12b **Future Development and Capital Improvements.** Evaluate future development applications and the City's Capital Improvement Program against compliance with the Sustainability Element and the GHG Emissions Reduction Strategy.

Program SU-12c **Annual Reports.** Prepare an annual report to the Planning Commission and City Council assessing the implementation of sustainability programs and the GHG Emissions Reduction Strategy.

Program SU-12d **Sustainability Coordinator.** Hire a Sustainability Coordinator to advance sustainability efforts.

Program SU-12e **Sustainability Commission.** Appoint a Sustainability Commission to advance sustainability efforts.

Policy SU-13 **Municipal Programs.** Implement municipal programs to demonstrate the City's commitment to sustainability efforts and reducing greenhouse gases.

Program SU-13a **Alternative Transportation Options.** Provide transit and carpool incentives to City employees, including alternative work schedules and telecommuting opportunities.

Program SU-13b **Alternative Fuel for City Fleet.** Continue to implement existing City policy to purchase alternative fuel vehicles and increase the efficiency of the vehicle fleet.

Program SU-13c **Limit Idling of City Vehicles.** Adopt a policy to limit City vehicle idling where practical. Evaluate equipping trucks with an auxiliary electrical system for illumination and warning signs.

Program SU-13d **Green Purchasing.** Modify the City's purchasing practices and policies to become a model for other businesses and organizations.

Program SU-13e **Energy Audits Municipal Buildings.** Complete energy audits of major City facilities and implement audit recommendations for energy efficiency and renewable energy potential.

Program SU-13f **City Electricity.** Participate in the Marin Energy Authority by switching all City accounts over to the Light Green option in 2010 and the Deep Green option (100% renewable power) by 2020.

Program SU-13g **Streetlights and Traffic Signals.** Pursue funding to complete the retrofit of City traffic signals and retrofit streetlights with LED fixtures.

Program SU-13h **Employee Awareness.** Increase City employees' awareness of climate protection issues, and develop an internal committee to implement plans.

Program SU-13i **Local Government Agency Involvement.** Continue to provide a leadership role with other local governmental agencies to share best practices and successes.

Program SU-13j **Advancing GHG and Sustainability Efforts.** Advocate for state and federal legislation that advance greenhouse gas reductions and other sustainability efforts.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this evaluation and based on Appendix G of the CEQA Guidelines, implementation of the proposed project would have a significant air quality impact if it would:

a) Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or

b) Conflict with an applicable plan, policy, or regulation adopted for the purposes of reducing the emissions of GHGs.

Thresholds of Significance

The BAAQMD has adopted and incorporated GHG thresholds of significance into its CEQA Guidelines (BAAQMD, 2017a) to assist lead agencies in evaluating and mitigating air quality impacts under CEQA. According to the BAAQMD, if a project, including stationary sources, is located in a community with an adopted qualified GHG Reduction Strategy, the project may be considered less than significant if it is consistent with the GHG Reduction Strategy. A project must demonstrate its consistency by identifying and implementing all applicable feasible measures and policies from the GHG Reduction Strategy into the project. The City of San Rafael's CCAP 2030 is considered a qualified GHG Reduction Strategy.

Less-than-Significant Impacts

GHG Emissions from Project Operations

GHG emissions generated by the project would not have a significant impact on the environment.

In 2019, the City of San Rafael adopted the CCAP 2030 in order to implement measures to reduce GHG emissions and adapt to climate change. The CCAP 2030 identifies strategies for reducing the City of San Rafael's GHG emissions 25 percent below 2005 levels by 2020, which is more stringent than the statewide 2020 target under AB 32, and 40 percent below 1990 levels by 2030, which is consistent with the statewide 2030 target under SB 32. These GHG reductions would also put the city on a trajectory to reduce GHG emissions 80 percent below 1990 levels by 2050, which is consistent with the statewide 2050 target under Executive Order S-3-05.

Emissions reductions related to transportation, energy efficiency, renewable energy, and water conservation are estimated in the CCAP 2030 and show that the City would surpass the City and statewide goals for 2020 and 2030 by reducing emissions 19 percent below 1990 levels by 2020 (equivalent to 31 percent below 2005 levels) and 42 percent below 1990 levels by 2030. These GHG reductions would primarily be achieved through low-carbon transportation, energy efficiency, renewable energy, waste reduction, and water conservation.

As shown in **Table 4.6-3**, the proposed project would be consistent with local measures identified in the CCAP 2030 to reduce GHG reduction measures. Therefore, the GHG emissions generated by the project would have a less-than-significant impact on the environment.

Consistency with San Rafael's CCAP 2030

The project would be consistent with the City of San Rafael's CCAP 2030.

As discussed above, the project's GHG emissions impact is considered less than significant because the project is consistent with the CCAP 2030.

Potentially Significant Impacts

The project would not have any potentially significant impacts related to GHG emissions.

TABLE 4.6-3 PROJECT CONSISTENCY WITH CITY OF SAN RAFAEL CLIMATE CHANGE ACTION PLAN (CCAP) 2030

Strategy	Measure	Project Consistency
Low Carbon Transportation	LCT-C2: Bicycling	The proposed project would include bicycle access and on-site bicycle parking.
	LCT-C5: Public Transit	The proposed project would be located two blocks west of the San Rafael Transit Center. The center includes 13 Marin Transit routes, eight Golden Gate Transit routes, and one Sonoma County Transit route. The Sonoma-Marin Area Rail Transit (SMART) San Rafael station is also located approximately two blocks or 950 feet east of the project site. The train provides service to cities and other destinations to the north, including Novato, Petaluma, Santa Rosa, and the Sonoma County Airport.
	LCT-C9: Smart Growth Development	The project would provide affordable housing for low-income seniors, whose automobile ownership would be prohibited by lease requirements. The traffic study applied a 23-percent reduction to the daily trip generation calculation based on characteristics of the project and surrounding area (such as the distance to transit).
Energy Efficiency	EE-C3: Cool Pavement and Roofs	The BioMarin project would include an exterior shade trellis on the south sides of the building to provide shading for the building façade and reduce heating of exterior materials.
	EE-C4: Green Building Reach Code	In accordance with the City of San Rafael's current Green Building Ordinance, the Whistlestop/Eden Housing project and the BioMarin project would comply with the State of California's Green Building Standards Code (CALGreen Code) and include energy-saving elements as described in the project description. In addition, the lobby for the Whistlestop/Eden Housing project would have a glass storefront entry that would provide natural light to the lobby, reducing the need for electric lighting and potentially maximizing energy savings. The building would also be designed to meet Green-Point Rated or Leadership in Energy and Environmental Design (LEED) standards of sustainability, with reduced energy and water use. Both BioMarin Building A and BioMarin Building B would be oriented with the long east/west axis of the project site to allow more sunlight into the buildings; this orientation could potentially maximize energy savings. The BioMarin project would include energy-saving light-emitting diode (LED) driveway and parking lot lights.
Renewable Energy	RE-C1: Renewable Energy Generation	All buildings in the proposed project would be designed to accommodate solar roof systems that could be installed at some point in the future.
Water Conservation	WC-C1: Community Water Use	The BioMarin project would reduce landscape water demand (relative to conventional landscape design) by installing permeable paving that adds water to the subsoil for all landscape trees east of the new buildings. The project site would also be furnished with complete automatic remote control irrigation system with Model Water Efficient Landscape Ordinance (MWELO)-compliant irrigation flow sensors, valves, and controllers. Equipment would be compatible with any future reclaimed water source that may become available.

Source: City of San Rafael, 2019. CCAP 2030.

Cumulative Impacts

GHG impacts are, by their nature, cumulative impacts because one project by itself cannot significantly contribute to or cause significant environmental effects. The proposed project would not result in or contribute to any significant cumulative GHG impacts because it would be consistent with the CCAP 2030.

REFERENCES

Bay Area Air Quality Management District (BAAQMD), 2015. Bay Area Emissions Inventory Summary Report: Greenhouse Gases, Base Year 2011, January.

Bay Area Air Quality Management District (BAAQMD), 2017a. California Environmental Quality Act Air Quality Guidelines, May.

Bay Area Air Quality Management District (BAAQMD), 2017b. Final 2017 Clean Air Plan, April 19.

California Air Resources Board (CARB), 2018. California Greenhouse Gas Emissions for 2000 to 2016 – Trends of Emissions and Other Indicators, July 11.

California Air Resources Board (CARB), 2019. Advanced Clean Cars Program: About. Website: https://ww2.arb.ca.gov/index.php/our-work/programs/advanced-clean-cars-program/about, accessed on April 15, 2019.

City of San Rafael, 2009. *City of San Rafael Climate Change Action Plan,* April.

City of San Rafael, 2018a. San Rafael City Council Agenda Report: Receive and Accept San Rafael Greenhouse Gas Reduction Strategy Report, March 19.

City of San Rafael, 2019. *Climate Change Action Plan 2030*, April 23.

Intergovernmental Panel on Climate Change (IPCC), 2013. Climate Change 2013; the Physical Science Basis; Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG), 2017. Plan Bay Area 2040. Regional Transportation Plan and Sustainable Communities Strategy for the San Francisco Bay Area 2017–2040. Adopted July 26.

National Aeronautics and Space Administration (NASA), 2019. 2018 Fourth Warmest Year in Continued Warming Trend, According to NASA, NOAA. Website: https://www.giss.nasa.gov/research/news/20190206/, posted February 6.

United States Environmental Protection Agency (EPA), 2010. Regulatory Announcement: EPA and NHTSA Finalize Historic National Program to Reduce Greenhouse Gases and Improve Fuel Economy for Cars and Trucks.

United States Environmental Protection Agency (EPA), 2012. Regulatory Announcement: EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017-2025 Cars and Light Trucks, August.

4.7 HAZARDS AND HAZARDOUS MATERIALS

INTRODUCTION

This section provides an overview of potential hazards and hazardous materials at and near the project site and assesses potential impacts that could result from implementation of the proposed project. Mitigation measures to reduce significant impacts are identified, where appropriate.

ENVIRONMENTAL SETTING

This section describes the existing conditions related to hazards and hazardous materials at and near the project site.

Unless indicated otherwise, the information in this section was obtained from the Remedial Action Completion Report (RACR) prepared by Terra Pacific Group (TPG) on behalf of Pacific Gas and Electric Company (PG&E), the former owner of the site, to document the completion of remedial actions at the project site (TPG, 2018a). In November 2018, the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC) approved the Remedial Action Completion Report (DTSC, 2018a).

Former Manufactured Gas Plant Operations

A manufactured gas plant (MGP) operated on the project site from 1875 to 1930, when natural gas arrived in San Rafael and the MGP was substantially shut down and put on standby status until 1960 when the MGP facility was dismantled. The MGP process included the production of gas via heating of feedstock (first coal and then later oil) in retorts,[1] gas purification, by-product separation, tar and hydrocarbon processing, and waste-water treatment. By-products of MGP processes typically included tars, light oils, sludge, lampblack, and other materials. The specific waste disposal practices associated with the former MGP are not known. However, disposal of waste MGP residues in low-lying marsh areas resulted in contamination of soil and groundwater at the project site and surrounding area.

Environmental Investigations and Regulatory Agency Requirements

Environmental investigations conducted since 1983 have identified contamination associated with former MGP operations in soil, soil gas, and groundwater at the project site. In 1985, the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) issued Waste Discharge Requirements Order No. 85-80 (Order) to PG&E for a 17-acre property that includes the project site. This Order approved the proposed remedial action plan for groundwater, which consisted of containment of contaminants (partial slurry wall keyed into the older alluvium) and a groundwater extraction and treatment system. The Order also required annual reports on the effectiveness of the groundwater cleanup program. The only component of the groundwater extraction and treatment system on the project site included one extraction well, which was

[1] A retort is a device used for distillation or dry distillation of substances.

destroyed under permit prior to the start of soil excavation activities described below. Most of the components of the groundwater extraction and treatment system are located within the blocks located adjacent to the south and southeast of the project site.

In 1989, the California Department of Health Services, Toxic Substances Control Division (DHS, now DTSC) entered into Consent Order Docket No. HSA 89/90-002 (Consent Order) with PG&E. The Consent Order was applicable to the 17-acre property that includes the project site (identified as the northwest parcel/Parcel 4). The Consent Order provided the requirements for development of the 17-acre property, including the creation of and submittal of a Soils Management Work Plan, a Health and Safety Plan, a Risk Assessment, and a site-specific Community Relations and Public Participation Plan. The Consent Order also made PG&E or future property owners responsible for the operation and maintenance of a cap (e.g., areas covered by buildings, pavement, walkways, and landscaping). In addition, a Covenant and Agreement to Restrict Use of Property (Covenant) was placed on the entire 17-acre property in 1989. This Covenant required that all current and future property owners maintain the site cap, manage any excavated soils in accordance with the Consent Order, and maintain the integrity of the slurry wall and groundwater extraction, treatment and monitoring system. The Covenant also restricted the property development to commercial or office space. In 1999, the First Amendment to the Covenant was prepared by DTSC and PG&E and recorded for the project site. The First Amendment revised parts of the Covenant to allow commercial, hotel, or office space, and restrict permanent residences for human habitation on the project site.

In 2007, a Voluntary Cleanup Agreement (VCA)\ (Docket No. HSA-VCA 06/07-130) was entered into by DTSC and PG&E for the investigation and possible remediation of the project site. As part of the development of a Remedial Action Plan (RAP) for the project site, a human health risk assessment (HHRA) was conducted to evaluate chemicals of potential concern (COPCs) at the project site and determine if they pose a risk to human health or the environment. The results of the HHRA suggested that levels of carcinogenic polycyclic aromatic hydrocarbons (CPAHs), naphthalene, 2-methylnaphthalene, benzene, arsenic, and lead present in soil, and benzene, ethylbenzene and naphthalene in soil gas would require remediation or other form of risk management (e.g., institutional controls) in the event that the cap on the project site were to be removed or altered and/or if the project site were to be developed for commercial or residential purposes, including mixed use (combined commercial and residential use). Additionally, the HHRA indicated that remediation or another form of risk management was warranted to protect the health of workers who may engage in subsurface construction activities at the project site.

Remedial Action Plan

The Final RAP for the project site was prepared in 2012. The remedial action selected for the project site consisted of containment and institutional controls along with focused excavation of soil. This approach included excavation and off-site disposal of impacted soil in select areas, restoration of the surface cover largely to its pre-existing condition with asphalt concrete (AC) paving and landscaped planters, and post-remediation groundwater monitoring. The remedial approach also included an amendment to the existing Covenant, which would allow multi-family residential development if the development is designed to prevent contact with the underlying soil by residents (eliminating soil ingestion, inhalation, and contact exposure pathways) and engineering controls are used to reduce potential vapor intrusion pathways, if needed, to acceptable levels or eliminated, and place restrictions on activities that could compromise the integrity of the existing cap and disturb any underlying impacted soil. An Operation and Maintenance (O&M) Plan and Soil and Groundwater Management Plan (SGMP) would be developed and implemented under an O&M Agreement with DTSC to ensure that the cap is properly maintained and functioning as intended, so that any subsurface impacted soil disturbed during future activities (e.g., utility line installation or repair) would be handled and managed appropriately. In areas of the project site where post-remediation soil gas concentrations exceed target action levels, if any, future buildings placed over these areas would require engineering controls such as vapor barriers, active or passive vapor venting systems or building design restrictions (e.g., no subgrade garage) to mitigate for potential vapor intrusion. Under the selected groundwater alternative, groundwater quality and flow direction conditions would be monitored periodically by PG&E on an ongoing basis.

RAP Implementation

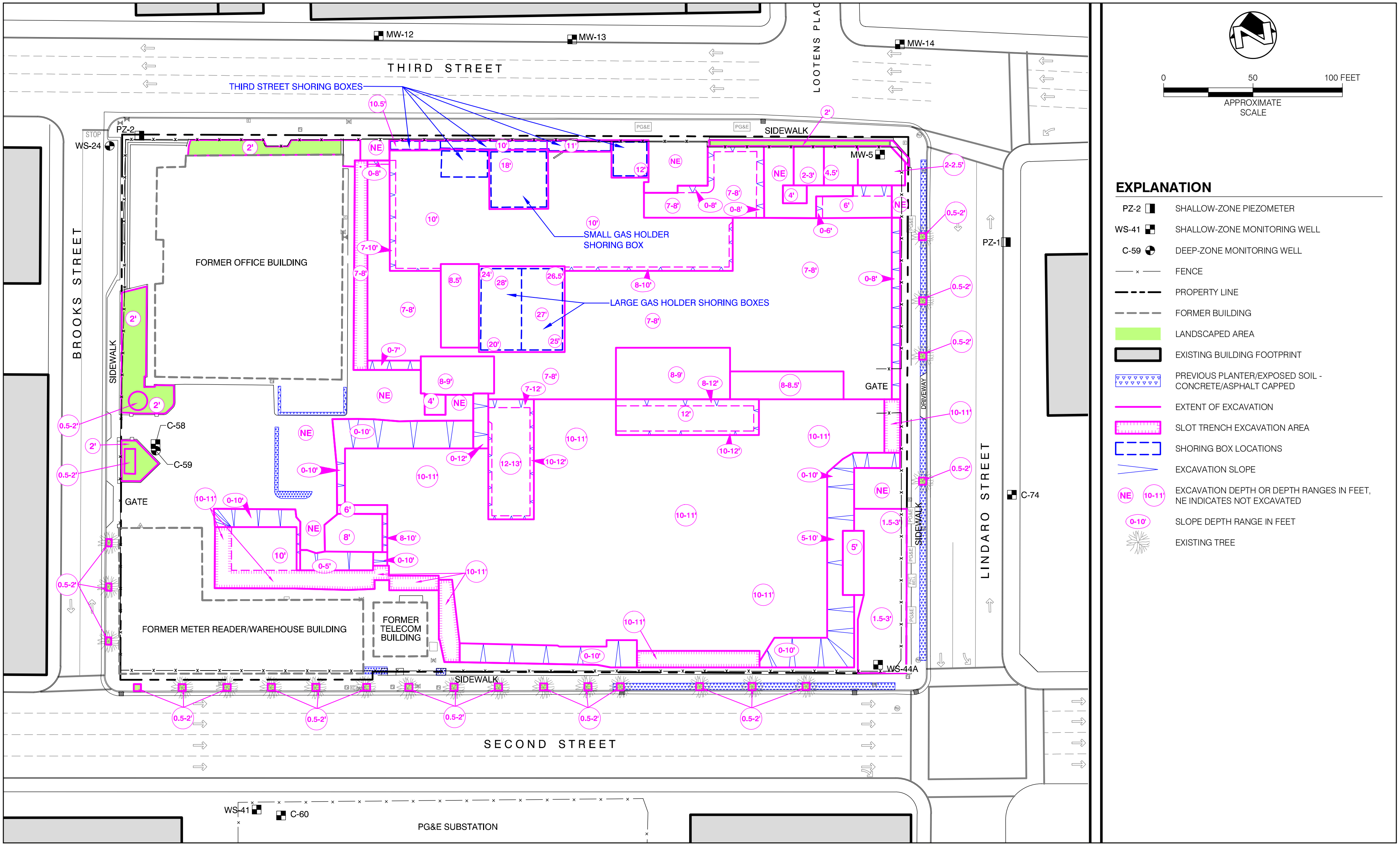
Remediation activities were completed at the project site over the period from October 15, 2015 through April 4, 2017. These activities included the excavation and off-haul of soil up to 28 feet below the ground surface. The locations and depths of remedial excavations performed at the project site are shown on **Figure 4.7-1**. In approximately 80 percent of the planned excavation area, excavation activities were conducted under four large tent structures to control odor and vapor emissions (and reduce/eliminate potential nuisance and public health concerns related to the release of contaminants into the air). The remaining approximately 20 percent of the proposed excavation area was excavated without the use of tents. In addition, groundwater dewatering activities were conducted during excavation activities, as needed, and pumped groundwater as well as surface rainwater that was in contact with impacted soil was treated at an on-site treatment facility and primarily discharged to the sanitary sewer under permit with the Central Marin Sanitation Agency.

To document post-excavation conditions, a total of 125 soil samples were collected from the excavation floors and sidewalls following the removal of impacted soils and analyzed for polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), benzene, arsenic, and lead to document post-remediation conditions. Approximately 47,079 tons of soil were excavated and disposed of at off-site landfills. Following the excavation and backfilling with imported fill materials including drain rock, aggregate base, sand-cement slurry, and top soil, the pavement, landscaped planters, and adjacent sidewalks were largely restored to pre-existing conditions.

Post-remediation soil gas sampling and a post-remediation HHRA were conducted to document the overall effectiveness of the remediation activities in reducing the concentrations of chemicals of concern at the project site, thereby reducing potential future risks to human health and the environment. The RACR indicates that the post-remediation HHRA supported the following findings:

Hypothetical Future Residential Scenario

- "Residual levels of CPAHs and arsenic remaining in soil are above ambient levels, and thus are at levels that warrant long-term risk management. As such, the post-remediation HHRA



SOURCE: TPG, 2018a. Remedial Action Completion Report, Former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California, November 19

Figure 4.7-1

EXCAVATION LIMITS FROM PREVIOUS REMEDIATION ACTIVITIES

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

supports that the proposed mitigation measures[2] and institutional controls are appropriate to ensure the long-term protection of human health associated with residual CPAH and arsenic impacts that remain in soil at the Site, specifically under the existing foundations of recently demolished buildings on the western portion of the Site and along the northern, eastern, and southern boundaries of the Site." (TPG, 2018a, p. xvii)

- "The cumulative cancer risk and non-cancer [hazard index (HI)] posed by other residual chemicals (i.e., chemicals other than CPAHs, expressed as benzo(a)pyrene equivalents, and arsenic) remaining in soil and by chemicals detected in soil gas are at levels that warrant long-term management under a hypothetical future residential scenario. Furthermore, the incremental blood-lead level estimated for future child residential populations are also above the benchmark level of concern. As such, the post-remediation soil and soil gas HHRAs support that proposed mitigation measures and institutional controls are appropriate to ensure the long-term protection of human health associated with residual chemicals that remain in soil at the Site, specifically under the existing foundations of recently demolished buildings on the western portion of the Site and along the northern, eastern, and southern boundaries of the Site and in soil gas at the Site." (TPG, 2018a, p. xvii)

Hypothetical Future Commercial Scenario

- "Potential health risks associated with residual chemicals in soil were not quantitatively evaluated under a hypothetical future commercial worker scenario. However, potential health risks associated with residual levels of CPAHs and arsenic remaining in soil were qualitatively evaluated relative to ambient levels which are typically above risk-based goals for CPAHs and arsenic. As indicated above, CPAHs and arsenic are above ambient levels, and thus are at levels that warrant long-term risk management, whether the future use of the Site is for residential or commercial purposes. As such, the post-remediation HHRA supports that the proposed mitigation measures and institutional controls are appropriate to ensure the long-term protection of future residential and commercial populations, associated with residual CPAH and arsenic impacts that remain in soil at the Site." (TPG, 2018a, p. xvii)
- "The estimated potential cancer risks associated with chemicals detected in soil gas at the project site for hypothetical future commercial worker populations are above 1 x 10-6, the point of departure for risk management decisions, but within the risk management range of 1 x 10-6 and 1 x 10-4… due primarily to potential future exposure to benzene and naphthalene in soil gas via the vapor intrusion pathway." (TPG, 2018a, pp. xvii - xviii)
- "The estimated potential non-cancer HI posed by chemicals detected in soil gas at the Site for the hypothetical future commercial population… are [sic] at or below the acceptable HI of 1." (TPG, 2018a, p. xviii)
- "Based on results of the HHRA using soil gas data from one round of soil gas sampling at each location representative of post-remediation conditions… levels of chemicals detected in soil gas were considered safe and protective of future commercial populations at the Site." (TPG, 2018a, p. xviii)

[2] The proposed mitigation measures mentioned in this section refer to remedial measures (engineering and institutional controls) that are proposed as part of the implementation of the RAP, and not the mitigation measures presented in this DEIR.

A post-remediation groundwater monitoring program will be implemented by PG&E under the oversight of the Regional Water Board to evaluate groundwater conditions associated with TPH, PAHs, benzene, arsenic, and lead residuals that remain in groundwater at the project site. A Second Amendment to the existing Covenant will be used to maintain the integrity of cap features and to enforce land use restrictions because the project site soils do not meet the conditions suitable for unrestricted land use due to residual concentrations of benzene, CPAHs, naphthalene, TPH quantified as diesel, arsenic, and lead remaining beneath the cap.

Operation and Maintenance Plan and Soil and Groundwater Management Plan

In November 2018, an O&M Plan (TPG, 2018b) was prepared for the project site and approved by DTSC (DTSC, 2018b). The O&M Plan outlines measures to ensure that the cap is properly maintained and measures to be taken whenever the cap and/or underlying materials (e.g., soil, groundwater) are disturbed to ensure protection of human health and the environment and compliance with the Covenant. The O&M Plan includes requirements for inspection and maintenance of the cap, which includes concrete foundations of former buildings, concrete pavement, asphalt pavement, clean top soil, and other clean fill materials. The O&M Plan includes a SGMP which provides a framework for managing soil and groundwater encountered during future intrusive subsurface activities that would disturb soil deeper than the clean fill or any groundwater, such as utility installation or repair, construction, and similar activities. The SGMP requires that, except in cases of emergency, notice is to be provided to DTSC 14 days before work begins that would disturb the cap, soil deeper than the clean fill, or any groundwater. The O&M Plan also outlines health and safety requirements for workers that would be performing activities under the SGMP. Soil and groundwater management procedures outlined in the SGMP include dust and odor control, stockpile management, stormwater runoff and erosion control, soil and groundwater disposal protocols, and protocols for the discovery of unanticipated conditions (e.g., subsurface features or contaminated soil not identified during previous investigations).

Current Regulatory Status and Planned Additional Investigation/Remediation

In December 2018, DTSC and BioMarin entered into a Voluntary Oversight Agreement (Docket No. HSA-FY18/19-053) for DTSC to provide oversight of investigation and remediation of the western portion of the project site which was not remediated by PG&E (DTSC, 2018c). The Voluntary Oversight Agreement indicates the following:

- BioMarin submitted a report to DTSC summarizing results from investigation activities conducted at the project site in May/June 2018 and DTSC will review the information to identify areas and media of concern, and to determine the additional work, if any, required to complete the investigation/remediation of the project site.
- The western portion of the project site is or may be contaminated with hazardous materials including PAHs, naphthalene, TPH as diesel, arsenic, lead, and cyanide in soil; naphthalene and benzene in soil vapor; and PAHs, naphthalene and TPH as diesel, gasoline, and motor oil in groundwater.
- BioMarin will prepare an Explanation of Significant Differences (ESD) that documents modifications and actions to be taken at the project site in addition to the actions included as part of the remedy selected in the Final RAP; and a Remedial Design and Implementation Plan (RDIP) for implementing the additional actions outlined in the ESD.

- Upon DTSC approval of the RDIP and schedule, BioMarin will implement the activities included in the RDIP in accordance with the approved schedule.

In February 2019, a Final Report, Pre-Design Subsurface Investigation (Subsurface Investigation Report) (Geologica, 2019a) was prepared which included the following conclusions based on the findings of subsurface investigation activities performed in the western portion of the project site in May and June of 2018:

- There were significant scattered detections of MGP-related compounds in soil vapor, soil, and groundwater beneath the western portion of the project site.
- The areal distribution of detections suggests contaminant heterogeneity in the shallow soils such that: (1) concentrations vary greatly over short distances; and, (2) detections are not associated with identifiable discrete source areas.
- Concentrations detected often exceeded target action levels established for PG&E's recent soil remediation at the project site.
- Soil vapor levels would require mitigation for the proposed senior residential development; vapor intrusion mitigation would probably be prudent for the future office building as well.
- Soil remediation by excavation is appropriate to address soil contaminant contributions to soil vapor and impacts to groundwater.

The Subsurface Investigation Report was approved by DTSC in April 2019 (DTSC, 2019a).

BioMarin is planning to remediate the western portion of the project site using the same remedy selected in the DTSC-approved Final RAP. In May 2019, an ESD (Geologica, 2019b) was prepared for the western portion of the project site. The ESD summarizes the justification and conceptual plan for excavation and off-site disposal of contaminated soil in the western portion of the project site in line with the Final RAP and without preparation of a new RAP. The soil excavation will encompass an area of approximately 1 acre and extend to depths ranging from 5 to 10 feet, based primarily on the soil target action levels established by the Final RAP, the 2019 Subsurface Investigation Report, and consultation with DTSC. It is estimated that up to approximately 5,800 cubic yards (i.e., 414 truck trips) of impacted soil will be excavated and transported to appropriate off-site permitted disposal facilities. In addition, it is estimated that approximately 2,200 cubic yards of clean soil will be excavated and re-used on the project site. The footprint of the excavated area will be expanded beyond the previous excavation area but will remain inside the fenced boundary of the project site. The additional soil excavation addressed by the ESD will be conducted in accordance with the requirements and safeguards outlined in the Final RAP, including work hour requirements, traffic control, noise and vibration consideration, daily limitations on soil off-haul truck trips and routes, tented encapsulation of the excavation area with air quality management systems according to BAAQMD permit requirements, perimeter dust and air monitoring, and other environmental controls. An RDIP has been prepared and submitted to DTSC that provides project implementation details (Geologica, 2019b).

All protective measures that were considered and included in the Final RAP and evaluated as part of the 2012 California Environmental Quality Act (CEQA) Initial Study and Negative Declaration (IS/ND) prepared for the RAP will apply to the remediation of the additional volume of impacted soil (Geologica, 2019b). DTSC indicated that for the remediation of the western portion of the project site to meet CEQA requirements, an Addendum to the 2012 IS/ND for the RAP would be prepared

(DTSC, 2018d). BioMarin will complete this second phase of remediation prior to initiation of the proposed project's construction and development activities.

In February 2019, DTSC published a Work Notice (DTSC, 2019b) indicating that contractors for BioMarin would be performing soil sampling in the western portion of the project site starting on February 28, 2019; and that the additional data would help in the development of a plan to complete the remediation of the project site.

In March 2019, DTSC approved a Post Remediation Soil Gas Sampling Work Plan Addendum which presents the scope of work proposed by PG&E for conducting a second round of soil gas sampling to verify that vapor mitigation systems are not necessary for future commercial buildings (DTSC, 2019c). As discussed above, based on results of the HHRA using soil gas data from one round of soil gas sampling, the estimated potential cancer risks for hypothetical future commercial workers associated with chemicals detected in soil gas at the project site are above 1×10^{-6}, and the RACR indicated that these soil gas conditions would be considered safe and protective of future commercial populations at the project site (TPG, 2018a). DTSC's Vapor Intrusion Mitigation Advisory (DTSC, 2011) indicates that sites with a cancer risk from volatile chemicals in excess of 1×10^{-6} require a response action and long-term environmental care which may include continued soil vapor monitoring, continued indoor air quality monitoring, mitigation, and volatile chemical source remediation. DTSC makes risk management decisions on a site-by-site basis with consideration of appropriate input from the project proponent (DTSC, 2011).

In 2019, DTSC prepared an Addendum to the 2012 IS/ND for the Former San Rafael Manufactured Gas Plant-RAP (DTSC, 2019d), which included the following conclusions:

- The activities proposed in the RDIP for the western portion of the project site would not alter the significance levels for any resource areas, as presented in the 2012 IS/ND.
- There will not be any new significant impacts or a substantial increase in the severity of impacts as compared to the issues identified in the 2012 IS/ND. No mitigation measures are required for the RDIP activities. Therefore, the impacts for the RDIP activities are within the scope of impacts identified in the 2012 IS/ND, and the 2012 IS/ND adequately addressed all impacts of the RDIP activities.
- An Addendum to the previously adopted IS/ND is the appropriate CEQA document for the RDIP activities pursuant to the CEQA Guidelines because none of the conditions described in the CEQA Guidelines apply. The Addendum has appropriately disclosed the potential impacts from the RDIP activities and will be included as part of the CEQA record for the RAP.
- A Notice of Determination will be filed with the State of California Office of Planning and Research, State Clearinghouse, upon approval of the RDIP.[3]

REGULATORY FRAMEWORK

This section describes the federal, state, and regional/local regulatory framework for hazardous materials and worker health and safety requirements.

[3] The RDIP was approved July 15, 2019.

Federal Agencies and Regulations

Environmental Protection Agency

The United Sates Environmental Protection Agency (EPA) is the federal agency responsible for enforcement and implementation of federal laws and regulations pertaining to hazardous materials and hazardous waste. The federal regulations are primarily codified in Title 40 of the Code of Federal Regulations. The legislation includes the Resource Conservation and Recovery Act (RCRA) of 1976, the Superfund Amendments and Reauthorization Acts of 1986, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, and the Toxic Substances Control Act of 1976 (TSCA). The EPA provides oversight for site investigation and remediation projects, and has developed protocols for sampling, testing, and evaluation of solid wastes. The EPA has an environmental oversight role at the project site with respect to the investigation and remediation of PCBs under TSCA.

Occupational Safety and Health Administration

Worker health and safety is regulated at the federal level by the Occupational Safety and Health Administration (OSHA). The Federal Occupational Safety and Health Act of 1970 authorizes states to establish their own safety and health programs with OSHA approval. Workers at hazardous waste sites (or workers who may be exposed to hazardous wastes that might be encountered during excavation of contaminated soils) must receive specialized training and medical supervision according to the Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations. Additional regulations have been developed for construction workers potentially exposed to lead and asbestos.

Department of Transportation

In 1990 and 1994, the federal Hazardous Material Transportation Act was amended to improve the protection of life, property, and the environment from the inherent risks of transporting hazardous material in all major modes of commerce. The United States Department of Transportation (DOT) developed hazardous materials regulations, which govern the classification, packaging, communication, transportation, and handling of hazardous materials, as well as employee training and incident reporting. The transportation of hazardous materials is subject to both RCRA and DOT regulations. The California Highway Patrol, California Department of Transportation (Caltrans), and DTSC are responsible for enforcing federal and state regulations pertaining to the transportation of hazardous materials.

Federal Regulation of Biotechnology Research and Development Wastes

Wastes generated during the course of biotechnology research and development (R&D) may include radioactive materials/waste and bio hazardous waste. At the federal level, the Food and Drug Administration, EPA, and the US Department of Agriculture regulate biotechnology research and product development, including genetically modified organisms that could affect the environment upon release. The US Nuclear Regulatory Commission (NRC) has adopted a waste classification system for low-level radioactive wastes (LLRW) that could be generated during biotechnology R&D uses and requirements for disposal. The classification of LLRW is found in

Title 10, Code of Federal Regulations, Part 61.55. There are also specific requirements for transport of radioactive wastes.

State Agencies and Regulations

Department of Toxic Substances Control

In California, DTSC is authorized by the EPA to enforce and implement federal hazardous materials laws and regulations. State of California regulations pertaining to hazardous materials are as stringent as or more stringent than the federal requirements. Most state hazardous materials regulations are contained in Title 22 of the California Code of Regulations (CCR). DTSC generally acts as the lead agency for soil and groundwater cleanup projects that have the potential to affect public health, and establishes cleanup levels for subsurface contamination that are equal to or more restrictive than federal levels. DTSC has also developed land disposal restrictions and treatment standards for hazardous waste disposal in California. DTSC is the lead oversight agency for the investigation and remediation of hazardous materials contamination at the project site.

State Water Resources Control Board

The State Water Resources Control Board (State Water Board) enforces the Porter-Cologne Water Quality Act through its nine regional boards, including the Regional Water Board, described below.

California Air Resources Board

The California Air Resources Board (CARB) is responsible for coordination and oversight of state and local air pollution control programs in California, including implementation of the California Clean Air Act of 1988. The CARB has developed state air quality standards and is responsible for monitoring air quality in conjunction with the local air districts.

California Code of Regulations Title 8 and California OSHA

State of California standards for workers dealing with hazardous materials are contained in California Code of Regulations Title 8 and include practices for all industries (General Industrial Safety Orders), and specific practices for construction, and other industries. Worker health and safety protections in California are regulated by the California Department of Industrial Relations, which includes the Division of Occupational Safety and Health, which acts to protect workers from safety hazards through its California OSHA (Cal/OSHA) program, and provides consultant assistance to employers. Cal/OSHA enforcement units conduct on-site evaluations and issue notices of violation to enforce necessary improvements to health and safety practices.

Title 8 of the California Code of Regulations specifically addresses laboratory environments in Article 107 of Group 16 regulations, section 5139-5155, *Control of Hazardous Substances*. Subsection 5154.1 discusses requirements for the ventilation of laboratory fumes, including hood design and operation, air volume movement, and exhaust stack design. In addition, circumstances under which air dilution or air cleaning is required (such as scrubbing or air incineration), and decontamination procedures are described.

California Department of Public Health, Medical Waste Management Program

Medical wastes are generated or produced as a result of diagnosis, treatment, or immunization of humans, and/or the production or testing of biological materials, and are either considered bio hazardous waste or sharps waste (e.g., used syringes). Cultures, blood and blood products, tissues, and body parts are considered medical wastes. Biotechnology R&D laboratories typically produce medical wastes. The California Department of Public Health Medical Waste Management Program regulates the generation, handling, storage, treatment, and disposal of medical waste by providing oversight for the implementation of the Medical Waste Management Act. The Medical Waste Management Program permits and inspects all medical waste offsite treatment facilities and medical waste transfer stations.

Medical and Research and Development Laboratory Construction Requirements

Design and construction requirements for laboratory environments, including hazardous or flammable materials use and storage, and hazardous or flammable fumes and exhaust systems, are specifically addressed by the California Building Code and the California Fire Code. The City of San Rafael has adopted the 2016 California Building Code (CBC), as amended in Chapter 12.12 of the San Rafael Municipal Code, which is enforced by the Building Division; and the 2016 California Fire Code (CFC) and 2015 International Fire Code (IFC), as amended in Chapter 4.08 of the San Rafael Municipal Code, which is enforced by the Fire Department.

The CFC requires that hazardous materials exhaust systems incorporate fire suppression systems and imposes use restrictions on the ducting of incompatible chemicals through a single system. A hazardous exhaust system is required wherever the handling of hazardous materials has the potential to create a vapor, gas, fume, mist or dust resulting in exposure to a material classified as a severe health hazard (life-threatening from a single short exposure), or exposure to materials classified as slight, moderate, or serious hazards in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.

Regional and Local Agencies, Regulations, and Policies

San Francisco Bay Regional Water Quality Control Board

The Regional Water Board provides for protection of state waters in accordance with the Porter-Cologne Water Quality Act of 1969. The Regional Water Board can act as lead agency to provide oversight of sites where the quality of groundwater or surface waters is threatened, and has the authority to require investigations and remedial actions. The Regional Water Board also developed Environmental Screening Levels (ESLs) (Regional Water Board, 2019) to help expedite the preparation of environmental risk assessments at sites where contaminated soil and groundwater have been identified.

Bay Area Air Quality Management District

The Bay Area Air Quality Management District (BAAQMD) has primary responsibility for control of air pollution from sources other than motor vehicles and consumer products (which are the responsibility of the EPA and the CARB). The BAAQMD is responsible for preparing attainment plans for nonattainment criteria pollutants, control of stationary air pollutant sources, and issuance of permits for activities that include asbestos demolition and renovation activities (District Regulation 11, Rule 2).

BAAQMD Regulation 8 Rule 47 requires permitting and treatment for emissions from active (e.g., with sub-slab depressurization) vapor mitigation systems. BAAQMD Regulation 2 Rule 1 Section 412 requires that the BAAQMD provide public notice if a proposed source of emissions is located within 1,000 feet of the outer boundary of a K-12 school.

Marin County Public Works, Certified Unified Program Agency

Marin County Public Works is the Certified Unified Program Agency (CUPA) for the City of San Rafael. The CUPA is the primary agency responsible for local enforcement of state and federal laws pertaining to hazardous materials and hazardous waste management, and is responsible for coordination of the following programs: Hazardous Materials Business Plan (HMBP) Program, Hazardous Waste Generator Program, Underground Storage Tank (UST) Program, California Accidental Release Program (Cal ARP), Tiered Permitting Program, and the Aboveground Storage Tank (AST) Program. The role of a CUPA is to consolidate, coordinate, and make consistent the administrative requirements, permits, inspections, and enforcement activities associated with the regulation of hazardous materials and hazardous wastes.

Chapter 6.95 of the Health and Safety Code establishes minimum statewide standards for HMBPs, including basic information on the location, type, quantity, and health risks of hazardous materials and/or waste. Each business must prepare a HMBP if that business uses, handles, or stores a hazardous material and/or waste or an extremely hazardous material in quantities greater than or equal to the following:

- 55 gallons for a liquid
- 500 pounds of a solid
- 200 cubic feet for any compressed gas
- Threshold planning quantities of an extremely hazardous substance

The Cal ARP Program requires any business that handles more than threshold quantities of an extremely hazardous substance to develop a Risk Management Plan (RMP). The RMP is implemented by the business to prevent or mitigate releases of regulated substances that could have off-site consequences through hazard identification, planning, source reduction, maintenance, training, and engineering controls.

Marin County Environmental Health Services

Marin County Environmental Health Services is the designated local enforcement agency implementing the medical waste program in Marin County in accordance with the Medical Waste Management Act. The purpose of the medical waste program is to protect the health of the public, health care facility personnel, and landfill personnel from exposure to medical wastes containing potentially infectious pathogenic organisms. This is accomplished by regulation of medical waste generators, including biotechnology R&D laboratories, through inspection, complaint investigation, emergency response, enforcement, public education, and assistance to industry in regards to the handling, storage, treatment and disposal of medical waste.

Pharmaceutical wastes may be classified as medical waste, hazardous waste or solid waste, and it is the responsibility of the generator to classify waste properly and dispose of it in accordance with applicable regulations. Generators of pharmaceutical medical waste must develop and implement a plan and procedure for properly managing and disposing of medical waste pharmaceuticals. This plan must be included as part of the facility's Medical Waste Management Plan. The plan is required to be used as a tool to assist the facility in communicating, with the medical waste enforcement agency, the status of the facility's compliance with the Medical Waste Management Act.

City of San Rafael General Plan 2020

San Rafael General Plan 2020 policies and programs that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact as related to hazardous materials issues include the following (City of San Rafael, 2017):

Policy S-1 **Location of Future Development.** Permit development only in those areas where potential danger to the health, safety, and welfare of the residents of the community can be adequately mitigated.

Program S-1a **Entitlement Process**. Through the entitlement process, evaluate applications for geoseismic and hazardous materials dangers and require appropriate mitigations.

Policy S-10 **Location of Public Improvements.** To minimize threat to human health or any extraordinary construction and monitoring expenses, avoid locating improvements and utilities in areas with dangerous levels of identified hazardous materials. When the location of public improvements and utilities in such areas cannot feasibly be avoided, effective mitigation measures will be implemented.

Policy S-11 **Restriction of Businesses.** Restrict siting of businesses or expansion of businesses that have the potential for a significant hazardous materials release within one-quarter mile of schools.

Program S-11a **Survey of Facilities.** Survey existing industrial facilities within one-quarter mile of the schools. The survey would be used to determine the presence of hazardous materials and evaluate the risk of an accidental release that could adversely affect the health and safety of students and school staff.

Policy S-12 **Use of Environmental Databases in Development Review.** When development is proposed, determine whether the site has been recorded as contaminated. Undertake appropriate studies to assure identification and implementation of mitigation measures for sites on or near identified hazards.

Program S-12a **Environmental Database.** Maintain environmental and hazardous materials-related databases, and update information on an ongoing basis. In addition, include the information in the

State GeoTracker database (database of contaminated Underground Storage Tanks sites).

Program S-12b **Environmental History.** Through the environmental review process, provide information about available environmental history of a site and proposed mitigation measures if warranted.

Policy S-13 **Potential Hazardous Soils Conditions.** Where development is proposed on sites with known previous contamination, sites filled prior to 1974 or sites that were historically auto service, industrial or other land uses that may have involved hazardous materials, evaluate such sites for the presence of toxic or hazardous materials. The requirements for site-specific investigation are contained in the Geotechnical Review Matrix.

Program S-13a **Potentially Hazardous Soils Map.** Prepare a map showing sites with known soil and groundwater contamination, in order to identify new developments that warrant environmental investigation and testing.

Program S-13b **Hazardous Soils Cleanup.** Require remediation and cleanup in accordance with regional and local standards in order to develop on sites where hazardous materials have impacted soil or groundwater. At a minimum, remediation and cleanup of contaminated sites shall be in accordance with regional and local standards. The required level of remediation and clean-up shall be determined by the CUPA based on the intended use of the site and health risk to the public.

Program S-13c **Local Implementing Agency.** The Certified Unified Program Agency (CUPA) shall oversee the investigation and closure of contaminated underground storage tank sites.

Policy S-14 **Hazardous Materials Storage, Use and Disposal.** Enforce regulations regarding proper storage, use and disposal of hazardous materials to prevent leakage, potential explosions, fires, or the escape of harmful gases, and to prevent individually innocuous materials from combining to form hazardous substances, especially at the time of disposal.

Program S-14a **CUPA Program.** Continue to participate in the CUPA program.

Policy S-15 **Hazardous Waste Management.** Support measures to responsibly manage hazardous waste consistent with protection of the public health, welfare, safety and the environment. The City of San Rafael supports the Marin County Hazardous Waste Management Plan as adopted by the State, County and Cities within Marin County.

Policy S-16 **Transportation of Hazardous Materials.** Enforce Federal, State and Local requirements and standards regarding the transportation of hazardous materials.

Support, as appropriate, legislation that strengthens safety requirements for the transportation of hazardous materials.

Program S-16a **Safe Transport of Hazardous Materials.** Support California Highway Patrol's efforts to ensure the safe transport of hazardous materials.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

Implementation of the project would result in a significant impact related to hazards and hazardous materials if it would:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment;

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area;

f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or

g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires.

Less-than-Significant Impacts

Routine Transportation, Use, or Disposal of Hazardous Materials

The project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.

During project construction, hazardous materials (e.g., fuel, oils, solvents, paints) would be routinely transported, stored, and used at the project site. Because the proposed project would result in soil disturbance greater than 1 acre, management of soil and hazardous materials during construction activities would be subject to the requirements of the Stormwater Construction General Permit (described in detail under Section 4.8, Hydrology and Water Quality of this DEIR), which requires preparation and implementation of a Stormwater Pollution Prevention Plan

(SWPPP) that includes hazardous materials storage requirements. For example, construction site operators must store chemicals in watertight containers (with appropriate secondary containment to prevent any spillage or leakage) or in a storage shed (completely enclosed).

Once the project is in operation, only small quantities of commercially available hazardous materials such as paints and cleaning products would be used for routine maintenance. The BioMarin project includes operation of a laboratory and R&D facility; therefore, the operational phase of the BioMarin project would be expected to involve the transportation, storage, use and disposal of hazardous materials (e.g., chemicals, radioactive materials/waste, pharmaceutical wastes, and medical/bio hazardous waste). In addition, equipment installed at the project site, such as hydraulic elevators systems and backup generators, may involve the storage of hazardous materials such as hydraulic fluid and fuel. All future uses of the project site would be subject to existing regulatory programs for hazardous materials (see "Regulatory Framework," above). The San Rafael Fire Department and Building Division would review project plans and perform inspections to ensure that the project is designed, constructed, and operated in accordance with the requirements of the CBC, CFC, and IFC for the storage and handling of hazardous materials, including required separation between hazardous materials and sensitive land uses, and proper hazardous materials storage facilities. The storage of hazardous materials at the project site would also be subject to existing hazardous materials regulations enforced by the Marin County CUPA (e.g., the HMBP Program, Hazardous Waste Generator Program, UST Program, Cal ARP, Tiered Permitting Program, and AST Program). The storage and disposal of hazardous medical waste would be performed in accordance with the requirements of the Medical Waste Management Act, as enforced by the Marin County Environmental Health Services. Hazardous materials would be transported by licensed hazardous materials haulers and hazardous waste would be disposed of at facilities that are permitted to accept such materials as required by DOT, RCRA, and state regulations.

The routine handling and use of hazardous materials by workers would be performed in accordance with OSHA regulations, which include training requirements for workers and a requirement that hazardous materials are accompanied by manufacturer's Safety Data Sheets (SDSs). Cal/OSHA regulations include requirements for protective clothing, training, and limits on exposure to hazardous materials. Compliance with these existing regulations would ensure that workers are protected from exposure to hazardous materials that may be transported, stored, or used on-site.

Compliance with the existing regulations for hazardous materials discussed above would ensure that the proposed project would not result in significant impacts related to the routine transport, use, storage, or disposal of hazardous materials.

Accidental Release of Hazardous Materials during Construction

During construction, the project would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

The following discussion addresses potential accidental releases of hazardous materials during construction of the project. The potential for accidental releases of hazardous materials during operation of the project is discussed below under "Potentially Significant Impacts."

As discussed under “Routine Transportation, Use, or Disposal of Hazardous Materials” above, the transportation of hazardous materials is subject to both RCRA and DOT regulations. If a discharge or spill of hazardous materials occurs during transportation, the transporter is required to take appropriate immediate action to protect human health and the environment (e.g., notify local authorities and contain the spill), and is responsible for the discharge cleanup.

An accidental release of hazardous materials (e.g., oils, fuels, solvents, and paints) during project construction could result in exposure of construction workers, the public, and/or the environment to hazardous materials. Although remediation has been performed in the eastern portion of the project site, and further investigation and remediation is planned for the western portion of the project site, contaminated soil may be encountered beneath clean fill material and it is possible that previously undiscovered contamination could be encountered during construction activities. Additionally, contaminated groundwater is known to remain beneath the project site, and dewatering may be required during construction activities. Improper management of contaminated soil and groundwater during construction could result in exposure of construction workers, the public, and/or the environment to hazardous materials.

As discussed under “Routine Transportation, Use, or Disposal of Hazardous Materials” above, construction of the proposed project would be subject to the requirements of the Construction General Permit, which require preparation and implementation of a SWPPP and best management practices (BMPs) to reduce the risk of spills or leaks from reaching the environment, including procedures to address minor spills of hazardous materials. Measures to control spills, leakage, and dumping must be addressed through structural as well as nonstructural BMPs, as required by the Construction General Permit. For example, equipment and materials for cleanup of spills must be available on-site, and spills and leaks must be cleaned up immediately and disposed of properly. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. The SWPPP must also include BMPs to reduce the risk of contaminated soil from impacting stormwater runoff.

As discussed under “Environmental Setting” above, construction activities that would disturb potentially contaminated soil and groundwater at the project site would be subject to the requirements of the Covenant and SGMP, including requirements for worker health and safety, dust and odor control, stockpile management, stormwater runoff and erosion control, soil and groundwater disposal protocols, and protocols for the discovery of unanticipated conditions (e.g., subsurface features or contaminated soil not identified during previous investigations).

Compliance with the requirements of the Covenant, SGMP, and the Construction General Permit would ensure that the proposed project would result in less-than-significant impacts related to the accidental release of hazardous materials during construction.

Hazardous Emissions near Schools

The project would not result in significant impacts related to emitting hazardous emissions or handling hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.

Saint Raphael Elementary is a private school located at 1100 Fifth Avenue, approximately 800 feet north of the project site. James B. Davidson Middle School is a public school located at 280 Woodland Avenue, approximately one-quarter mile south of the project site. No other schools were identified within one-quarter mile south of the project site (California Department of Education, 2019).

Construction-Phase Impacts

As discussed under "Routine Transportation, Use, or Disposal of Hazardous Materials" and "Accidental Release of Hazardous Materials during Construction" above, the proposed project would include the handling of hazardous materials during construction, and implementation of SWPPP as required by the Construction General Permit and compliance with the requirements of the Covenant and SGMP as required by DTSC would ensure that the proposed project would result in less-than-significant impacts related to potential releases of hazardous materials during construction. Therefore, the proposed project would result in less-than-significant impacts related to the hazardous emissions near schools during construction of the project.

Operation-Phase Impacts

Vapor mitigation systems could be installed beneath structures on the project site due to the concentrations of VOCs in soil gas on the project site. Emissions of VOCs occur from the ventilation risers of vapor mitigation systems. PG&E is planning to perform a second round of soil gas sampling to further evaluate whether vapor mitigation systems could be necessary for future commercial buildings (DTSC, 2019b). The determination of whether vapor mitigation systems would be required for the (residential) Whistlestop/Eden Housing project would be made following the completion of further investigation and remediation of the western portion of the project site. If vapor mitigation systems are installed at the project site, the VOCs emissions from ventilation risers would be evaluated and monitored under DTSC oversight to ensure that the emissions would not present a significant exposure risks for nearby receptors, including schools. The concentrations of VOCs in emissions from passive vapor mitigation systems are typically relatively minor and do not pose exposure risks to nearby receptors due to the dilution of the emissions in ambient air. If vapor mitigation systems would include active sub-slab depressurization, the vapor mitigation systems would require permitting from the BAAQMD as the vapor mitigation systems would be considered soil vapor extraction systems under BAAQMD Regulation 8 Rule 47 (*Organic Compounds; Air Stripping and Soil Vapor Extraction Operations*). Pursuant to BAAQMD Regulation 8-47-301, emission controls (e.g., carbon scrubbing), would be required to reduce VOCs emissions by 90 percent, unless an applicable exemption exists. BAAQMD Regulation 2-1-412 (*Public Notice, Schools*) requires that the BAAQMD provide public notice if a proposed source of emissions is located within 1,000 feet of the outer boundary of a K-12 school.

As discussed under "Routine Transportation, Use, or Disposal of Hazardous Materials" and "Accidental Release of Hazardous Materials during Construction" above, the proposed project would be designed, constructed, and operated in accordance with the requirements of the CBC, CFC, and IFC for the storage and handling of hazardous materials; and operation of the project would be required to comply with existing hazardous materials regulations enforced by Marin County.

Compliance with the existing regulations discussed above would ensure that the proposed project would have less-than-significant impacts related to potential hazardous emissions near schools during operation of the project.

Hazardous Materials Sites (Government Code Section 65962.5)

The project would not be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5.

Although the project site is a known hazardous materials release site, the project site is not included on any of the lists of hazardous materials release sites compiled pursuant to Government Code Section 65962.5, also known as the "Cortese List" (CalEPA, 2019). Therefore, the proposed project would have no impact related to being included on a list of hazardous materials release sites compiled pursuant to Government Code Section 65962.5.

Aviation Hazards

The project is not located in the vicinity of an airport and therefore would not result in airport-related safety hazards or excessive noise for people residing or working in the project area.

The nearest airport to the project site is San Rafael Airport, approximately 3 miles north of the project site. San Rafael Airport is a private use airport (AirNav, 2019) and does not have a land use plan. The nearest public airport to the project site is the Marin County Airport at Gnoss Field in Novato, approximately 12 miles to the north. The project site is not located within the land use plan area for the Marin County Airport at Gnoss Field (Marin County Planning Department, 1991). There are no airports located within 2 miles of the project site. Therefore, the proposed project would have no impacts related to aviation hazards.

Emergency Evacuation and Response

The project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.

Construction of the project could require temporary closure of portions of streets adjacent to the project site. Traffic control requirements imposed by the City for the permitting of temporary closure of street areas would ensure that appropriate emergency access is maintained at all times during construction activities. The proposed project would not permanently alter roadways in the vicinity of the project site. Therefore, the proposed project would have a less-than-significant impact related to impeding or interfering with emergency response or evacuation plans.

Wildfires

The project would not expose people or structures, either directly or indirectly, to significant risk of loss, injury, or death involving wildland fires.

The project site is within a highly urbanized area and is not located near heavily vegetated areas or wildlands that could be susceptible to wild fires. The project site is not located in or near a State Responsibility Area or a Very High Fire Hazard Severity Zone as mapped by the California Department of Forestry and Fire Protection (CAL FIRE, 2008). The project site is not in or near a

Wildland-Urban Interface area mapped by the City of San Rafael (City of San Rafael, 2007). (Wildland-Urban Interface areas are areas where structures are built near lands prone to wildland fire.) Therefore, the project would have a less-than-significant impact related to wildland fire hazards.

Potentially Significant Impacts

Accidental Release of Hazardous Materials during Operation

Impact HAZ-1: Future occupants of the project site could be exposed to hazardous materials in indoor air from vapor intrusion during operation of the project. (PS)

As discussed under "Routine Transportation, Use, or Disposal of Hazardous Materials" above, the transportation of hazardous materials is subject to both RCRA and DOT regulations. If a discharge or spill of hazardous materials occurs during transportation, the transporter is required to take appropriate immediate action to protect human health and the environment (e.g., notify local authorities and contain the spill), and is responsible for the discharge cleanup.

As also discussed under "Routine Transportation, Use, or Disposal of Hazardous Materials" above, the proposed project would be designed, constructed, and operated in accordance with the requirements of the CBC, CFC, and IFC for the storage and handling of hazardous materials; and operation of project would be required to comply with existing hazardous materials regulations enforced by Marin County.

As discussed under "Environmental Setting" above, the Covenant and O&M Plan for the project site require that the cap on the project site be inspected and maintained to prevent potential exposure to residual contamination in soil underlying the project site. Based on current conditions at the project site, engineering and institutional controls would be required to prevent exposure of residential receptors to potential vapor intrusion health hazards (TPG, 2018a). PG&E is planning to perform a second round of soil gas sampling to further evaluate whether vapor mitigation systems could be necessary for future commercial buildings (DTSC, 2019b). The Covenant for the project site does not include a requirement for vapor mitigation systems to be installed beneath commercial structures, and it is not known whether vapor mitigation systems would be required for the (residential) Whistlestop/Eden Housing project, as that would be determined following the completion of further investigation and remediation for the western portion of the project site. If post-remediation levels of VOCs in groundwater and/or soil gas at the project site exceed acceptable risk levels for potential vapor intrusion for commercial and/or residential land use (e.g., if post-remediation HHRAs determine that the vapor intrusion exposure pathway poses health risks for future receptors on the project site greater than an excess cancer risk of 1×10^{-6} or a non-cancer hazard index greater than 1, or other threshold as determined to be appropriate by DTSC), and vapor mitigation systems are not installed beneath structures at the project site, future occupants of the project site could be exposed to health risks associated with hazardous materials in indoor air from vapor intrusion.

> *Mitigation Measure HAZ-1: Prior to the approval of building permits, the applicants shall provide the City of San Rafael with a letter from the Department of Toxic Substances Control (DTSC) indicating that the project site has been appropriately remediated and appropriate engineering controls have been incorporated into the project design, as*

necessary, to ensure that future occupants of the project site would not be exposed to unacceptable health risks from hazardous materials in the subsurface of the project site. The Covenant and Agreement to Restrict Use of Property (Covenant) and Operation and Maintenance (O&M) Plan for the project site shall be amended to account for post-remediation conditions of the project site and ensure the engineering controls are operated and maintained such that conditions at the project site remain protective of human health and the environment.

Implementation of Mitigation Measure HAZ-1, compliance with the requirements of the Covenant and O&M Plan as required by DTSC, and compliance with existing regulations related to hazardous materials that would be handled during operation of the project would ensure that the proposed project would result in less-than-significant impacts related to accidental releases of hazardous materials during operation. (LTS)

Cumulative Impacts

As discussed above, the project could result in adverse effects to workers, future site occupants, the public, or the environment related to improper management of hazardous materials or soil and groundwater impacted with hazardous materials. Occurrence of a cumulative effect would require that multiple projects release hazardous materials at the same time in close proximity to each other. As discussed above, implementation of Mitigation Measure HAZ-1, compliance with the requirements of the Covenant, O&M Plan, and SGMP for the project site, and compliance with existing regulations for the management of hazardous materials would ensure that potential impacts related to hazardous materials would be less than significant. Each site, including the project site, would be required to comply with existing hazardous materials regulations to reduce the risk of impacts associated with hazardous materials releases. Therefore, the potential for impacts associated with hazardous materials releases from the proposed project to combine with impacts associated with hazardous materials releases from other sites is not cumulatively considerable.

REFERENCES

AirNav, LLC, 2019. AirNav.com, CA 35, San Rafael Airport, San Rafael, California, USA. Website: https://www.airnav.com/airport/CA35, accessed on June 18.

California Department of Education, 2019. California Schools Directory. Website: https://www.cde.ca.gov/schooldirectory/, accessed on March 25.

California Environmental Protection Agency (CalEPA), 2019. Cortese List data Resources. Website: https://calepa.ca.gov/sitecleanup/corteselist/, accessed on March 25.

CAL FIRE, 2008. Marin County Very High Fire Hazard Severity Zones in LRA, October 16.

City of San Rafael, 2007. City of San Rafael Wildland-Urban Interface (WUI), July 2.

City of San Rafael, 2017. *San Rafael General Plan 2020.* Reprinted April 28, 2017.

Department of Toxic Substances Control (DTSC), 2011. Vapor Intrusion Mitigation Advisory, Final Revision 1, October.

Department of Toxic Substances Control (DTSC), 2018a. Letter to Ms. Sharon Reackhof of PG&E regarding approval of Remedial Action Completion Report, November 30.

Department of Toxic Substances Control (DTSC), 2018b. Letter to Ms. Sharon Reackhof of PG&E regarding approval of Final Operation and Maintenance Plan, November 30.

Department of Toxic Substances Control (DTSC), 2018c. Docket No. HSA-FY18/19-053, Voluntary Oversight Agreement, December 14.

Department of Toxic Substances Control (DTSC), 2018d. Letter to Mr. Donald Clark of BioMarin regarding CEQA requirements, December 18.

Department of Toxic Substances Control (DTSC), 2019a. Letter to Mr. Donald Clark of BioMarin regarding approval of Final Report Pre-Design Subsurface Investigation, April 15.

Department of Toxic Substances Control (DTSC), 2019b. Work Notice, Former San Rafael Manufactured Gas Plant Site, 999 3rd Street, San Rafael, CA 94901, February. DTSC, 2019c. Letter to Ms. Sharon Reackhof of PG&E regarding approval of Soil Gas Sampling Workplan Addendum, March 18.

Department of Toxic Substances Control (DTSC), 2019d. Addendum to the Negative Declaration for the Former San Rafael Manufactured Gas Plant – Remedial Action Plan, State Clearinghouse Number: 2012102020, Site Code: 202210.

Geologica, 2019a. Final Report Pre-Design Subsurface Investigation, Former Office, Telecom & Warehouse Buildings ,999 Third Street San Rafael, California 94901. February 21.

Geologica, 2019b. Explanation of Significant Differences, Final Remedial Action Plan, Extension of Remedial Soil Excavation to Parcel 4 West, Former PG&E Manufactured Gas Plant (MGP) Site, 999 3rd Street, San Rafael, CA, May 1.

Regional Water Board, 2019. Environmental Screening Levels, January 24.

Marin County Planning Department, 1991. *Airport Land Use Plan, Marin County Airport Gnoss Field,* June 10.

Terra Pacific Group (TPG), 2018a. Remedial Action Completion Report, Former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California, November 19.

Terra Pacific Group (TPG), 2018b. Final Operation and Maintenance Plan, Former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California, November 20.

4.8 HYDROLOGY AND WATER QUALITY

INTRODUCTION

This section describes the hydrology and water quality setting of the project site, including conditions related to climate, water resources, hydrology, and water quality within the vicinity of the project site; the extent and quality of surface water and groundwater; and flood conditions. The section identifies the project's potential hydrology and water quality impacts, including surface water and groundwater quality degradation, changes in runoff and drainage patterns, and flood hazards. The impact analysis considers the analysis and recommendations of two technical studies prepared for the project: preliminary site investigation and recommendations for sea level rise (CSW/Stuber-Stroeh Engineering Group, Inc. [CSW-ST2], 2018a) and a preliminary hydrology study (CSW-ST2, 2018b). The impact analysis also evaluates how application of existing permits and regulatory requirements would reduce or avoid identified impacts. Appropriate mitigation measures are identified, as necessary, to address any remaining potentially significant impacts.

ENVIRONMENTAL SETTING

Climate

The project site and vicinity have a mild Mediterranean climate with long, dry, warm summers and cooler, rainy winters. The majority of precipitation occurs between October and May. Based on historical weather data from 1894 through 2016, the mean annual precipitation in San Rafael is 35.6 inches (Western Regional Climate Center [WRCC], 2016). The mean daily high temperature is around 70 degrees Fahrenheit (ºF) with the mean daily low temperature around 48 ºF (WRCC, 2016).

Surface Water Resources

The nearest surface water body to the project site is San Rafael Creek (also known as Mahon Creek in San Rafael General Plan 2020), which, at its nearest, is located approximately 750 feet south and east of the project site. San Rafael Creek drains a watershed 11 square miles in area (Marin Watershed Program, 2019). The creek drains to San Pablo Bay, which is located approximately 1.7 miles east of the project site.

The San Francisco Bay Basin Water Quality Control Plan (Basin Plan) prepared by the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) indicates that existing beneficial uses of San Rafael Creek are cold and warm freshwater habitats, wildlife habitat, water contact and noncontact recreation, and navigation by vessels (Regional Water Board, 2017). Many of the San Francisco Bay Region's urban creeks, including San Rafael Creek, are listed as impaired for diazinon, a pesticide, under the federal Clean Water Act Section 303(d) (State Water Resources Control Board [State Water Board], 2010). A Water Quality Attainment

Strategy, including establishment of Total Maximum Daily Loads (TMDLs)[1] for contaminants, has been established to address pesticide-related toxicity in the all of the region's urban creeks (Regional Water Board, 2017).

The existing beneficial uses of San Pablo Bay are industrial service supply, commercial and sport fishing, shellfish harvesting, estuarine habitat, fish migration, preservation of rare and endangered species, fish spawning, wildlife habitat, water contact and non-contact recreation, and navigation by vessels (Regional Water Board, 2017). San Pablo Bay is listed as impaired for the pesticides chlordane, DDT, and dieldrin; dioxin compounds; furan compounds; invasive species; mercury; polychlorinated biphenyls (PCBs); dioxin-like PCBs; and selenium (State Water Board, 2010). TMDLs and implementation plans have been established for mercury, dioxin compounds, PCBs, dioxin-like PCBs, and selenium, and are in preparation for other causes of impairment (Regional Water Board, 2017; EPA, 2016).

Surface Water Drainage

Existing surface water drainage on the project site and surrounding sidewalks is described in the site-specific preliminary hydrology study completed by CSW-ST2 (2018b). The total drainage area of the project site and surrounding sidewalks is 3.37 acres. The project site is paved with asphalt and concrete. Landscaped areas comprise approximately 0.07 acre, and are mostly located in the sidewalks surrounding the project site. A municipal storm drain system is located in all four streets surrounding the project site. There are at least six locations where runoff from the project site enters this storm drain system. The majority of the project site runoff (2.44 acres of the 3.37-acre drainage area) drains to an existing storm drain system within the project site, which ties into a municipal storm drain manhole in Lindaro Street. The remaining five locations are comprised of municipal drainage inlets that intercept runoff from the curb and gutter surrounding the site. The drainage areas contributing runoff to these curb and gutter inlets range in size from 0.04 acre to 0.48 acre.

Groundwater Resources

The project site is not located within a mapped groundwater basin, and therefore is assumed not to be underlain by a substantial groundwater aquifer (California Department of Water Resources, 2019). Previous environmental and geotechnical investigations indicate that shallow groundwater is present at the project site at depths of around 1 to 4 feet below the ground surface (bgs) (Miller Pacific Engineering Group, 2018). Prior to remediation activities on the project site, which are described in Section 4.7, Hazards and Hazardous Materials, the groundwater flow at the project site generally appeared to be radially outward from the bedrock high area at the north-central and northwestern portion of the site, toward the site boundaries (Terra Pacific Group, 2018). Due to significant excavation and backfilling activities recently completed on the site, this groundwater flow regime may have been altered (Terra Pacific Group, 2018). Groundwater-bearing zones on the project site consist of fill material and highly weathered bedrock (Terra Pacific Group, 2018).

[1] On a broad level, the TMDL process leads to a "pollution budget" designed to restore the health of a polluted body of water. The TMDL process provides a quantitative assessment of the sources of pollution contributing to a violation of the water quality standards and identifies the pollutant load reductions or control actions needed to restore and protect the beneficial uses of the impaired water body.

Groundwater on the project site is known to be impacted by contamination from past uses of the site, which contained a manufactured gas plant. The extent of the contamination and the cleanup activities at this site are discussed in Section 4.7, Hazards and Hazardous Materials, of this DEIR.

Flood Hazards

Mapped Flood Hazard Zones

The majority of the project site is located within flood hazard zones mapped by the Federal Emergency Management Agency (FEMA) as having a 1 percent chance of a flood event per year, referred to as the 100-year flood hazard zone, with areas of shallow flooding (usually areas of ponding) between 1 and 3 feet (see **Figure 4.8-1**) (FEMA, 2016). The shallow flooding zones (Zone AH in Figure 4.9-1) adjacent to San Rafael Creek are caused by overflows from the channel near D Street that flow west along the channel. The ponding areas are caused by the constricted section between A and B Streets and by the channel levees near the Southern Pacific Railroad. The channel levees cause the water to pond up to elevation 11 North American Vertical Datum of 1988 (NAVD 88) before it can spill back into the channel near Lincoln Avenue (FEMA, 2017). The northwest corner of the project site is mapped as having a 0.2 percent chance of a flood event per year, referred to as the 500-year flood hazard zone, as flooding would be expected to occur every 500 years (see Figure 4.8-1).

Elevations at the project site range from about 8 feet NAVD 88 at the southeast corner to about 10 to 12 feet NAVD 88 at the northwest corner (CSW-ST2, 2018a and 2018b). The base flood elevation in the 100-year flood hazard zone is 11 feet NAVD 88 (FEMA, 2016). The water level in the surrounding municipal storm drain system and the site has the potential to be affected by flooding due to storm overflows from San Rafael Creek, from encroaching tide waters, and from the combination of storm overflows and encroaching tide waters (CSW-ST2, 2018a). Surrounding storm and creek systems have insufficient capacity to convey peak flows generated by large storms, contributing to flooding in this area (CSW-ST2, 2018a). Even without the occurrence of a storm, the conveyance capacity of the surrounding storm drain systems may already be partially or fully reduced because these systems can be filled with water due to high tide events (CSW-ST2, 2018a).

Sea Level Rise

Sea level (including in San Pablo Bay) is rising and is expected to continue to rise even with existing efforts to mitigate global warming through reduction of greenhouse gas emissions (National Research Council of the National Academies, 2012). In the San Francisco Bay area, the background rate of sea level rise has been estimated to be approximately 0.076 inch per year from 1900 to 2008 (National Research Council of the National Academies, 2012). Sea level rise projections for the San Francisco Bay region are summarized in **Table 4.8-1** below.

Rates of sea level rise may vary at specific locations, as local subsidence or uplift affects the relative change in sea level between land masses and the ocean. The Marin Shoreline Sea Level Rise Vulnerability Assessment indicates that the rise in sea levels will exacerbate flood hazards in the project site vicinity, with buildings and public utility infrastructure, including stormwater infrastructure, subject to damage as a result of flooding caused by sea level rise (Marin County, 2017).

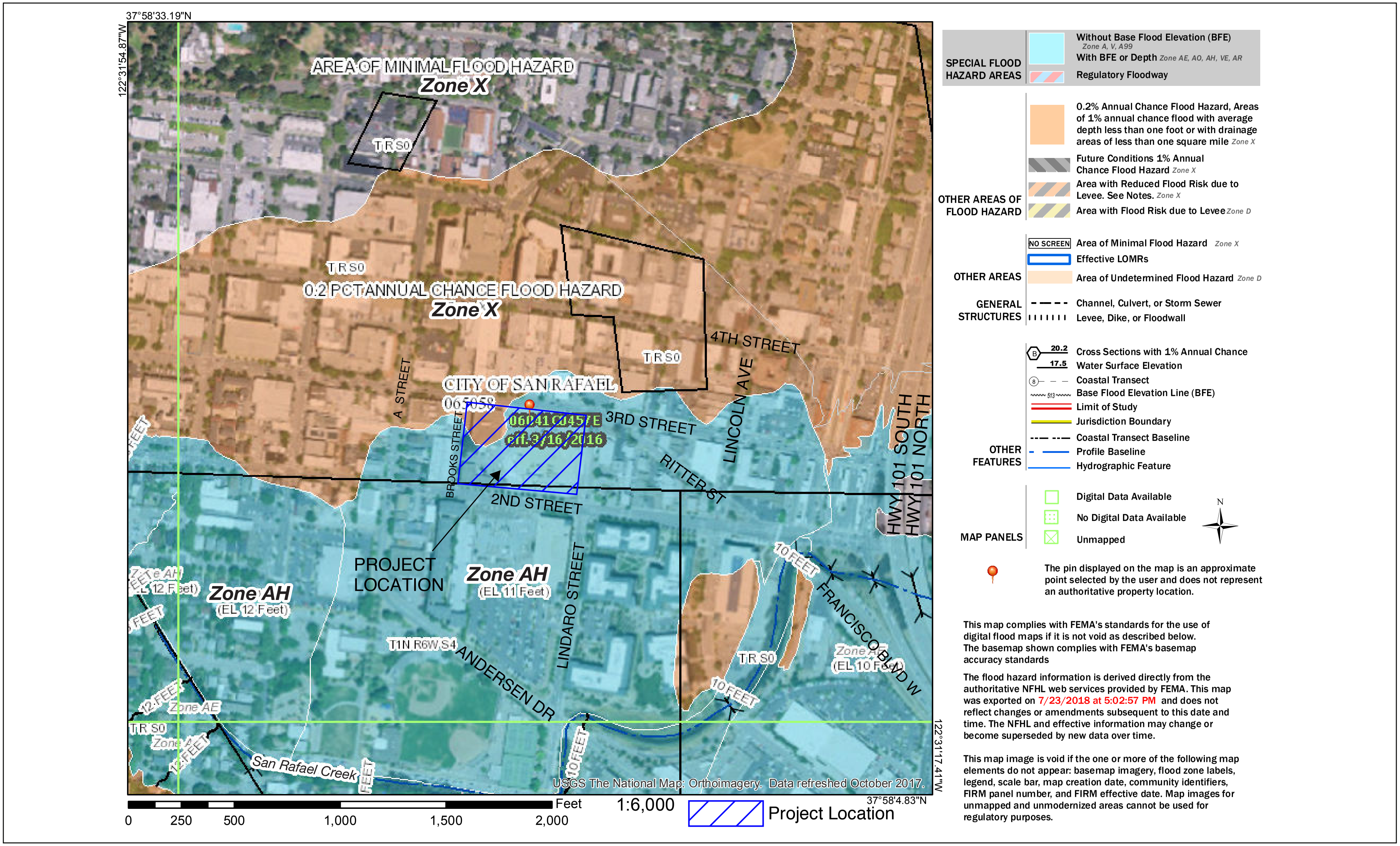


Figure 4.8-1

FLOOD HAZARD ZONES

SOURCE: CSW/Stuber-Stroeh Engineering Group, Inc., 2018b

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

TABLE 4.8-1 SEA LEVEL RISE PROJECTION FOR SAN FRANCISCO BAY REGION

Time Period	Time Range	Projected Range of Height in Sea Level Rise (Inches)
By 2030	Near Term	1.6 – 11.8
By 2050	Medium Term	4.7 – 24.0
By 2100	Long Term	16.6 – 65.8

Source: National Research Council of the National Academies, 2012.

A site-specific study to address sea level rise was completed for the project site by CSW-ST2 (2018a). The study used the U.S. Geological Survey's Coast Storm Modelling System to evaluate the levels of flooding that could be anticipated on the project site as a result of sea level rise in the near, medium, and long term. The model can account for sea level rise with recurring events such as King Tide,[2] and 20-year and 100-year storm surge events.[3] The model results indicate that the project site may experience flooding from sea level rise in the near and medium term with a 100-year storm surge event; in the medium and long term with a 20-year storm surge event; and in the long term during King Tides. The model does not account for runoff that would be generated during precipitation events nor for the exacerbation of flooding that would occur as a result of sea level rise impairing the ability of storm drain systems to convey storm flows.

Dam Inundation Areas

The project site is not located in a mapped dam inundation area (Clearwater Hydrology, 2005).

Seiche and Tsunamis

A seiche is the oscillation of a body of water, occurring most frequently in enclosed or semi-enclosed basins such as lakes, bays, or harbors. In an otherwise still body of water, a seiche can be triggered by strong winds, changes in atmospheric pressure, earthquakes, tsunamis, or tides. Seiches are not considered a hazard in San Francisco Bay because of physical characteristics of the Bay that make it unlikely that oscillations of the magnitude that would result in inundation hazards would occur (Borrero, 2006).

Tsunamis are long-period water waves caused by underwater seismic events, volcanic eruptions, or undersea landslides. Tsunamis entering San Francisco Bay through the relatively narrow Golden Gate would tend to dissipate as the energy of the wave spreads out as the Bay becomes wider and shallower (Borrero, 2006). The California Emergency Management Agency has produced tsunami inundation maps to aid emergency response planning for areas along the state's

[2] King Tides are exceptionally high tides that occur occasionally throughout the year and currently affect roads and properties in Marin County and throughout the San Francisco Bay Area. As sea level rises, the extent of impact of the King Tides will increase.

[3] In the Coast Storm Modelling System, the 20-year and 100-year storm events are storm-driven wind events producing wave surges, which travel across the Bay toward the shore and are driven by wind and atmospheric pressure conditions. This is different from the 100-year storm event flooding mapped by FEMA, which estimates flooding due to peak runoff from the surrounding watershed travelling downstream toward the Bay. Thus, the Coast Storm Modelling System flood level estimates do not account for runoff that could be generated by precipitation events.

coastline, including San Rafael. The map for San Rafael indicates that the project site is not located within a mapped tsunami inundation area (CalEMA, 2009).

REGULATORY FRAMEWORK

Federal and State Regulations

Clean Water Act

Overview

The federal Clean Water Act is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. It is administered by the U.S. Environmental Protection Agency (EPA). The Clean Water Act operates on the principle that all discharges into the nation's waters are unlawful unless specifically authorized by a permit. The EPA has delegated its authority to implement and enforce most of the applicable water quality provisions of this law to the individual states. In California, the provisions are enforced by nine regional water boards under the auspices of the State Water Board.

National Pollutant Discharge Elimination System (NPDES) Permit Program

Under Section 402 of the Clean Water Act, the discharge of pollutants through a point source into waters of the United States is prohibited unless the discharge is in compliance with an NPDES permit. The NPDES program regulates the discharge of pollutants from municipal and industrial wastewater treatment plants and sewer collection systems, as well as stormwater discharges from industrial facilities, municipalities, and construction sites. In California, implementation and enforcement of the NPDES program is conducted through the State Water Board and the nine regional water boards. The regional water boards set standard conditions for each permittee in their region, which includes effluent limitations and monitoring programs.

Federal Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods. The National Flood Insurance Program makes federally backed flood insurance available for communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. FEMA manages the National Flood Insurance Program and creates Flood Insurance Rate Maps that designate 100-year flood hazard zones and delineate other flood hazard areas.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (California Water Code, Division 7, Water Quality) was promulgated in 1969. It established the State Water Board and divided California into nine hydrologic regions, each overseen by a regional water board. The State Water Board is the primary state agency responsible for protecting the quality of California's surface and groundwater supplies, but much of its daily implementation authority is delegated to the nine regional water boards. The Porter-Cologne Act also provides for the development and tri-annual review of Water

Quality Control Plans that designate beneficial uses of California's major rivers and groundwater basins and establish narrative and numerical water quality objectives for those waters. The City of San Rafael lies within the jurisdiction of the San Francisco Bay Regional Water Board, which enforces compliance with water quality objectives for beneficial uses of surface waters.

NPDES Small MS4 Permit

Pursuant to Section 402 of the Clean Water Act and the California Porter-Cologne Water Quality Control Act, municipal stormwater discharges at the project site are regulated under the statewide NPDES General Permit for the Discharge of Storm Water from Small Municipal Separate Storm Sewer Systems (Small MS4 Permit). Locally, the NPDES program is overseen by the Regional Water Board. Development projects in San Rafael are subject to compliance with requirements of the current MS4 Permit, issued in February 2013 by State Water Board Order 2013-0001-DWQ. The Marin County Stormwater Pollution Prevention Program assists cities, towns, and Marin County with coordination and consistency of approaches across the county in implementing the MS4 Permit requirements.

Section E.12 of the 2013 Phase MS4 Permit addresses requirements for retention and treatment of stormwater generated by development projects. The Bay Area Stormwater Management Agencies Association (BASMAA), which includes the Marin County Stormwater Pollution Prevention Program, has developed Design Guidance for Stormwater Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties (BASMAA, 2019) to assist in compliance with Section E.12. Because the proposed project would replace more than 5,000 square feet of impervious surface, the project must comply with the post-construction stormwater management measures described in the Small MS4 General Permit, such as Low Impact Development (LID) design standards. LID employs principles such as preserving and recreating natural landscape features and minimizing impervious surfaces to create functional and appealing site drainage that treats stormwater as a resource, rather than as a waste product. LID measures provide effective stormwater treatment by filtering pollutants and sequestering them within soils (BASMAA, 2019). Additionally, some pollutants may be rendered less toxic through biological action in the soil (BASMAA, 2019). Common practices used to adhere to the LID principles may include, but are not limited to, the use of permeable pavement and bioretention facilities,[4] both of which are included in the design of the proposed project, as described in Chapter 3, Project Description, of this DEIR.

NPDES Construction General Permit

Construction projects disturbing more than 1-acre of land during construction are required to comply with the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ, NPDES No. CAS000002 (Construction General Permit).

To obtain coverage under the Construction General Permit, the project applicant must provide via electronic submittal, a Notice of Intent, a Storm Water Pollution Prevention Plan (SWPPP), and other documents required by Attachment B of the Construction General Permit. Activities subject to the Construction General Permit include clearing, grading, and disturbances to the ground, such as

[4] Bioretention facilities infiltrate some runoff and also feature underdrains to convey treated stormwater to storm drains.

grubbing or excavation. The permit also covers linear underground and overhead projects such as pipeline installations. Construction General Permit activities are regulated at a local level by the Regional Water Board.

The Construction General Permit uses a risk-based permitting approach and mandates certain requirements based on the project risk level (i.e., Level 1, Level 2, or Level 3). The project risk level is based on the risk of sediment discharge and the receiving water risk. The sediment discharge risk depends on the project location and timing (i.e., wet season versus dry season activities). The receiving water risk depends on whether the project would discharge to a sediment-sensitive receiving water. The determination of the project risk level would be made by the project applicant when the Notice of Intent is filed (and more details of the timing of the construction activity are known).

The performance standard in the Construction General Permit is that dischargers shall minimize or prevent pollutants in stormwater discharges and authorized non-stormwater discharges through the use of controls, structures, and best management practices (BMPs) that achieve Best Available Technology (BAT) for treatment of toxic and non-conventional pollutants and Best Conventional Technology (BCT) for treatment of conventional pollutants. A SWPPP must be prepared by a Qualified SWPPP Developer that meets the certification requirements in the Construction General Permit. The purpose of the SWPPP is (1) to identify the sources of sediment and other pollutants that could affect the quality of stormwater discharges, and (2) to describe and ensure the implementation of BMPs to reduce or eliminate sediment and other pollutants in stormwater as well as non-stormwater discharges resulting from construction activity. Operation of BMPs must be overseen by a Qualified SWPPP Practitioner that meets the requirements outlined in the permit.

The SWPPP must also include a construction site monitoring program. Depending on the project risk level, the monitoring program may include visual observations of site discharges, water quality monitoring of site discharges (pH, turbidity, and non-visible pollutants, if applicable), and receiving water monitoring (pH, turbidity, suspended sediment concentration, and bioassessment).

Local Regulations and Policies

San Rafael Municipal Code

Section 9.30 of the San Rafael Municipal Code contains the City of San Rafael Urban Runoff Pollution Prevention Ordinance, which adopts requirements of the Clean Water Act, the Basin Plan, and the Small MS4 Permit (Section 9.30.050). BMPs are required for all construction within the City (Section 9.30.140). An erosion and sediment control plan is required for any construction subject to a grading permit or that may have the potential for significant erosion (Section 9.30.150). The sediment and erosion plan must follow most recent version of the Marin County Stormwater Pollution Prevention Program Construction Erosion and Sediment Control Plan Applicant Package. New development must comply with land development standards in the Small MS4 Permit (Section 9.30.151).

Section 18 of the San Rafael Municipal Code contains provisions for protection of flood hazard areas. A development permit must be obtained for construction within any flood hazard area (Section 18.40.010). Structures within a flood hazard area are not permitted to unnaturally divert flood waters or increase flood hazards in other areas (Section 18.10.040). Standards of construction specific to flood hazard areas must be included in building design and construction (Section 18.50). Residential buildings must be constructed so that the lowest floor is above the base flood elevation, taking into account predicted 30 years' settlement. Non-residential construction must meet similar standards or be certified to be watertight with structural components capable of resisting pressures from floodwaters and buoyancy effects.

San Rafael General Plan 2020

The following policies and programs from San Rafael General Plan 2020 would apply to the proposed project (City of San Rafael, 2017):

Water Quality and Stormwater

Policy AW-7 **Local, State, and Federal Standards**. Continue to comply with local, state and federal standards for water quality.

Program AW-7a **Countywide Stormwater Program**. Continue to participate in the countywide stormwater program and comply with its performance standards.

Program AW-7b **Stormwater Runoff Measures**. Continue to incorporate measures for stormwater runoff control and management in construction sites.

Program AW-7c **Water Quality Improvements in Canal and Other Waterways**. Support water quality improvement efforts in the San Rafael Canal, creeks, and drainageways in accordance with standards of the State Water Quality Control Board or any agencies with jurisdiction.

Policy AW-8 **Reduce Pollution from Urban Runoff**. Address non-point source pollution and protect receiving waters from pollutants discharged to the storm drain system by requiring Best Management Practices quality.

- Support alternatives to impervious surfaces in new development, redevelopment, or public improvement projects to reduce urban runoff into storm drain system, creeks, and the Bay
- Require that site designs work with the natural topography and drainages to the extent practicable to reduce the amount of grading necessary and limit disturbance to natural water bodies and natural drainage systems.
- Where feasible, use vegetation to absorb and filter fertilizers, pesticides and other pollutants.

Program AW-8a **Proper Disposal of Pollutants**. Continue to promote proper disposal of pollutants to the sanitary sewer or hazardous waste facilities rather than to the storm drainage system.

Program AW-8b **Compliance by Contractors**. Continue to require contractors to comply with accepted stormwater pollution prevention planning practices for all projects subject to erosion potential. Also, continue to require the proper use, storage and disposal of on-site materials.

Program AW-8c **System Improvements**. Improve storm drainage performance by constructing new system improvements. Evaluate stormwater volumes when replacing undersized or otherwise inadequate lines with larger or parallel lines.

Policy AW-9 **Erosion and Sediment Control**. Establish development guidelines to protect areas that are particularly susceptible to erosion and sediment loss.

Policy S-22 **Erosion**. Require appropriate control measures in areas susceptible to erosion, in conjunction with proposed development. Erosion control measures and management practices should conform to the most recent editions of the Regional Water Quality Control Board's Erosion and Sediment Control Field Manual and the Association of Bay Area Governments' Manual of Standards for Erosion and Sediment Control or equivalent.

Program S-22a **Erosion Control Programs**. Review and approve erosion control programs for projects involving grading one acre or more or 5,000 square feet of built surface as required by Standard Urban Stormwater Management Plans (SUSUMP). Evaluate smaller projects on a case-by-case basis.

Program S-22b **Grading During the Wet Season**. Discourage grading during the wet season and require that development projects implement adequate erosion and/or sediment control and runoff discharge measures.

Policy S-25 **Regional Water Quality Control Board (RWQCB) Requirements**. Continue to work through the Marin County Stormwater Pollution Prevention Program to implement appropriate Watershed Management plans as dictated in the RWQCB general National Pollutant Discharge Elimination System permit for Marin County and the local stormwater plan.

<u>Flooding</u>

Policy S-17 **Flood Protection of New Development**. Design new development within the bay mud areas to minimum floor elevation that provides protection from potential impacts of flooding during the "100-year" flood. The final floor elevation (elevation of the first floor at completion of construction) shall account for the ultimate settlement of the site due to consolidation of the bay mud from existing and new loads, taking into account soils conditions and the type of structure proposed. Design for settlement over a 50-year period is typically considered sufficient.

Program S-17a **Title 18 Flood Protection Standards**. Evaluate and revise the City's Title 18 flood protection standards for new development based on Federal and regional criteria.

Policy S-18 **Storm Drainage Improvements**. Require new development to improve local storm drainage facilities to accommodate site runoff anticipated from a "100-year" storm.

Program S-18a **Storm Drainage Improvements**. Require that new development proposals which are likely to affect the limited capacity of downstream storm drainage facilities provide a hydrological analysis of the storm drain basin of the proposed development and evaluate the capacity of existing downstream storm drainage facilities and fund improvements to accommodate increased drainage from the project site resulting from a 100-year storm, where practical.

Sea Level Rise

Policy S-21 **Rise in Sea Level**. Support efforts to address rise in sea level by: a) continually monitoring changes in projection information, data and technology; b) utilizing the "Climate Adaptation – Sea Level Rise" San Rafael White Paper (January 2014) as a starting point for pursuing critical tasks and actions including the preparation of a vulnerability assessment; and c) coordinating with the County of Marin and other local, state, federal agencies in planning for long-term adaptation.

Program S-21a **Local Hazard Mitigation Plan**. Prepare and adopt a local/multi-hazard mitigation plan, which includes addressing rise in sea level and measures for disaster preparedness and adaptation.

Program S-21b **Vulnerability Assessment-BayWAVE Program**. Coordinate and work with the County of Marin and other local jurisdictions in the BayWAVE Program to prepare and adopt a vulnerability assessment of the bay shoreline and areas susceptible to rise in sea level.

Policy SU-15. **Adapting to Climate Change.** Increase understanding and preparation to adapt to the effects of climate change, including sea level rise.

Program SU-15c**Levee Analysis**. Develop a program of levee analysis, including inventorying heights, testing, and maintaining public and private levees.

Program SU-15d **Sea Level Monitoring and Planning**. Work with the Bay Conservation and Development Commission (BCDC) to monitor sea level rise and plan for shoreline defense.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

Implementation of the project would result in a significant impact related to hydrology and water quality if it would result in any of the following:

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality;

b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin;

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would: (1) result in substantial erosion or siltation on- or off-site; (2) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site; (3) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or (4) impede or redirect flood flow;

d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation; or

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

The following significance criterion would not apply to the proposed project and is therefore excluded from further discussion in this impact analysis:

- *Substantially Decrease Groundwater Supplies or Interfere Substantially with Groundwater Recharge such that the Project May Impede Sustainable Groundwater Management of the Basin.* No significant groundwater resources are located at the project site.

Less-than-Significant Impacts

Erosion and Siltation

The project would not result in substantial erosion or siltation on- or off-site.

Construction activities would involve excavation and grading, which would temporarily alter drainage patterns and expose soil to potential erosion. Compliance with the Construction General Permit and City of San Rafael BMPs for construction activities would ensure that erosion of exposed soil and sedimentation of receiving waters or the combined sewer system would not occur during construction of the proposed project.

During operation of the project, the site would be covered by buildings, pavement, and landscaped areas, with no ongoing soil exposure or disturbance that could result in erosion and siltation.

Additionally, as described in the preliminary hydrology study (CSW-ST2, 2018b), the proposed project would increase pervious surfaces on the site from 0.07 acre to 0.41 acre through the addition of new landscaping and permeable pavements to the site. Due to the increase in pervious surfaces, peak flow stormwater runoff volumes from the project site would decrease (CSW-ST2, 2018b). As a result, the potential for erosion and siltation to occur in San Rafael Creek would also decrease.

For these reasons, the potential of project construction and operation to change drainage patterns in a manner that would result in erosion or siltation on- or off-site would be less than significant.

Flood Flows

The project would not impede or redirect flood flow.

As shown in Figure 4.8-1, the majority of the proposed project is located within the 100-year flood hazard zone. The project site is not located in a regulatory floodway.[5] Any proposed development of modification of the regulatory floodway is subject to the special study requirements of San Rafael Municipal Code Section 15.50.060. The flooding at the project site and vicinity is mapped as shallow flooding of 1 to 3 feet that usually consists of areas of ponding. The development of the project site would not alter this existing flooding pattern, which is controlled by the properties of San Rafael Creek (i.e., constrictions, levees), as described under "Environmental Setting" above (FEMA, 2017). In addition, the project would be required to comply with the requirements of Section 18 of the San Rafael Municipal Code and acquire a development permit in accordance with Section 18.40.010. Therefore, after development of the buildings, the flood water surrounding the project site would continue to consist of shallow flooding with areas of ponding, and the potential of the proposed project to redirect or impede flood flows would be less than significant.

Release of Pollutants in Flood Hazard, Tsunami, or Seiche Zones

The project would not result in a substantial release of pollutants during inundation of the project site by flood waters.

The project site is not located in an area subject to flooding due to tsunami, seiche, or dam inundation. Therefore, the risk of the release of pollutants from these flood hazards would be less than significant during both project construction and operation. The potential for the release of pollutants due to the location of the project site within a 100-year flood hazard zone is described below.

<u>Construction-Phase Impacts</u>

During project construction, areas within mapped flood inundation zones could encounter contaminated soil and groundwater exposed during ground-disturbing activities, which could release pollutants. Pollutants could also be released if inundation waters encounter hazardous materials used during construction, such as paints, solvents, and fuels. Construction materials swept out to surface waters could become floating material, which is considered a pollutant

[5] The regulatory floodway is the channel of a river or other watercourse and the adjacent land areas where most flow occurs and that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

because it can cause a nuisance and adversely affect beneficial uses (Regional Water Board, 2017). Flooding could occur during the 8- to 10-year construction period. The construction of the proposed project would be required to implement a SWPPP and to comply with City of San Rafael BMPs for construction activities, including measures for managing hazardous materials used on construction sites and for keeping the construction site maintained in a clean and orderly state, and hazardous materials storage requirements. For example, construction site operators must store chemicals in watertight containers (with appropriate secondary containment to prevent any spillage or leakage) or in a storage shed (completely enclosed). Additionally, construction activities would occur after remediation activities are complete, thereby reducing the risk of the release of pollutants from the soil and groundwater into floodwaters. Any construction activities that would disturb potentially contaminated soil and groundwater at the project site would be subject to the requirements of the Covenant and Agreement to Restrict Use of Property (Covenant) and of the Soil and Groundwater Management Plan (SGMP), discussed in Section 4.7, Hazards and Hazardous Materials, including requirements for stockpile management, stormwater runoff and erosion control, and soil and groundwater storage and disposal protocols. These measures would minimize the amounts of pollutants and floating materials that could be swept into San Rafael Creek and San Pablo Bay if the project site is flooded during construction. For these reasons, the potential for a substantial release of pollutants due to inundation of work and staging areas would be less than significant.

Operation-Phase Impacts

Once constructed, the project buildings would be subject to inundation during the 100-year flood, as well as to inundation due to sea level rise. Urban pollutants associated with the proposed land uses include oils, fuels, and metals associated with motor vehicle traffic; fertilizers and pesticides used to maintain landscaped areas; and trash generated by new site occupants. In addition, some contamination would likely be present in the soil and groundwater on the project site even after remediation is complete.

The pollutants that flood waters would encounter on the project site would be similar to the urban pollutants found in the streets and buildings of the urban area surrounding the project site. Even without the occurrence of flooding, such pollutants are carried to San Rafael Creek and San Pablo Bay by stormwater runoff from the project site and its vicinity during any storm large enough to generate overland flows and flows to storm drains. The levels of urban pollutants occurring on the project site would be minimized through compliance with the Small MS4 Permit, which requires projects to identify potential sources of pollutants and implement source control measures. The land uses proposed at the ground floors of BioMarin Buildings A and B are lobbies, conference rooms, a fitness center, dining space, and retail space. The land uses proposed at the ground floor of the Whistlestop/Eden Housing building are a Healthy Aging Center and 12 parking spaces. Other ground-floor land uses on the project site are a landscaped plaza and a surface parking lot containing 29 spaces. None of these proposed land uses would involve the storage or handling of substantial quantities of hazardous materials.

The proposed project would be required to comply with the Covenant discussed in Section 4.7, Hazards and Hazardous Materials, which requires the future property owners to maintain the site cap.[6] The maintenance of the site cap would prevent contaminants in the soil and groundwater on the site from coming into contact with floodwaters.

For these reasons, the potential for the release of pollutants from the project site to San Rafael Creek and San Pablo Bay during flooding of the project site as a result of the 100-year flood and sea level rise would be less than significant.

Conflict with Water Quality Control Plan or Groundwater Management Plan

The project would not conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

No significant groundwater resources are located at the project site, and there is no groundwater management plan for the area of the project site. The Basin Plan is the master policy document that establishes the water quality objectives and strategies needed to protect designated beneficial water uses in the San Francisco Bay region. The State Water Board and Regional Water Board enforce compliance with the water quality objectives of the Basin Plan through the issuance of NPDES permits. The project would comply with the Construction General Permit and Small MS4 Permit. Compliance with these permits would ensure that the proposed project would not have the potential to conflict with the Basin Plan. Therefore, this impact would be less than significant.

Potentially Significant Impacts

Water Quality Impacts

Impact HYDRO-1: Development of the proposed project could substantially degrade surface and groundwater quality. (PS)

The primary water quality concern is the potential for the project to result in construction- and/or operation-period degradation of stormwater and groundwater quality. San Rafael Creek, which receives runoff from the project site, as well as San Pablo Bay, which San Rafael Creek discharges to, have been classified as impaired water bodies under the federal Clean Water Act. Therefore, any discharges of pollutants via stormwater to those water bodies could affect water quality and violate water quality standards. Additionally, groundwater on the project site is known to be impacted by contamination from past uses of the project site, and changes to the project site could result in the spread of existing groundwater contamination or interference with the existing groundwater extraction and treatment system located adjacent to the south and southeast of the project site. (This system is described in Section 4.7, Hazards and Hazardous Materials, of this DEIR.)

Construction-Phase Impacts

Hazardous materials such as fuels, lubricants, and construction chemicals would be used during construction of the proposed project and spills could occur, adversely affecting site soils and runoff water quality at the project site. During earthmoving activities, stormwater runoff could entrain

[6] The site "cap" is part of the remediation efforts discussed in Section 4.7, Hazards and Hazardous Materials. This cap is a layer of clean soil and/or pavement that isolates the underlying contaminated soil from users of the site.

exposed soils, resulting in erosion on the site and potentially transporting hazardous materials in contaminated soil and groundwater on the site to receiving waters.

Existing regulations protecting stormwater quality described under "Regulatory Framework" above would apply to construction activities. The proposed project would disturb more than 1 acre and therefore would be required to prepare a construction-phase SWPPP, in accordance with the requirements of the Construction General Permit. Additionally, the City of San Rafael specifies BMPs to be incorporated for construction activities, including erosion control BMPs (e.g., scheduling and timing of grading activities, timely revegetation of graded areas, the use of hydroseed and hydraulic mulches, installation of erosion control blankets); sediment control BMPs (e.g., properly sized detention basins, dams, or filters and installation of construction entrances to prevent tracking of sediment off-site); and pollution prevention BMPs (e.g., designated washout areas or facilities, control of trash and recycled materials, tarping of materials stored on-site, and proper location of and maintenance of temporary sanitary facilities) (Municipal Code Section 9.30.140). In addition, as described in Section 4.7, Hazards and Hazardous Materials, construction activities that would disturb potentially contaminated soil and groundwater at the project site would be subject to the requirements of the site's Covenant and SGMP, including requirements for stockpile management, stormwater runoff and erosion control, soil and groundwater disposal protocols, and protocols for the discovery of unanticipated conditions (e.g., subsurface features or contaminated soil not identified during previous investigations). Implementation of the SWPPP consistent with City of San Rafael guidance, as well as compliance with the requirements of the Covenant and SGMP, would reduce potential water quality impacts during construction of the project to a less-than-significant level.

Operational-Phase Impacts

The buildout of the proposed project would develop research, office, and residential land uses on a currently vacant site. Urban pollutants associated with these land uses include oils, fuels, and metals associated with motor vehicle traffic; fertilizers and pesticides used to maintain landscaped areas; and trash generated by new site occupants. These pollutants may be transported in runoff from the project site and thereby degrade water quality in San Rafael Creek and San Pablo Bay.

The proposed project would create or replace more than 5,000 square feet of impervious surfaces, and therefore would be required to prepare a Stormwater Control Plan in accordance with Section E.12 of the Small MS4 Permit. The Stormwater Control Plan must include measures to route runoff to bioretention or other facilities sized and designed using either volumetric or flow-based criteria specified in the Small MS4 Permit, and these measures must be approved by the City Engineer. Site design must reduce the amount of storm runoff to the extent technically feasible. As described in Chapter 3, Project Description, of this DEIR and detailed in the preliminary hydrology study (CSW-ST2, 2018b), the project applicants would install bioretention planters and pervious concrete pavers throughout the site. The project would also be required to identify potential sources of pollutants and implement source control measures, and provide for ongoing maintenance of bioretention facilities.

Implementation of these existing regulatory requirements would ensure that stormwater runoff from development of the proposed project would not result in significant stormwater quality impacts with the potential to affect surface water bodies, and would require stormwater infrastructure to be built and maintained to prevent an increase in volumes or rates of stormwater runoff from the project site. These measures would reduce potential surface water quality impacts during operation of the project to a less-than-significant level.

The project proposes to increase pervious surfaces on the project site. The alteration of infiltration rates on the project site could alter the flow of groundwater underneath the project site and vicinity, and thereby could spread existing groundwater contamination or interfere with the effectiveness of the groundwater extraction and treatment system located adjacent to the south and southeast of the project site. The implementation of Mitigation Measure HYDRO-1 would require the project applicants to obtain input from the Department of Toxic Substances Control (DTSC) on whether a restriction on infiltration at the project site is necessary. As discussed in Section 4.7, Hazards and Hazardous Materials, DTSC is the lead oversight agency for the investigation and remediation of hazardous materials contamination at the project site. This mitigation measure would reduce the potential for the degradation of groundwater quality at the project site and its vicinity as a result of changes in infiltration to a less-than-significant level.

> *Mitigation Measure HYDRO-1: Prior to the approval of building permits, the applicants shall provide the City of San Rafael with a letter from the Department of Toxic Substances Control (DTSC) indicating that the infiltration proposed by the post-construction stormwater management plans would not lead to the spread of existing groundwater contamination or interference with the effectiveness of the groundwater extraction and treatment system located adjacent to the south and southeast of the project site. If DTSC indicates that restrictions to infiltration are necessary, then the post-construction stormwater management plan shall be modified, as appropriate, to limit infiltration. For example, the pervious pavements and bioretention facilities could be underlain by a low permeability liner that would limit infiltration to the subsurface. Any changes to the post-construction stormwater management plan must be approved by DTSC and the City Engineer prior to approval of building permits for the project. (LTS)*

Alteration of Drainage Patterns in a Manner Resulting in On- and Off-Site Flooding/Exceedance of Stormwater Drainage System Capacity

Impact HYDRO-2: Changes in drainage patterns on the project site could result in localized flooding due to the exceedance of the local stormwater drainage system capacity. (PS)

As described in the site-specific hydrology study, the development of the proposed project would increase pervious surfaces on the site, and thereby decrease the rate and amount of surface runoff from the project site (CSW-ST2, 2018b). This in turn would decrease the potential for the proposed project to contribute to the flood hazard at the project site and the vicinity. However, the proposed project would substantially alter the surface water drainage patterns on the site relative to existing conditions. These changes would alter the size and location of the area that drains to an on-site storm drainage system and to the five drainage inlets located along the curbs and gutters surrounding the project site (CSW-ST2, 2018b). The estimated areas flowing to the on-site stormwater drainage system before and after development of the proposed project are summarized in **Table 4.8-2** below.

As indicated in Table 4.8-2, without any measures to address changes in site drainage patterns, peak flows to two of the drainage inlets surrounding the project site would increase, which could result in an exceedance of the capacity of these inlets and thereby result in localized flooding near

TABLE 4.8-2 PROJECT SITE DRAINAGE

Drainage Area	Type of Drainage	Existing Area (Acres)	Post-Project Area (Acres)	Percent Change in Peak Flow[a]	Adjusted Percent Change in Peak Flow[b]
A	On-Site Stormwater Drainage System	2.44	1.67	-32.9 %	-21.3 %
B	Inlet	0.18	0.53	155.4 %	0 %
C	Inlet	0.06	0.03	-53.6 %	-53.6 %
D	Inlet	0.04	0.02	-52.6 %	-52.6 %
E	Inlet	0.48	0.53	-6.9 %	-6.9 %
F	Inlet	0.17	0.59	203.1 %	0 %

[a] The estimated change in peak flow to each drainage point to which runoff from the project site drains.
[b] The estimated change in peak flow to each drainage point to which runoff from the project site drains after the implementation of the following measures: (a) the final project design will shift some of the drainage from Inlet B to an on-site stormwater drainage system, and (b) the capacity for large-storm detention is provided in Drainage Area F.
Source: CSW-ST2, 2018b.

the project site. However, the hydrologic study shows that peak flows to both the on-site stormwater drainage system and to inlets surrounding the project site could be reduced to existing conditions, or below existing conditions, with the implementation of the following measures: (a) shift some of the drainage from Inlet B to an on-site stormwater drainage system, and (b) include construction of additional storage capacity for large-storm detention in Drainage Area F (CSW-ST2, 2018b). The hydrologic study recommends that a final hydrology and hydraulic study be completed as the design progresses to confirm that the proposed measures are effective at reducing peak flows to individual points of drainage around the site to be at or below existing conditions. The implementation of Mitigation Measure HYDRO-2 would ensure that the recommendations of the hydrology study are implemented. This would reduce the potential for the exceedance of the local stormwater drainage capacity as a result of changes in stormwater drainage patterns on the project site to a less-than-significant level.

> *Mitigation Measure HYDRO-2: The project applicants shall incorporate the recommendations of the preliminary hydrology study into the project design, and shall complete a final hydrology study based on the final design of the proposed project. The final hydrology study shall verify that peak flows to individual points of drainage around the project site would be limited to at or below existing levels under the final project design, or shall provide recommendations to achieve these limits. The project applicants shall implement all of the recommendation of the final hydrology study. Prior to the issuance of a grading permit and building permit, the applicants shall demonstrate to the satisfaction of the City Engineer that the recommendations of the final hydrology and hydraulic study have been incorporated into the project grading plans and building plans. (LTS)*

Cumulative Impacts

For hydrology and water quality, the cumulative impact area considered is the project site and nearby projects (see Table 6-1 and Figures 6-1 and 6-2 in Chapter 6, CEQA Considerations, of this DEIR).

Stormwater discharged from past and existing projects within the project vicinity has contained pollutants that have contributed to impairment of the water quality of receiving waters, including San Rafael Creek and San Pablo Bay, which is a cumulative impact. Stormwater regulations have become progressively more stringent since the passing of the federal Clean Water Act, and current regulations now require new developments to manage and treat all significant sources of stormwater pollutants. Stormwater runoff from the project site would be treated in accordance with Construction General Permit, City of San Rafael BMPs related to construction activities, and/or MS4 Permit requirements. As such, no change in overall pollutant loads in stormwater runoff from the project site would occur. Therefore, the proposed project's contribution to cumulative surface water quality impact would be less than cumulatively considerable.

None of the cumulative projects are located adjacent to the project site. The nearest projects to the project site are Projects 4, 6, 8, and 9 (see Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR), which involve construction of residences, a corporate center, and an above-ground parking garage. These cumulative projects do not propose belowground floors and therefore would not be anticipated to involve activities, such as pumping of large volumes of groundwater, which could alter groundwater flow patterns at the project site and thereby affect existing groundwater contamination. The proposed project would be subject to Mitigation Measure HYDRO-1, which would ensure that changes to infiltration at the project site would not result in degradation of groundwater quality at the project site or surrounding area. Therefore, no cumulative impact related to the degradation of groundwater quality would occur.

The proposed project and other projects in the vicinity would be required to comply with the Construction General Permit and MS4 Permit. Therefore, construction and operation of these projects would not conflict with the water quality objectives of the Basin Plan, and the cumulative impact would be less than significant.

Even without the occurrence of a storm, the storm drain systems in the vicinity of the project site may already be partially or fully filled with water due to high tide events (CSW-ST2, 2018a).The proposed project and nearby projects could alter drainage patterns in a manner the exacerbates the potential for runoff from the sites to exceed the drainage capacity of parts of the local stormwater drainage system, which is a potentially significant cumulative impact. The proposed project would be subject to Mitigation Measure HYDRO-2, which requires the implementation of measures that would ensure that the peak flows to stormwater drainage system inlets do not increase relative to existing levels. Compliance with this measure would reduce the project's potential contribution to the cumulative exceedance of stormwater drainage capacity to a less-than-cumulatively-considerable level.

The project site and other project sites are located within flood hazard zones. Both the proposed project and other projects would be required to comply with San Rafael Municipal Code Section 18.50 requirements for construction within a flood hazard zone. This would ensure that the potential of the proposed project and cumulative projects to result in a cumulative impact related to impeding and redirecting flood water flows would be less than significant.

If the project site and other project sites are inundated by flood waters during construction, pollutants such as sediments, debris, and hazardous materials could be swept into San Rafael Creek and San Pablo Bay. The project site would need to be maintained in a clean and orderly state, and hazardous materials and contaminated soils and groundwater would be managed in accordance with the project-specific SWPPP and with a Soil and Groundwater Management Plan, as described in Section 4.7, Hazards and Hazardous Materials. These measures would minimize the amounts of pollutants and floating materials that could be swept from the project site into San Rafael Creek and San Pablo Bay if flooding occurs on the project site during construction. The project's contribution to the cumulative impact would be less than cumulatively considerable with the implementation of appropriate site design; construction period BMPs, the SWPPP, and the Soil and Groundwater Management Plan.

The proposed project and Projects 4, 5, 6, 7, 8, and 9 (see Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR) are located in a low-lying areas near San Rafael Creek that are subject to exacerbated flooding impacts as a result of sea level rise (CSW-ST2, 2018a). Additionally, both the proposed project and Projects 1, 4, 5, 6, 7, 8, and 9 (see Figure 6-1) are located within flood hazard areas (see Figure 4.8-1). The levels of urban pollutants occurring at the project site and the other project sites would be minimized through compliance with the Small MS4 Permit, which requires projects to identify potential sources of pollutants and implement source control measures. Furthermore, the proposed project and the other projects involve typical urban land uses, such as residences, a parking garage, a transit center, and offices, and do not propose land uses that would involve the storage or handling of substantial quantities of hazardous materials. The transit center involves the relocation of existing transit facilities currently located in a flood hazard area, and do not contain fueling facilities. Therefore, the potential of the proposed project and other projects to release a substantial amount of pollutants to local waters during flooding of the area as a result of the 100-year flood hazard and sea level rise would be less than significant.

REFERENCES

Bay Area Stormwater Management Agencies Association (BASMAA), 2019. Design Guidance for Stormwater Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties, January.

Borrero, Jose, et al, 2006. Numerical Modeling of Tsunami Effects at Marine Oil Terminals in San Francisco Bay, Report prepared for Marine Facilities Division of the California State Lands Commission, June 8.

California Department of Water Resources, 2019. Bulletin 118. Website: https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118, accessed on April 16, 2019.

California Emergency Management Agency (CalEMA), 2009. Tsunami Inundation map for Emergency Planning, San Rafael Quadrangle/San Quentin Quadrangle, July 1.

City of San Rafael, 2014. *Climate Adaptation – Sea Level Rise, San Rafael, CA,* White Paper, January.

City of San Rafael, 2017. *General Plan 2020.* Reprinted April 28, 2017.

Clearwater Hydrology, 2015. *Marin Countywide Plan Flooding Technical Background Report,* November.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018a. Preliminary Investigation and Recommendation, FEMA Requirements, and Sea Level Rise, July 26.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018b. *Preliminary Hydrology Study,* October 1.

Federal Emergency Management Agency (FEMA), 2016. Flood Insurance Rate Map, Marin County California, Map Number 06041C0457E, March 16.

Federal Emergency Management Agency (FEMA), 2017. Flood Insurance Study, Marin County California, Study Number 06041CV001D, August 15.Marin County, 2017. Marin County Sea Level Rise Vulnerability Assessment, June.

Marin Watershed Program, 2019. San Rafael Creek. Website: https://www.marinwatersheds.org/creeks-watersheds/san-rafael-creek, accessed on April 16, 2019.

Miller Pacific Engineering Group, 2018. *Geotechnical Feasibility Report, BioMarin Office Buildings, 999 3rd Street, San Rafael, California,* August 24.

National Research Council of the National Academies, 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future,* Chapter 4.

San Francisco Bay Regional Water Quality Control Board (Regional Water Board), 2017. *San Francisco Bay Basin Water Quality Control Plan (Basin Plan),* May 4.

State Water Resources Control Board (State Water Board), 2010. 2010 Integrated Report (Clean Water Act Section 303(d) List 305(b) Report). Website: https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml, accessed on April 16, 2019.

Terra Pacific Group, 2018. *Remedial Action Completion Report, Former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California,* November 19.

United States Environmental Protection Agency (EPA), 2016. *Waterbody Quality Assessment Report for San Pablo Bay.* Website: https://ofmpub.epa.gov/waters10/attains_waterbody.control?p_au_id=CAB2061001019980928100945&p_list_id=CAB2061001019980928100945&p_cycle=2016, accessed on April 16, 2019.

Western Regional Climate Center (WRCC), 2016. San Rafael Civic Center, California (047880), Period of Record Monthly Climate Summary, 01/01/1894 to 06/10/2016. Website: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7880, accessed on April 16, 2019.

4.9 LAND USE AND PLANNING

INTRODUCTION

The analysis of land use and planning generally considers the compatibility of a proposed project with neighboring areas, change to, or displacement of existing uses, and consistency of the project with relevant local land use policies and regulations that have been adopted with the intent to mitigate or avoid an environmental effect. With respect to land use conflicts or compatibility issues, the magnitude of these impacts depends on how a proposed project affects the existing development pattern, development intensity, traffic circulation, noise, air quality, and visual setting in the project site vicinity.

This section considers whether the proposed project may conflict with applicable land use plans, policies, or regulations (including, but not limited to the general plan and zoning ordinance) that were adopted for the purpose of avoiding or mitigating an environmental effect (see Appendix G to the California Environmental Quality Act [CEQA] Guidelines). This section also considers whether the proposed project could physically divide a community (see Appendix G of the CEQA Guidelines).

ENVIRONMENTAL SETTING

Regional Setting

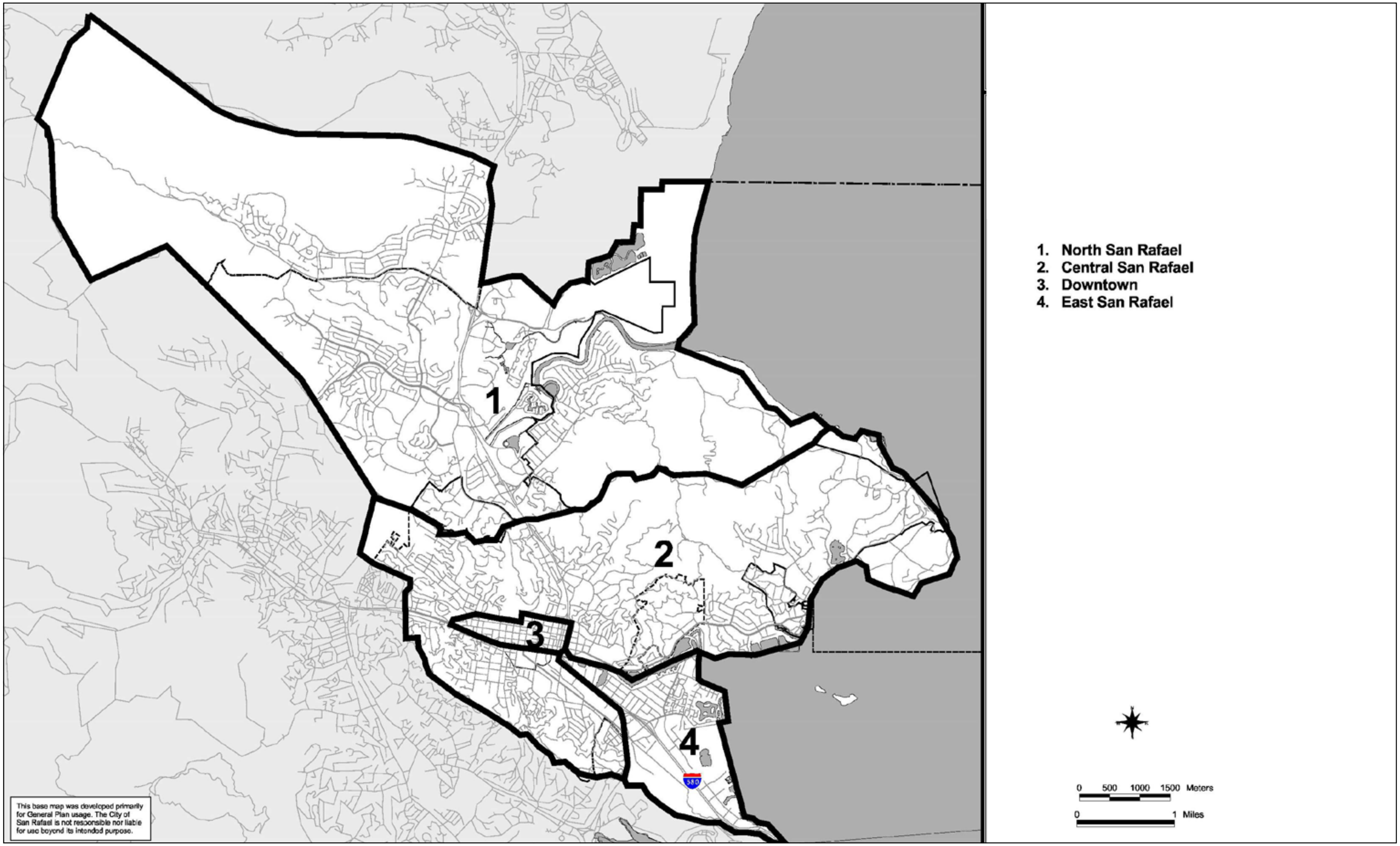
The project site is located in the City of San Rafael in Marin County. Regional access to the site is from U.S. Highway 101 located east of the site. The project site is in the “Downtown” subarea as identified in San Rafael General Plan 2020 (City of San Rafael, 2017) (see **Figure 4.9-1**) in an area of mixed land uses, dominated by commercial businesses, apartments, and parking facilities.

The project site is two blocks (or a five-minute walk) from the San Rafael Transit Center (also known as the C. Paul Bettini Transportation Center) and the Sonoma-Marin Area Rail Transit (SMART) San Rafael station. It is located immediately north of the approximately 15.54-acre San Rafael Corporate Center (SRCC), which is a Planned Development (PD) zoning district area where BioMarin’s 400,000+-square-foot headquarters are currently located.

The primary arterial roadways serving the project site are 2nd and 3rd Streets. Smaller collector streets, such as Brooks Street and Lindaro Street, intersect these one-way arterials.

Project Site Setting and Surrounding Land Uses

The project site has been vacant since 1998. The site and surrounding areas are shown in Figures 3-1 and 3-2 in Chapter 3, Project Description, of this DEIR. As shown in Figure 3-2, the project site is located directly north of BioMarin’s existing SRCC campus. A Pacific Gas & Electric (PG&E) substation and multi-family residential units are located south of the project site, across 2nd Street. A commercial building and Kaiser Permanente Downtown San Rafael are located west



SOURCE: City of San Rafael, 2004

Figure 4.9-1

CITY OF SAN RAFAEL GENERAL PLAN 2020 SUB-AREAS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

of the project site, across Brooks Street. A parking lot and various retail establishments are located north of the project site, across 3rd Street, and various retail establishments are also located east of the project site, across Lindaro Street. Nearby commercial establishments include grocery stores and pharmacies.

The San Rafael Transit Center, located less than one-quarter mile east of the project site, has grown into a major transit hub for Marin County. The SMART rail line currently connects central San Rafael with northern Santa Rosa and the Sonoma County Airport, and a future planned extension will connect San Rafael with the Larkspur Ferry Terminus at Larkspur Landing.

Whistlestop currently operates an Active Aging Center at 930 Tamalpais Avenue, adjacent to the San Rafael Transit Center.

REGULATORY FRAMEWORK

Federal and State Regulations

The California Department of Toxic Substances Control (DTSC) can impose covenants that restrict uses on a site when contamination has been identified. Refer to Section 4.7, Hazards and Hazardous Materials, of this DEIR, which addresses hazards at the project site.

Local Regulations and Policies

San Rafael General Plan 2020

San Rafael General Plan 2020 (General Plan) was adopted in 2004 and amended and reprinted in 2017 (City of San Rafael, 2017). The General Plan provides a comprehensive statement of the City of San Rafael's development policies. It covers all lands located within the City limits as well as the City's Sphere of Influence area. The Sphere of Influence is the service area of a city or district as approved by the Local Agency Formation Commission of the county (Government Code Section 56076). The City limits and Sphere of Influence area are illustrated in the General Plan map, which can be seen in **Figure 4.9-2** (City of San Rafael, 2014).

The City of San Rafael is in the process of updating its General Plan. The General Plan update is referred to as "General Plan 2040." At the time of publication of this DEIR, a draft Land Use Element and Land Use Map had not been released.

Land Use Designation, Floor Area Ratio, and Building Height Limits

The General Plan designates the project site as "Second/Third Mixed Use." This land use designation allows a gross residential density of 32 to 62 units per acre and encourages office and office-support retail and service uses. In areas east of B Street, such as the project site, residential uses are allowed as part of a mixed-use development, and limited auto-serving retail uses (such as gas stations) are also allowed.

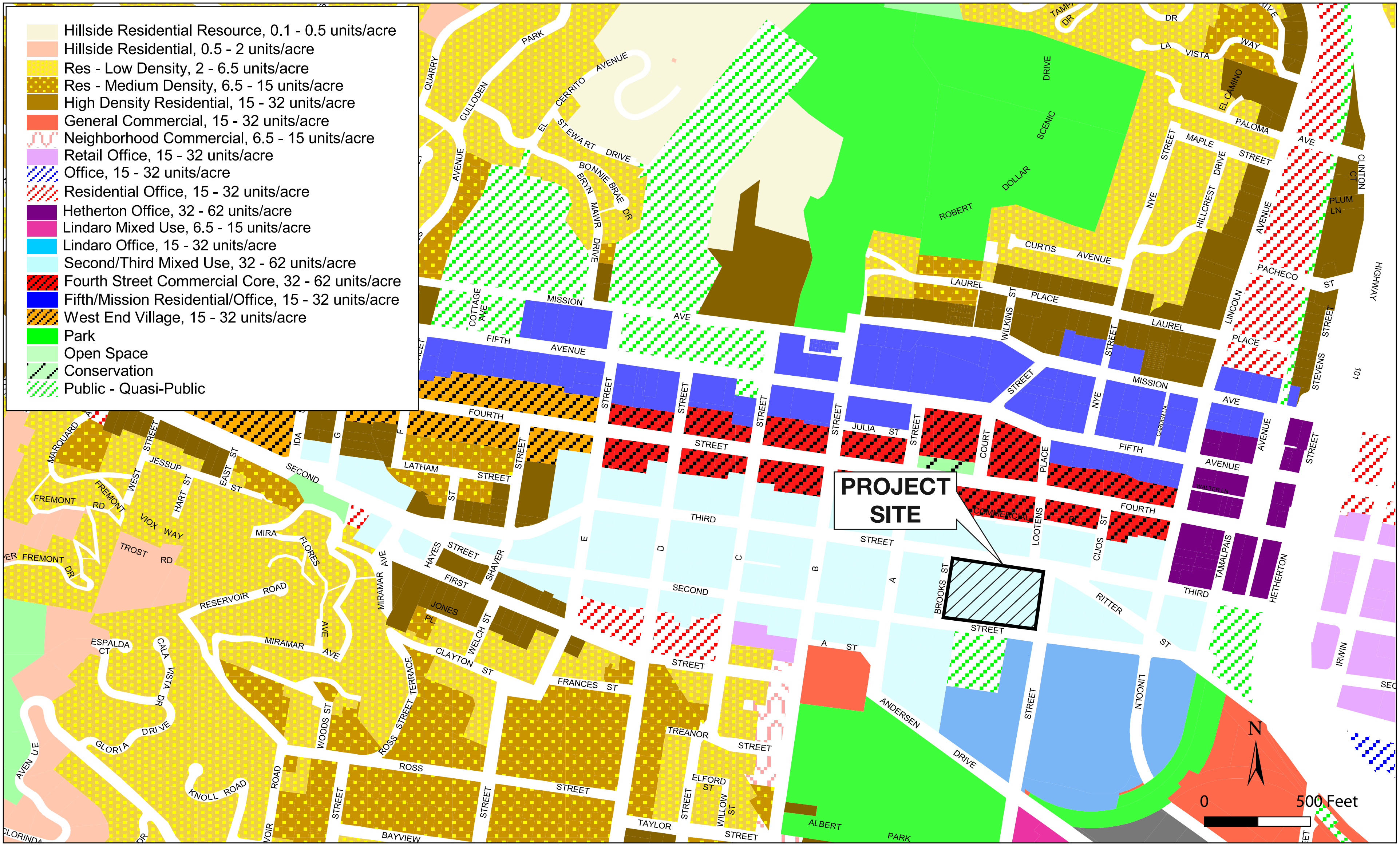


Figure 4.9-2

CITY OF SAN RAFAEL GENERAL PLAN

SOURCE: City of San Rafael General Plan 2020, Baseline 2019

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

The General Plan assigns floor area ratio (FAR) to identify appropriate intensities for commercial and industrial areas and permits FAR transfers between sites in certain circumstances. The project site is in an area where the allowable FAR is 1.50.

The General Plan establishes city-wide building height limits and permits height bonuses in certain circumstances. The project site is in an area where maximum building height is 54-feet. A maximum height bonus up to 12-feet, for a total of 66-feet, is available for provision of one or more amenities, including affordable housing, public parking, overhead crosswalks, and mid-block passageways between 4th Street and parking on 3rd Street.

Relevant Policies and Programs

The General Plan contains the following relevant policies and programs related to land use. A variety of other policies from the General Plan are addressed in individual sections of this DEIR such as Section 4.10, Noise; Section 4.13, Transportation; and Section 4.2, Air Quality.

Policies and Programs from Land Use Element. The Land Use Element of the General Plan contains the following relevant policies and programs:

Policy LU-2 **Development Timing.** For health, safety and general welfare reasons, new development should only occur when adequate infrastructure is available consistent with the following findings:

a. Project-related traffic will not cause the level of service established in the Circulation Element to be exceeded;

b. Any circulation improvements needed to maintain the level of service standard established in the Circulation Element have been programmed and funding has been committed;

c. Environmental review of needed circulation improvement projects has been completed;

d. The time frame for completion of the needed circulation improvements will not cause the level of service in the Circulation Element to be exceeded, or the findings set forth in Policy C-5 have been made; and

e. Sewer, water, and other infrastructure improvements will be available to serve new development by the time the development is constructed.

Program LU-2a **Development Review.** Through the development and environmental review processes, ensure that policy provisions are evaluated and implemented. The City may waive or modify any policy requirement contained herein if it determines that the effect of implementing the same in the issuance of a development condition or other approvals would be to preclude all economically viable use of a subject property.

Policy LU-9 **Intensity of Nonresidential Development.** Commercial and industrial areas have been assigned floor area ratios (FARs) to identify appropriate intensities (see Exhibits 4, 5 and 6). Maximum allowable FARs are not guaranteed, particularly in environmentally sensitive areas. Intensity of commercial and industrial development on any site shall respond to the following factors: site resources and constraints, traffic and access, potentially hazardous conditions, adequacy of infrastructure, and City design policies.

a. Where the existing building is larger than the FAR limit and no intensification or change of use is proposed, the property may be redeveloped at the same size as the existing building if parking and design requirements in effect at the time of the new application can be met.

b. FAR transfers between or among sites shall not be permitted except where the City Council finds the following:

  1. The development of the beneficiary parcel is consistent with the General Plan 2020, except that FARs or maximum densities may be exceeded, and

  2. The proposed development will comply with all applicable zoning and design parameters and criteria as well as traffic requirements; and one or both of the following:

    i) Unique or special circumstances are found to exist (e.g., preservation of wetlands or historic buildings) that would cause significant environmental impacts if the transfer is not allowed, and/or

    ii) A significant public benefit will be provided, such as securing a new public facility site (e.g. park, school, library, fire station, police station).

Policy LU-12 **Buildings Heights.** Citywide height limits in San Rafael are described in Exhibits 7 and 8. For Downtown height limits see Exhibit 9:

a. Height of buildings existing or approved as of January 1, 1987 shall be considered conforming to zoning standards.

b. Hotels have a 54-foot height limit, except where a taller height is shown on Exhibit 9 (Downtown Building Height Limits).

c. Height limits may be exceeded through granting of a zoning exception or variance, or through a height bonus as described in LU-13 (Height Bonuses).

Policy LU-13. **Height Bonuses.** A height bonus may be granted with a use permit for a development that provides one or more of the amenities listed in Exhibit 10,[1] provided the building's design is consistent with Community Design policies and design guidelines. No more than one height bonus may be granted for a project.

[1] Exhibit 10 of the General Plan shows that height bonuses of 12 feet are permitted in the Second/Third Mixed Use East Zoning District with the provision of affordable housing, public parking, overhead crosswalks, or mid-block passageways between 4th Street and parking on 3rd Street.

Policy LU-14. **Land Use Compatibility.** Design new development in mixed residential and commercial areas to minimize potential nuisance effects and to enhance their surroundings.

Policy LU-17. **Limited Retail and Service Uses in Industrial and Office Areas.** Allow limited retail and service uses that serve area businesses/workers to locate throughout industrial/office and industrial areas.

Policy LU-23 **Land Use Map and Categories.** Land use categories are generalized groupings of land uses and titles that define a predominant land use type (See Exhibit 11). All proposed projects must meet density and FAR standards (See Exhibits 4, 5 and 6) for that type of use, and other applicable development standards. Some listed uses are conditional uses in the zoning ordinance and may be allowed only in limited areas or under limited circumstances. Maintain a Land Use Map that illustrates the distribution and location of land uses as envisioned by General Plan policies (see Exhibit 11).

General Policies and Programs from Neighborhoods Element. The Neighborhoods Element of the General Plan contains the following relevant policies and programs:

Policy NH-6 **Bicycle- and Pedestrian-Friendly Streets.** Create bicycle-and pedestrian-friendly residential streets with large street trees, sidewalks and other appropriate amenities.

Policy NH-7 **Neighborhood Identity and Landmarks.** Enhance neighborhood identity and sense of community by retaining and creating gateways, landmarks, and landscape improvements that help to define neighborhood entries and focal points.

Policy NH-8 **Parking.** Maintain well-landscaped parking lots and front setbacks in commercial and institutional properties that are located in or adjacent to residential neighborhoods. Promote ways to encourage parking opportunities that are consistent with the design guidelines.

Program NH-8a **Restore Parking Spaces.** Continue Code Enforcement efforts to work with apartment owners to restore parking spaces being used for storage.

Program NH-8b **Additional On-Site Parking.** In neighborhoods with excessive on-street parking, work with property owners to add on-site parking where feasible as part of review of expansion or remodels.

Program NH-8c **Permit Parking.** In neighborhoods with excessive on-street parking, evaluate the benefits and drawbacks of a Permit Parking Program (i.e. to limit cars per unit and/or to limit nonresidential cars) where supported by a significant majority of neighborhood residents.

Program NH-8d **Zoning Ordinance Review.** Evaluate and amend as necessary zoning regulations to ensure adequate on-site parking, and sufficient screening of parking areas adjacent to residences.

City of San Rafael Municipal Code, Title 14 – Zoning Ordinance

The project site is zoned "Second/Third Streets Mixed-Use East (2/3 MUE)". The 2/3 MUE district allows general office and office-support retail and service uses, with housing encouraged for mixed-use projects. Laboratories are allowed with a conditional use permit from the Zoning Administrator. Multi-family housing is allowed as part of a mixed-use development, with an administrative use permit from the Planning Director (or Planning Commission, if referred by the Planning Director).

The project site is immediately north of the SRCC, which is located within a Planned Development (PD) zoning district (Ordinance 1901, as amended by Ordinance 1936).. The allowable FAR in the PD zone is 0.75, which would allow for up to 507,690 square feet of building area within the 676,922-square-foot existing SRCC campus area (see Table 3-3 in Chapter 3, Project Description, of this DEIR), and the allowable building height is 54-feet, with a 24-foot height bonus for certain buildings based on public benefits provided by BioMarin. Currently, the PD zoning and entitlements allow an office park with a maximum of 473,096 square feet of building area within six office buildings approved for administrative office, general office, and research and development (R&D) uses. The PD zoning requires 3.3 parking spaces per 1,000 gross square feet (gsf) of building area. Within the PD zone, BioMarin currently has five buildings including a research building for a total of approximately 400,000 square feet. In 2015, the City of San Rafael approved the addition of a four-story office building at 755 Lindaro Street and the expansion of the garage at 791 Lincoln Avenue. Once the office building is constructed, the total SRCC development would be approximately 473,000 square feet.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this DEIR and based on Appendix G of the CEQA Guidelines, implementation of the proposed project would have a significant effect related to land use if it would:

a) Physically divide an established community; or

b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.

Conflicts with land use policies ultimately are to be determined by the City's decision-makers. While the DEIR can address potential conflicts, the City's decision-makers have to decide if the conflict is acceptable or not. Also, it is common for City policies to conflict. For example, there can be policies to encourage downtown commercial or office development for the purposes of economic development for the city, but that development may result in increased traffic. If the City has a policy to prevent excessive traffic impacts, there would be an inherent conflict. The DEIR authors have taken the liberty to identify what may be project conflicts with adopted policies, with an emphasis on those policies related to environmental issues. Some of these impacts could be significant and unavoidable if mitigation measures cannot adequately reduce the degree of the impact. However, the City decision-makers would have to decide if the project warrants such impacts and this would be addressed at the time of findings being prepared for the CEQA document adoption.

Less-than-Significant Impacts

The project would not divide an established community.

No land uses are present on the project site. The project would allow development of office, R&D, multi-family housing, and retail uses that would be generally compatible with surrounding uses in the downtown area. Thus, the project would not divide an established community, and the impact would be less than significant.

Potentially Significant Impacts

Impact LAND-1: The project could result in a conflict with San Rafael General Plan 2020 Policy LU-2, which specifies that new development should only occur when adequate traffic conditions and circulation improvements are available. Refer to Impacts TRANS-2, TRAN-3, and TRANS-4 (see Section 4.13, Transportation, of this DEIR). As shown for these three potential impacts, no mitigation measure would be available to reduce these impacts to less-than-significant levels. Thus, this potential impact would remain significant and unavoidable. (PS)

As discussed in Section 4.13, Transportation, of this DEIR, the project would add a significant number of daily vehicle trips to this area of San Rafael, and levels of service at nearby intersections would be degraded. At the projected traffic levels, no mitigation measures would be able to reduce impacts to less-than-significant levels. The project would have to be significantly reduced in scale to reduce the number of projected trips, and this reduction would possibly conflict with the City's desire to increase downtown development for the purposes of infill development and economic development. Thus, such a reduction in scale was not considered feasible for the project, and the impact remains significant and unavoidable.

> *Mitigation Measure LAND -1: No feasible mitigation measures are available, and therefore this impact would be significant and unavoidable on both a project and cumulative basis. (SU)*

Cumulative Impacts

Approved and pending projects are shown in Figure 6-1 and listed in Table 6-1 in Chapter 6, CEQA Considerations, of the DEIR. As shown in Figure 6-1, none of these projects adjoin the project site, but eight of the projects are approved or pending in the general downtown neighborhood. The level of intensity of these projects is variable. No significant cumulative land use impacts from the projects are anticipated. The projects would not divide physically divide an existing community. Some projects would result in redevelopment of areas where existing development (e.g., 703 3rd Street) would be replaced.

Conflicts with some of the City's policies or regulations could occur with some of the proposed projects but these conflicts would relate to each individual project. The proposed BioMarin and

Whistlestop/Eden Housing Project would not cumulatively contribute to such conflicts beyond the individual impacts identified in the discussion above. However, because the project's land use impact related to policy consistency and traffic impacts would be significant and unavoidable, cumulative impacts would also be significant and unavoidable.

REFERENCES

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28.

4.10 NOISE

INTRODUCTION

This section provides a summary of noise and vibration terminology and describes the current noise setting in the vicinity of the project site, as well as relevant guidance or rules for evaluating and regulating noise and vibration. A noise and vibration impact assessment of the proposed project is included. The impacts examined include temporary noise and vibration impacts during construction, and noise generated during the operation of the proposed project. The impact analysis identifies environmental impacts related to noise and vibration, as well as feasible mitigation measures that would reduce or avoid potentially significant impacts.

ENVIRONMENTAL SETTING

Noise and Vibration Terminology

Noise

Noise is commonly defined as unwanted sound that annoys or disturbs people and can have an adverse psychological or physiological effect on human health. The effects of noise on people can be grouped into three general categories: 1) subjective effects of annoyance, nuisance, and dissatisfaction; 2) interference with such activities as speech and sleeping; and 3) physiological effects, such as hearing loss.

Sound is measured in decibels (dB), which is a logarithmic scale. Decibels describe the purely physical intensity of sound based on changes in air pressure, but they cannot accurately describe sound as perceived by the human ear since the human ear is only capable of hearing sound within a limited frequency range. Therefore, the frequency of a sound must be taken into account when evaluating the potential human response to sound. For this reason, a frequency-dependent weighting system is used to account for the relative loudness perceived by the human ear. This system is referred to as A-weighted decibels (dBA). Decibels and other technical terms are defined in **Table 4.10-1**, below.

In unconfined space, such as outdoors, noise attenuates with distance according to the inverse square law. Noise levels at a known distance from point sources are reduced by 6 dBA for every doubling of that distance for hard surfaces, such as cement or asphalt surfaces, and 7.5 dBA for every doubling of distance for soft surfaces, such as undeveloped or vegetative surfaces (Caltrans, 1998). Noise levels at a known distance from line sources (such as traffic noise) theoretically decrease at a rate of 3 dBA for every doubling of the distance for hard surfaces and 4.5 dBA for every doubling of distance for soft surfaces (Caltrans, 1998). Greater decreases in noise levels can result from the presence of intervening structures, buffers, or topography. Typical A-weighted noise levels at specific distances are shown for different noise sources in **Table 4.10-2**.

TABLE 4.10-1 DEFINITION OF ACOUSTICAL TERMS

Term	Definitions
Decibel (dB)	A unit describing the amplitude of sound on a logarithmic scale. Sound described in decibels is usually referred to as sound or noise “level.” This unit is not used in this analysis because it includes frequencies that the human ear cannot detect.
Vibration Decibel (VdB)	A unit describing the amplitude of vibration on a logarithmic scale.
Frequency (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level (dBA)	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted.
Noise	Unwanted sound.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level during the measurement period. For this California Environmental Quality Act (CEQA) evaluation, L_{eq} refers to a one-hour period unless otherwise stated.
L_{max}	The maximum A-weighted sound level during the measurement period.
L_n	The sound pressure level exceeded for n percent of the time. For n percent of the time, the fluctuating sound pressure levels are higher than the Ln level.
Day/Night Noise Level (L_{dn})	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured during the night between 10:00 PM and 7:00 AM.
Community Noise Equivalent Level (CNEL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 to 10:00 PM and after addition of 10 decibels to sound levels during the night between 10:00 PM and 7:00 AM.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Peak Particle Velocity (PPV)	The maximum instantaneous peak of a vibration signal.
Root Mean Square (RMS) Velocity	The average of the squared amplitude of a vibration signal.

Source: Charles M. Salter Associates, 1998; Federal Transit Administration, 2018.

TABLE 4.10-2 TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

Noise Source (Distance in Feet)	A-Weighted Sound Level (dBA)
Jet Takeoff (200)	112
Subway Train (30)	100
Truck/Bus (50)	85
Vacuum Cleaner (10)	70
Automobile (50)	65
Normal Conversation (3)	65
Whisper (3)	42

Source: Charles M. Salter Associates, 1998.

A typical method for determining a person's subjective reaction to a new noise is by comparing it to existing conditions. The general relationship between change in decibel level and perceived change in loudness is described as follows (Charles M. Salter Associates, 1998):

- A change of 1 dBA cannot typically be perceived, except in carefully controlled laboratory experiments;
- A 3-dBA change is considered a just-perceivable difference;
- A minimum of a 5-dBA change is required before any noticeable change in community response is expected; and
- A 10-dBA increase is subjectively perceived as approximately a doubling in loudness.

It should be noted that because decibels are based on a logarithmic scale, they cannot be added or subtracted in the usual arithmetical way. For instance, if one noise source emits a sound level of 90 dBA, and a second source, placed beside the first, emits a sound level of 90 dBA, the combined sound level is 93 dBA, not 180 dBA. When the difference between two co-located sources of noise is 10 dBA or more, the higher noise source dominates and the lower noise source makes no perceptible difference in what can be heard or measured. For example, if the noise level is 95 dBA, and another noise source is added that produces a noise level of 80 dBA, the noise level will still be 95 dBA.

Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Several different methods are used to quantify vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors to vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration-sensitive equipment. Vibration amplitudes are usually expressed as either peak particle velocity (PPV) or the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous peak of the vibration signal. PPV is appropriate for evaluating potential damage to buildings, but it is not suitable for evaluating human response to vibration because it takes the human body time to respond to vibration signals. The response of the human body to vibration is dependent on the average amplitude of a vibration. The RMS of a signal is the average of the squared amplitude of the signal and is more appropriate for evaluating human response to vibration. PPV and RMS are normally described in units of inches per second (in/sec), and RMS is also often described in vibration decibels (VdB).

Surrounding Receptors

Sensitive receptors are defined as land uses where noise-sensitive people may be present or where noise-sensitive activities may occur. Examples of noise-sensitive land uses include residences, schools, hospitals, and retirement homes. Examples of noise-sensitive activities are those that occur in locations such as churches and libraries.

Potential sensitive receptors are located both on-site and off-site. The nearest off-site sensitive receptors to the project site include 1) multi-family residential units along 2nd Street, located approximately 70 feet at the closest distance to the south of the project site; and 2) Kaiser

Permanente Downtown San Rafael, located approximately 75 feet at the closest distance to the west of the project site. As the construction of the proposed project would occur in phases, there would be on-site receptors on the project site during construction of the later phases of the proposed project. On-site sensitive receptors include future occupants of the Whistlestop/Eden Housing project during construction of BioMarin Building A and BioMarin Building B.[1]

Commercial land uses are not considered sensitive receptors, but are still considered in this analysis because noise limits at commercial land uses are specified in the San Rafael Municipal Code (Table 4.10-5). Nearest commercial land uses are: BioMarin's existing San Rafael Corporate Center to the south across 2nd Street; a commercial building to the west across Brooks Street; various retail establishments to the north across 3rd Street and to the east across Lindaro Street.

A Pacific Gas & Electric substation is located south of the project site and a parking lot is located north of the project site. However, they are not considered in this analysis because they do not contain noise sensitive activities or uses and are not considered susceptible to noise or vibration disturbance.

Ambient Noise

The primary sources of noise at the project site are traffic on major local roadways and highways, including 1) traffic on 3rd Street, which runs east to west adjacent to the northern boundary of the project site; 2) traffic on 2nd Street, which runs west to east adjacent to the southern boundary of the project site; and 3) traffic on U.S. Highway 101.

Based on the estimated 2020 traffic noise level contours[2] presented in Appendix H of San Rafael General Plan 2020 (General Plan) (City of San Rafael, 2017), existing noise levels range from 65 dBA L_{dn} to 69 dBA L_{dn} in the northern portion of the project site and from 68 dBA L_{dn} to 72 dBA L_{dn} in the southern portion of the project site.[3] Brooks Street borders the project site to the west, and Lindaro Street borders the project site to the east; these roads are not major roadways, and therefore noise contours are not provided for them in the General Plan.

The local noise environment was further characterized by conducting a noise monitoring survey for this DEIR analysis. On April 9 2019, Baseline Environmental Consulting (Baseline) conducted short-term (10-minute) noise level measurements at three locations in the vicinity of the project site and one long-term (24-hour) noise level measurement to characterize the ambient noise levels. A Casella CEL-633C2 noise meter was used for the noise level measurements. The meter was calibrated before the measurements to ensure accuracy. The measurement locations are shown in **Figure 4.10-1**. The numerical summaries of the ambient noise level measurements are provided in **Table 4.10-3** and are generally consistent with the noise level contours in the General Plan.

[1] Occupants of BioMarin Building A would also be located on-site during construction of BioMarin Building B. However, BioMarin Building A would not contain residences and therefore is not considered a sensitive receptor.

[2] 2020 traffic noise levels are used to represent the existing traffic noise levels because it is not anticipated that land uses and associated traffic noise would change substantially between 2019 and 2020.

[3] According to the noise level contours for 2020, traffic noise levels on U.S. Highway 101 range from 60 dBA L_{dn} to 65 dBA Ldn on the project site. Noise levels from traffic on 3rd Street range from 60 dBA Ldn to 65 dBA L_{dn} in the northern portion of the project site, and are below 60 dBA L_{dn} in the southern portion of the project site. Noise levels from traffic on 2nd Street range from 65 dBA L_{dn} to 70 dBA L_{dn} in the southern portion of the project site, and are approximately 60 dBA L_{dn} in the northern portion of the project site.

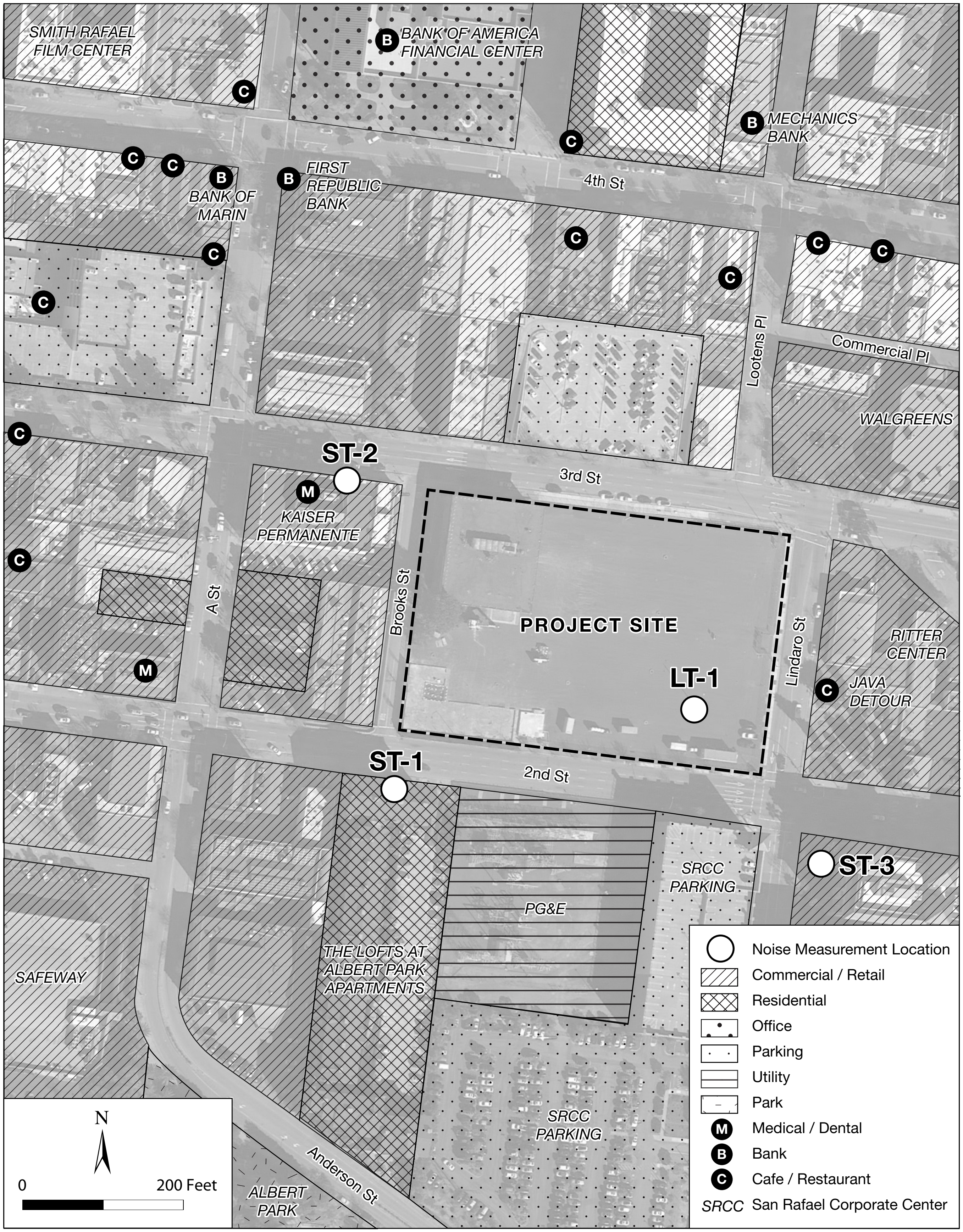


Figure 4.10-1

NOISE MEASUREMENT LOCATIONS

SOURCE: Google Earth, 2018 and A. Skewes-Cox, 2018, Baseline 2019

TABLE 4.10-3 STATISTICAL SUMMARY OF AMBIENT NOISE MEASUREMENTS

Location ID and Description	Noise Levels (L_{eq} for Short-Term, L_{dn} for Long-Term)	L_{max}	L_{min}	Primary Noise Sources
ST-1, multi-family residential units on 2nd Street	71.7 L_{eq}	82.3	54.2	Traffic on 2nd Street
ST-2, Kaiser Permanente Downtown San Rafael on 3rd Street	67.8 L_{eq}	79.9	54	Traffic on 3rd Street
ST-3, BioMarin's existing San Rafael Corporate Center (SRCC) campus on 2nd Street	69.3 L_{eq}	80.7	58.3	Traffic on 2nd Street
LT-1, on-site	65.8 L_{dn}	NA	NA	NA

Note: NA = Not applicable
Source: Field data collected by Baseline Environmental Consulting.

REGULATORY FRAMEWORK

Federal and State Regulations

40 Code of Federal Regulations (CFR), Part 205(B)

Federal regulations establish noise limits for medium and heavy trucks weighing more than 4.5 tons (gross vehicle weight rating) under 40 Code of Federal Regulations (CFR), Part 205(B). Under this regulation, the truck pass-by noise standard is 80 dBA at 15 meters from the vehicle pathway center line. These controls are implemented through regulatory controls on truck manufacturers.

California Noise Control Act

Sections 46000 to 46080 of the California Health and Safety Code codify the California Noise Control Act (CNCA) of 1973. The CNCA established the Office of Noise Control under the California Department of Health Services. The CNCA required that the Office of Noise Control adopt, in coordination with the Office of Planning and Research, guidelines for the preparation and content of noise elements for general plans. The most recent guidelines are contained in General Plan Guidelines, published by the California Office of Planning and Research in 2017 (California Office of Planning and Research, 2017). The document provides guidelines for cities and counties to use in their general plans to reduce conflicts between land use and noise.

California Occupational Safety and Health Administration (Cal/OSHA) Regulations

Noise exposure of construction workers is regulated by the California Occupational Safety and Health Administration (Cal/OSHA). Title 8, Subchapter 7, Group 15, Article 105 of the California Code of Regulations (Control of Noise Exposure) sets noise exposure limits for workers and requires employers who have workers who may be exposed to noise levels above these limits to establish a hearing conservation program, make hearing protection available, and keep records of employee noise exposure measurements. The Cal/OSHA also requires backup warning alarms that activate immediately upon reverse movement on all vehicles that have a haulage capacity of 2.5 cubic yards or more (Title 8, California Code of Regulations). The backup alarms must be audible above the surrounding ambient noise level at a distance of 200 feet. In order to meet this requirement, backup alarms are often designed to generate sound as loud as 82 to 107 dBA L_{max} at 4 feet (NCHRP, 1999).

California Building Standards Code

The 2016 California Building Standards Code specifies interior noise levels for both residential and non-residential uses during operation. Specifically, it requires that interior noise levels attributable to exterior sources not exceed 45 dBA L_{dn} in any habitable room (e.g., residential homes for living, sleeping, eating, or cooking).[4] The noise metric used (either L_{dn} or CNEL) must be consistent with the noise element of the local general plan (California Code of Regulations, Title 24, Part 2, Volume 1, Section 1207.4). The 2016 California Building Standards Code also specifies that buildings containing non-residential uses (e.g., retail spaces and offices) that are exposed to exterior noise levels at or above 65 dBA L_{eq} or CNEL must maintain interior noise level below 50 dBA L_{eq} in occupied areas during any hour of operation (California Code of Regulations, Title 24, Part 11, Section 5.507). The buildings are required to comply with this interior sound level by either a prescriptive or performance method. A prescriptive method requires the use of building assemblies and components with appropriate Sound Transmission Class (STC) values and Outdoor-Indoor Sound Transmissions Class (OITC) values. A performance method requires an acoustical analysis documenting compliance with this interior sound level to be prepared by personnel approved by the architect or engineer of record before the building is built.

Local Regulations and Policies

San Rafael General Plan 2020

The following relevant policies and programs are contained within the General Plan Noise Element (City of San Rafael, 2017):

Policy N-1 **Noise Impacts on New Development.** Protect people in new development from excessive noise by applying noise standards in land use decisions. Apply the Land Use Compatibility Standards [see **Table 4.10-4**] to the siting of new uses in existing noise environments. These standards identify the acceptability of a project based on noise exposure. If a project exceeds the standards in [Table 4.10-4], an acoustical analysis shall be required to identify noise impacts and potential noise mitigations. Mitigation should include the research and use of state-of-the-art abating materials and technology.

Policy N-3 **Planning and Design of New Development.** Encourage new development to be planned and designed to minimize noise impacts from outside noise sources.

[4] Habitable space is a space in a building for living, sleeping, eating, or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

TABLE 4.10-4 LAND USE COMPATIBILITY STANDARDS FOR NEW DEVELOPMENT

	Exterior Noise Exposure to the Site L_{dn} (Db)						
Land Use	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**75-80**	**80+**
Residential, Hotels, Motels							
Schools, Libraries, Churches, Hospitals, Nursing Homes							
Auditoriums, Concert Halls, Amphitheaters							
Sports Arena, Outdoor Spectator Sports							
Playgrounds, Neighborhood Parks							
Other Outdoor Recreation and Cemeteries							
Office and Other Commercial Uses							
Industrial, Manufacturing, Utilities, Agriculture							

	Interior Noise Exposure to the Site L_{dn} (Db)						
	35-40	**40-45**	**45-50**	**50-55**	**55-60**	**60-65**	**65+**
Bedrooms in Residential Units not in Downtown							
Other Rooms in Residential Units not in Downtown							
Bedrooms in Residential Units in Downtown							
Hotels, Motels, Downtown Multi-Family							

Key:

Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable – Specific land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Clearly Unacceptable – New construction of development clearly should not be undertaken.

Source: City of San Rafael, 2017.

Program N-3a **Noise Mitigation.** Require, where appropriate, the following mitigation measures to minimize noise impacts on proposed development projects:

1. **Site Planning.** Proper site planning is the first mitigation measure that should be investigated to reduce noise impacts. By taking advantage of the natural shape and terrain of the site, it often is possible to arrange the buildings and other uses in a manner that will reduce and possibly eliminate noise impacts. Specific site planning techniques include:

a. Increasing the distance between the noise source and the receiver;

b. Placing non-noise sensitive land uses such as parking lots, maintenance facilities, and utility areas between the source and the receiver;

c. Using non-noise sensitive structures such as garages to shield noise-sensitive areas; and

d. Orienting buildings to shield outdoor spaces from a noise source.

2. **Noise Barriers.** Absorptive types of noise barriers or walls should be used to reduce noise levels from ground transportation noise sources and industrial sources. A barrier must interrupt the line of sight between the noise source and the receiver in order to reduce noise level both outdoors and indoors. A barrier should provide at least L_{dn} 5 dB of noise reduction to achieve a noticeable change in noise levels.

3. **Construction Modifications.** If site planning, architectural layout, noise barriers, or a combination of these measures does not achieve the required noise reduction, then mitigation should be facilitated through construction modification to walls, roofs, ceilings, doors, windows.

4. **Alternatives to Sound Walls.** Encourage new development to identify alternatives to the use of sound walls to ease noise impacts.

Policy N-4 **Noise from New Nonresidential Development.** Design nonresidential development to minimize noise impacts on neighboring uses.

a. **Performance Standards for Uses Affecting Residential Districts.** New nonresidential development shall not increase noise levels in a residential district by more than 3 dB L_{dn}, or create noise impacts that would increase noise levels to more than 60 dB L_{dn} at the property line of the noise receiving use, whichever is the more restrictive standard.

b. **Performance Standards for Uses Affecting Nonresidential and Mixed Use Districts.** New nonresidential projects shall not increase noise levels in a nonresidential or mixed-use district by more than 5 dB L_{dn}, or create noise impacts that would increase noise levels to more than 65 dB L_{dn} (Office, Retail) or 70 dB L_{dn} (Industrial), at the property line of the noise receiving use, whichever is the more restrictive standard.

c. **Waiver.** These standards may be waived if, as determined by an acoustical study, there are mitigating circumstances (such as higher existing noise levels), and no uses would be adversely affected.

Program N-4a **Require Acoustical Study.** Identify through an acoustical study noise mitigation measures to be designed and built into new nonresidential and mixed-use development, and encourage absorptive types of mitigation measures between noise sources and residential districts.

Policy N-5 **Traffic Noise from New Development.** Minimize noise impacts of increased off-site traffic caused by new development. Where the exterior L_{dn} is 65 dB or greater at a residential building or outdoor use area, and a plan, program, or project increases traffic noise levels by more than L_{dn} 3 dB, reasonable noise mitigation measures shall be included in the plan, program or project.

Program N-5a **Traffic Noise Studies.** Require acoustical studies to evaluate potential off-site noise impacts resulting from traffic generated by new development.

Policy N-9 **Nuisance Noise** Minimize impacts from noise levels that exceed community sound levels.

Program N-9b **Mitigation for Construction Activity Noise.** Through environmental review, identify mitigation measures to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity.

San Rafael Municipal Code

The San Rafael Municipal Code contains the following relevant requirements:

Chapter 8.13 – Noise

Section 8.13.040 – General noise limits. Subject to the exceptions and exemptions set forth in Sections 8.13.050 and 8.13.060, the general noise limits set forth in this section shall apply. A summary of the general noise limits not to be exceeded at the property plane of the receiving property types or zones is presented in **Table 4.10-5**.

Section 8.13.050 – Standard exceptions to general noise limits. A summary of the standard exceptions applicable to the proposed project provided in this section is set forth in **Table 4.10-6**.

Section 8.13.060 – Exceptions allowed with permit. In addition to the standard exceptions permitted pursuant to Section 8.13.050, the director of community development or his designee may grant a permit allowing an exception from any or all provisions of this chapter where the applicant can show that a diligent investigation of available noise abatement techniques indicates that immediate compliance with the requirements of this chapter would be impractical or unreasonable, or that no public detriment will result from the proposed exception.

Section 8.13.070 – Exemptions. Uses established through any applicable discretionary review process containing specific noise conditions of approval and/or mitigation measures.

TABLE 4.10-5 GENERAL NOISE LIMITS ESTABLISHED BY SAN RAFAEL MUNICIPAL CODE

Property Type or Zone	Daytime Limits	Nighttime Limits
Residential	60 dBA Intermittent 50 dBA Constant	50 dBA Intermittent 40 dBA Constant
Mixed-use	65 dBA Intermittent 55 dBA Constant	55 dBA Intermittent 45 dBA Constant
Multi-Family Residential (Interior Sound Source)	40 dBA Intermittent 35 dBA Constant	35 dBA Intermittent 30 dBA Constant
Commercial	65 dBA Intermittent 55 dBA Constant	65 dBA Intermittent 55 dBA Constant
Public Property	Most restrictive noise limit applicable to adjoining private property	Most restrictive noise limit applicable to adjoining private property

Note: "Daytime" means the period between 7:00 AM and 9:00 PM Sunday through Thursday and between 7:00 AM and 10:00 PM on Friday and Saturday. "Nighttime" means the period between 9:00 PM and 7:00 AM Sunday through Thursday and between 10:00 PM and 7:00 AM on Friday and Saturday.
Intermittent sound is defined as L_{max} and constant sound is defined as L_{eq}.
Source: San Rafael Municipal Code Section 8.13.040.

TABLE 4.10-6 STANDARD EXCEPTIONS TO GENERAL NOISE LIMITS ESTABLISHED BY SAN RAFAEL MUNICIPAL CODE

Type of Activity	Maximum Noise Level	Days/Hours Permitted
Construction	90 dBA (at any point outside of the construction property plane)[a]	Monday-Friday 7:00 AM-6:00 PM Saturday 9:00 AM-6:00 PM Sunday, Holiday—prohibited or as otherwise set by city approval

[a] Property plane means a vertical plane including the property line that determines the property boundaries in space.
Source: San Rafael Municipal Code Section 8.13.050.

Chapter 14.16 – Site and Use Regulations

Section 14.16.260 – Noise standards. Any new development located in a "conditionally acceptable" or "normally unacceptable" noise exposure area, based on the land use compatibility chart standards in the general plan, shall require an acoustical analysis. Noise mitigation features shall be incorporated where needed to assure consistency with general plan standards. New construction is prohibited in noise exposure areas where the land use compatibility chart indicates the noise exposure is "clearly unacceptable."

Section 14.16.260 also provides performance standards for noise from new nonresidential development consistent with General Plan Policy N-4, and traffic noise standards consistent with General Plan Policy N-5, which requires projects that are located in residential areas where ambient noise levels are 65 dBA L_{dn} or greater, and that have the potential to increase traffic noise levels by more than 3 dBA L_{dn}, to implement reasonable noise mitigation measures.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this evaluation and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a potentially significant noise or vibration impact if it would:

a) Result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

b) Result in generation of excessive groundborne vibration or groundborne noise levels;

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels; or

d) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.

Thresholds of Significance

To apply the significance criteria listed above, the analysis in this section uses the following significance thresholds, which are based on federal, state, and local regulations.

Construction Noise Thresholds

The San Rafael Municipal Code Section 8.13.050 states that construction noise shall not exceed 90 dBA L_{max} at any point outside of the construction site property plane. However, since there are no sensitive receptors at the property plane, for the purposes of this noise analysis, a potentially significant noise impact would be identified if project construction noise would cause exterior noise levels at nearby sensitive receptors to exceed 90 dBA L_{max}.

Operational Noise Thresholds

Consistent with San Rafael Municipal Code Section 8.13.040, permanent noise impacts from project operations (e.g., mechanical equipment) would be considered potentially significant if exterior noise levels could exceed 60 dBA L_{max}/50 dBA L_{eq} during daytime or 50 dBA L_{max}/40 dBA L_{eq} during nighttime at the nearest residential receptors, or if exterior noise levels could exceed 65 dBA L_{max}/55 dBA L_{eq} during both daytime and nighttime at the nearest commercial land uses.

Consistent with General Plan Policy N-5 and San Rafael Municipal Code Section 14.16.260, a significant noise impact would occur if the proposed project would increase traffic noise levels by more than 3 dBA L_{dn}, where exterior noise levels are 65 dBA L_{dn} or greater.

General Plan Policy N-4 does not apply to the proposed project. General Plan Policy N-4 specifies performance standards from new nonresidential development at both residential and nonresidential uses. However, it is indicated that these performance standards can be waived if the existing noise levels are higher according to item c of General Plan Policy N-4. Based on the results of the noise monitoring survey and the noise level contours presented in the General Plan, ambient noise levels in the vicinity of the proposed project are over 65 dBA L_{dn}, which is above the performance standards specified in General Plan Policy N-4: 60 dB L_{dn} at residential uses and 65 dB L_{dn} at office or retail uses. Therefore, these performance standards would not be applicable to the proposed project. Instead, the performance standards described above for noise from mechanical equipment and traffic would be used as the thresholds of significance for operational noise.

Vibration Thresholds

Consistent with guidance from the Federal Transit Administration (FTA), vibration impacts from the proposed project would be considered potentially significant if they would exceed the FTA's recommended vibration thresholds to prevent disturbance to people from "Infrequent Events" (see **Table 4.10-7**) or damage to buildings (see **Table 4.10-8**) (FTA, 2018). Specifically, the following thresholds are used for this analysis:

- 80 VdB at multi-family residential units and at the future proposed on-site Whistlestop/Eden Housing project where people normally sleep; and
- 0.3 in/sec PPV at both on-site and off-site buildings for potential cosmetic damage to occur.

TABLE 4.10-7 VIBRATION CRITERIA TO PREVENT DISTURBANCE – ROOT MEAN SQUARE (RMS) (VIBRATION DECIBELS [VDB])

Land Use Category	Frequent Events[a]	Occasional Events[b]	Infrequent Events[c]
Residences and buildings where people normally sleep	72	75	80

[a] More than 70 vibration events of the same kind per day or vibration generated by a long freight train.
[b] Between 30 and 70 vibration events of the same kind per day.
[c] Fewer than 30 vibration events of the same kind per day.
Source: FTA, 2018.

TABLE 4.10-8 VIBRATION CRITERIA TO PREVENT DAMAGE TO STRUCTURES

Building Category	Peak Particle Velocity (PPV) (Inches per Second)	Root Mean Square (RMS) (Vibration Decibels [VdB])
Reinforced-concrete, steel or timber (no plaster)	0.5	102
Engineered concrete and masonry (no plaster)	0.3	98
Non-engineered timber and masonry buildings	0.2	94
Buildings extremely susceptible to vibration damage	0.12	90

Source: FTA, 2018.

FTA does not provide vibration impact criteria to prevent disturbance for commercial locations including office buildings, and therefore vibration disturbance impacts at these receptors are not discussed further in this impact analysis. In addition, because sensitive receptors would be located on-site, and off-site sensitive receptors are also in close proximity to the project site, vibration disturbance effects at non-sensitive uses (commercial locations including office buildings) is not expected to exceed vibration disturbance effects at on-site or the nearest off-site sensitive receptors. If potentially significant vibration disturbance impact were identified at the sensitive receptors, mitigation measures would be developed to reduce the impact. These mitigation measures would also reduce vibration disturbance effects at non-sensitive uses.

Land Use Compatibility Thresholds

Consistent with General Plan Land Use Compatibility Standards (see Table 4.10-4), exposure of residential land uses to exterior noise levels of 75 dBA L_{dn} or above is considered clearly unacceptable (i.e., new construction of development clearly should not be undertaken). In this analysis, a significant land use compatibility impact would be identified if exterior noise would exceed 75 dBA L_{dn} where the Whistlestop/Eden Housing project would be located.

According to Table 4.10-4, exposure of bedrooms in residential units in downtown to interior noise levels of 45 dBA L_{dn} or above is considered clearly unacceptable. An interior noise level of 45 dBA L_{dn} or below for any habitable room is also required by the 2016 California Building Standards Code. In this analysis, a significant land use compatibility impact would be identified if interior noise would exceed 45 dBA L_{dn} at the project site where the Whistlestop/Eden Housing project would be located.

General Plan Land Use Compatibility Standards (see Table 4.10-4) specify that exposure of office and other commercial uses to exterior noise levels of 65 dBA L_{dn} or above is considered conditionally acceptable (i.e., specific land uses may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design). The 2016 California Building Standards Code requires that buildings containing non-residential uses (e.g., retail spaces and offices) that are exposed to exterior noise levels at or above 65 dBA L_{eq} or CNEL must maintain interior noise levels below 50 dBA L_{eq} in occupied areas during any hour of operation. In this analysis, a significant land use compatibility impact would occur if interior noise would exceed 50 dBA L_{dn}[5] at the project site where the BioMarin project would be located.

Less-than-Significant Impacts

Airport Noise

The project would not expose people residing or working in the project area to excessive airport noise levels.

The nearest private airstrip to the project site is the San Rafael Airport, approximately 3 miles to the north. A heliport is located approximately 2.6 miles southeast of the project site. The project site is located outside of the 60 dBA L_{dn} contour line of both San Rafael Airport and the heliport (City of San Rafael, 2017). The project site is not located within the vicinity of any other private airstrip (Federal Aviation Administration, 2019). Therefore, the proposed project would not expose people in the project area to excessive noise levels from any private airstrips.

The nearest public use airport to the project site is the Marin County Airport (also known as Gnoss Field) in Novato, approximately 12 miles to the north. The project site is not located in a land use

[5] For this analysis, Leq value is regarded same as L_{dn} value.

plan for Marin County Airport (Marin County Planning Department, 1991). Therefore, the proposed project would not expose people at the project site to excessive noise levels from any public use airports.

Operational Noise Related to Increased Traffic

Project-related traffic would not generate a substantial permanent increase in ambient noise levels in excess of standards established in San Rafael General Plan 2020 or the noise ordinance.

The proposed project would increase vehicle trip generation during operation. In this analysis, a significant noise impact would be identified if the proposed project would increase traffic noise levels by more than 3 dBA.

The assessment of the AM and PM peak hour traffic volumes at 36 intersections in the vicinity of the project site indicates that traffic volume increases would range from approximately 0 to 44 percent. The highest traffic volume increase of 44 percent would occur along Brooks Street between 3rd Street and 2nd Street during the AM peak hour. The predicted baseline[6] and baseline-plus-project traffic noise levels for this roadway segment are summarized in **Table 4.10-9** below. Traffic noise is expected to increase by about 0.7 dB along this roadway segment. As this segment would have the greatest predicted increase in traffic, traffic noise increases along other roadway segments affected by the proposed project would be less than 0.7 dB. This is below the 3 dBA significance threshold for project-generated traffic noise. Consequently, the proposed project would not result in a significant increase in traffic noise along local area roadways.

TABLE 4.10-9 BASELINE AND BASELINE-PLUS-PROJECT PEAK-HOUR TRAFFIC NOISE LEVELS FOR THE ROADWAY SEGMENT WITH HIGHEST INCREASE, DBA L_{EQ} AT 50 FEET

Roadway Segment	Baseline Traffic Noise Levels	Baseline-Plus-Project Traffic Noise Levels	Estimated Increase in Noise
Brooks Street between 3rd Street and 2nd Street (AM peak period)	50.8	51.5	0.7

Note: Traffic noise model outputs are included in Appendix C. FHWA TNM Version 2.5 model was used for these results.
Source: Fehr & Peers, 2019.

Land Use Compatibility

The project would not cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating a noise effect.

According to the traffic noise level contours of the General Plan, existing noise levels range from 65 dBA L_{dn} to 69 dBA L_{dn} in the northern portion of the project site and from 68 dBA L_{dn} to 72 dBA L_{dn} in the southern portion of the project site.

[6] Due to the normal fluctuations in traffic, the baseline scenario (as described in the traffic report as year 2023) is considered to be the “existing” condition for this analysis.

The Whistlestop/Eden Housing project, which includes residential land uses, would be located in the northern portion of the project site and therefore would be exposed to noise levels of 65 dBA L_{dn} to 69 dBA L_{dn}. The BioMarin project, which includes offices and commercial uses, would cover the entire eastern side of the project site and would be exposed to noise levels of 65 dBA L_{dn} to 72 dBA L_{dn}. According to the General Plan Land Use Compatibility Standards (see Table 4.10-4), these noise conditions are considered conditionally acceptable for both residential uses and office and other commercial uses. A typical building façade with windows closed provides a noise level reduction of approximately 25 dBA (Charles M. Salter Associates Inc., 1998), and therefore conventional construction would likely reduce the interior noise levels for the Whistlestop/Eden Housing project to 40 dBA L_{dn} to 44 dBA L_{dn}, which is consistent with the interior noise levels requirements of 45 dBA L_{dn} in the General Plan Land Use Compatibility Standards (see Table 4.10-4) and the 2016 California Building Standards Code for residential land uses. A typical building façade with windows closed would also reduce the interior noise levels for the BioMarin project to 40 to 47 dBA L_{dn}, which is consistent with the interior noise levels requirements of 50 dBA L_{dn} in 2016 California Building Standards Code for buildings containing non-residential uses. Therefore, impacts related to land use compatibility would be less than significant.

Potentially Significant Impacts

Construction Noise

Impact NOISE-1: Heavy equipment used in project construction could generate noise in excess of standards established in San Rafael General Plan 2020 or the noise ordinance. (PS)

Construction of the proposed project would involve the use of heavy construction equipment. Construction noise levels would vary from day to day, depending on the number and condition of the pieces of equipment being used, the types and duration of activity being performed, the distance between the noise source and the receptor, and the presence or absence of barriers, if any, between a noise source and a receptor.

Typical noise levels associated with various types of construction equipment that may be used during construction work at the project site are summarized in **Table 4.10-10**. In accordance with FTA guidance (FTA, 2018), the combined noise levels of the two noisiest pieces of equipment were calculated to represent the potential reasonable worst-case noise levels.[7] Table 4.11-10 also presents the buffer distance that would be required to reduce noise levels to below the 90 dBA L_{max} threshold for on-site and off-site receptors.

Impacts on Off-Site Sensitive Receptors

As discussed above, the nearest off-site sensitive receptors to the project site are multi-family residential units located approximately 70 feet at the closest distance to the south of the project site and Kaiser Permanente medical offices located approximately 75 feet at the closest distance to the west of the project site. Based on the buffer distances presented in Table 4.10-10, construction of the proposed project would not have the potential to generate construction noise that would exceed

[7] Noise levels are calculated based on the following equation: ($L = 10LOG10\left(\sum_{i=1}^{n} 10^{\left(\frac{Li}{10}\right)}\right)$).

TABLE 4.10-10 NOISE LEVELS FROM CONSTRUCTION EQUIPMENT (DBA L_{MAX})

Construction Phase	Equipment	Amount	Noise Level at 50 Feet (dBA L_{max})	Addition of Two Noisiest Pieces of Equipment at 50 Feet (dBA L_{max})[a]	Required Buffer Distance for Noise Levels to be Below 90 dBA L_{max}[b]
Site Preparation	Tractors/Loaders/Backhoes	4	80	88	40
	Rubber Tired Dozers	3	85		
Grading	Rubber Tired Dozers	1	85	88	40
	Tractors/Loaders/Backhoes	3	80		
	Graders	1	85		
	Excavators	1	85		
	Bore/Drill Rigs	1	85		
Building Construction	Cranes	1	83	86	35
	Tractors/Loaders/Backhoes	3	80		
	Welders	1	73		
	Generator Sets	1	81		
Architectural Coating	Air Compressors	1	81	81	20
Paving	Pavers	2	85	88	40
	Rollers	2	74		
	Paving Equipment	2	85		

[a] The combined noise levels of the two noisiest pieces of equipment from each phase were calculated. For architectural coating, noise levels for an air compressor were used because there is only one air compressor anticipated to be needed.
[b] Receptors within the buffer distance could be exposed to construction noise levels above 90 dBA L_{max}. The following propagation adjustment was applied to estimate buffer distances:
dBA2 = dBA1 + 10 Log10(D1/D2)^2
Where:
dBA1 is the reference noise level at a specified distance (in this case 50 feet).
dBA2 is 90 dBA L_{max}.
D1 is the reference distance (in this case 50 feet).
D2 is the buffer distance.
Source: The types of construction equipment are based on the California Emissions Estimator Model (CalEEMod) equipment list. A drill rig has been included in the assessment because torque down piles would be used.

90 dBA L_{max}, and therefore potential impacts related to construction noise on off-site sensitive receptors would be less than significant.

Impacts on On-Site Sensitive Receptors

During construction of BioMarin Building A and BioMarin Building B, future occupants of the Whistlestop/Eden Housing project could be present on-site and be located in close proximity to construction activities associated with BioMarin Building A and BioMarin Building B. It is conservatively assumed that on-site sensitive receptors could be located within the buffer distances presented in Table 4.10-10 and therefore, on-site sensitive receptors could be exposed to construction noise that would exceed 90 dBA L_{max}. Consistent with San Rafael Municipal Code Section 8.13.050, construction activity would be limited to 7:00 AM to 6:00 PM, Monday through Friday, and 9:00 AM to 6:00 PM on Saturday. No construction is allowed on Sundays or holidays or outside the weekday and Saturday hours described above, unless a request is made and approved by the Chief Building Official. These limits on construction activity timing would ensure that generating noise when it would be most objectionable to sensitive receptors would be avoided and would prevent the disturbance of sleep for a majority of both on-site and off-site residents.

General Plan Policy N-9 requires mitigation measures to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity. In addition, calculations in Table 4.10-10 indicate that construction noise could exceed 90 dBA Lmax at a future on-site sensitive receptor (the occupied Whistlestop/Eden Housing project) during construction of BioMarin Building A and BioMarin Building B, which would represent an exceedance of the construction noise threshold of significance.

The implementation of the following mitigation measures would address this construction noise impact.

Mitigation Measure NOISE-1a: The BioMarin project applicant shall require use of noise-reducing measures that may include the following and that shall be described and included in applicable contract specifications: After the Whistlestop/Eden Housing project is completed and housing residents, require that the construction contractor for BioMarin Building A and BioMarin Building B not operate more than one piece of noise-generating equipment (listed in Table 4.10-10) within 40 feet of the Whistlestop/Eden Housing project. This would ensure that the 90 dBA L_{max} is not exceeded at the Whistlestop/Eden Housing project.

Mitigation Measure NOISE-1b: The BioMarin and Whistlestop/Eden Housing project applicants shall require use of noise-reducing measures that may include the following and that shall be described and included in applicable contract specifications:

1. *Equip internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and are appropriate for the equipment.*
2. *Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from noise-sensitive land uses. Muffle the stationary equipment, and enclose within temporary sheds or surround by insulation barriers, if feasible.*
3. *To the extent feasible, establish construction staging areas at locations that would create the greatest distance between the construction-related noise sources and noise-sensitive receptors during all project construction.*
4. *Use "quiet" air compressors and other stationary noise sources where technology exists.*
5. *Construct or use temporary noise barriers, as needed, to shield on-site construction and demolition noise from noise-sensitive areas to the extent feasible. To be most effective, the barrier should be placed as close as possible to the noise source or the sensitive receptor. Examples of barriers include portable acoustically lined enclosure/housing for specific*

equipment (e.g., jackhammer and pneumatic-air tools, which generate the loudest noise), temporary noise barriers (e.g., solid plywood fences or portable panel systems, minimum 8 feet in height), and/or acoustical blankets, as feasible.

6. *Control noise levels from workers' amplified music so that sounds are not audible to sensitive receptors in the vicinity.*
7. *Prohibit all unnecessary idling of internal combustion engines.*

Mitigation Measure NOISE-1c: The BioMarin and Whistlestop/Eden Housing construction contractors shall develop a set of procedures that are described and included in applicable contract specifications for tracking and responding to complaints received pertaining to construction vibration and noise, and shall implement the procedures during construction. At a minimum, the procedures shall include:

1. *Designation of an on-site construction complaint and enforcement manager for the project.*
2. *Protocols specific to on-site and off-site receptors for receiving, responding to, and tracking received complaints. The construction complaint and enforcement manager shall promptly respond to any complaints and work cooperatively with affected receptors to ensure that the source of the noise- or vibration-generating activity is discontinued or determine an acceptable schedule to resume the activity when the receptor is not present in the residence.*
3. *Maintenance of a complaint log that records what complaints were received and how these complaints were addressed.*

Mitigation Measure NOISE-1d: Nearby residents shall be informed by posting informational notices on the fence line of the construction site. The notice shall state the date of planned construction activity and include the contact information of the construction complaint and disturbance coordinator identified in Mitigation Measure NOISE-1b.

The above measures shall be included in contract specifications. In addition, an independent construction monitor shall conduct periodic site inspections, but in no event fewer than four total inspections, during the course of construction to ensure these mitigation measures are implemented and shall issue a letter report to the City of San Rafael Building Division documenting the inspection results. Reports indicating non-compliance with construction mitigation measures shall be cause to issue a stop work order until such time as compliance is achieved.

The combination of the four mitigation measures above would reduce the impact to a less-than-significant level. (LTS)

Operational Noise Related to Mechanical Equipment

Impact NOISE-2: The project's mechanical equipment could generate operational noise in excess of standards established in San Rafael General Plan 2020 or the noise ordinance. (PS)

The operation of the new buildings would include the use of new mechanical heating, ventilation, and air conditioning (HVAC) systems. Information regarding the noise-generating characteristics and locations of the equipment was not available at the time this analysis was conducted. Without standard controls in place, noise from mechanical equipment could potentially exceed 60 dBA L_{max}/50 dBA L_{eq} during daytime or 50 dBA L_{max}/40 dBA L_{eq} during nighttime at the nearest residential receptors and could exceed 65 dBA L_{max}/55 dBA L_{eq} during both daytime and nighttime at the nearest commercial land uses. This is a potentially significant impact. Mitigation Measure NOISE-1 would ensure that appropriate noise controls on mechanical equipment are applied, and would reduce this potential impact to a less-than-significant level.

> *Mitigation Measure NOISE-2: The project applicants shall use mechanical equipment selection and acoustical shielding to ensure that noise levels from the installation of mechanical equipment do not exceed the exterior noise standards of 60 dBA L_{max}/50 dBA L_{eq} during daytime or 50 dBA L_{max}/40 dBA L_{eq} during nighttime at the nearest residential land uses, and do not exceed the exterior noise standards of 65 dBA L_{max}/55 dBA L_{eq} during both daytime and nighttime at the nearest commercial land uses. Controls that would typically be incorporated to attain this outcome include locating equipment in less noise-sensitive areas, when feasible; selecting quiet equipment; and providing sound attenuators on fans, sound attenuator packages for cooling towers and emergency generators, acoustical screen walls, and equipment enclosures. (LTS)*

Construction Vibration

Impact NOISE-3: Project construction could expose persons to or generate excessive groundborne vibration levels. (PS)

Construction activities associated with the proposed project would result in varying degrees of groundborne vibration, depending on the equipment, activity, and soil conditions. Once constructed, the operation of the proposed project would not cause any vibration or result in excessive vibration impacts because no vibration-generating activities or land uses would occur on the project site.

Construction activities could require the use of vibratory rollers, jackhammers, or other high-power or vibratory tools, and the use of mobile construction equipment, such as bulldozers, which can generate vibration in the immediate vicinity of the work area. **Table 4.10-11** presents published reference vibration levels at 25 feet from the types of construction equipment that could be used during construction of the proposed project. Table 4.10-11 also presents the buffer distance that would be required to reduce vibration levels to below the 80 VdB threshold that could disturb sensitive receptors, and the 0.3 in/sec PPV threshold for both on-site and off-site potential building damage. The impacts associated with vibration disturbance and vibration damage are discussed in detail below.

Vibration Disturbance

Off-Site Sensitive Receptors. As discussed above, off-site multi-family residential units are located approximately 70 feet at the closest distance to the south of the project site. Based on the buffer distances presented in Table 4.10-11, construction for the proposed project would have the potential to generate construction vibration that would exceed 80 VdB, and therefore could cause disturbance to off-site sensitive receptors.

TABLE 4.10-11 VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

			Buffer Distances for Vibration Disturbance (Feet)	Buffer Distances for Vibration Damage (Feet)
Equipment	**PPV at 25 Feet[a] (in/sec)**	**RMS at 25 Feet[b] (VdB)**	**On-Site and Off-Site Receptors (80 VdB Threshold)**	**On-Site and Off-Site Receptors (0.3 in/sec PPV Threshold)**
Vibratory roller	0.210	94	73	18
Large bulldozer	0.089	87	43	8
Caisson drilling	0.089	87	43	8
Loaded trucks	0.076	86	40	7
Jackhammer	0.035	79	23	4
Small bulldozer	0.003	58	5	1

Notes: Receptors within the buffer distance could be affected by construction-generated vibration. Consistent with guidance from the Federal Transit Administration (FTA), the 80 VdB threshold is used for on-site and off-site receptors where people normally sleep.
[a] PPV = peak particle velocity, in/sec = inches per second,
[b] RMS = root mean square, VdB = vibration decibel
PPV2 = PPV1 x (D1/D2)^1.1
Where:
PPV1 is the reference vibration level at a specified distance, and PPV2 is the calculated vibration level.
D1 is the reference distance (in this case 25 feet), and D2 is the distance from the equipment to the receiver.
RMS2 = RMS1 – 30 Log10 (D2/D1)
Where:
RMS1 is the reference vibration level at a specified distance, and RMS2 is the calculated vibration level.
D1 is the reference distance (in this case 25 feet, and D2 is the distance from the equipment to the receiver.
Source of Equation: FTA, 2018. Section 7; Caltrans, 2013.

On-Site Sensitive Receptors. During construction of BioMarin Building A and BioMarin Building B, future occupants of the Whistlestop/Eden Housing project could be located in close proximity to BioMarin Building A and BioMarin Building B. It is conservatively assumed that on-site future occupants of the Whistlestop/Eden Housing project could be located within the buffer distances presented in Table 4.10-11; therefore, they could be exposed to construction vibration that would exceed 80 VdB and therefore could be subject to disturbance.

It should be noted that the 73-foot buffer distance is conservatively calculated based on the construction equipment that would generate the highest level of vibration (i.e., vibratory roller) being operated at the construction zone boundary; however, the locations of construction equipment would vary over time, and the equipment with the potential to generate the highest vibration levels would not be in use every day. Therefore, the construction vibration impact at any given receptor would generally be limited in both frequency and duration. In addition, the limitation of construction activity to the hours between 7:00 AM to 6:00 PM, Monday through Friday, and 9:00 AM to 6:00 PM on Saturday would limit any impacts to normal daytime hours, thereby reducing the likelihood of disturbing residents (i.e., through interfering with sleep).

Implementation of the following mitigation measures would further reduce the potential vibration impacts by ensuring that any affected sensitive receptors would have the ability to lodge complaints and that responses to the complaints would be provided.

> *Mitigation Measure NOISE-3: Mitigation Measures NOISE-1a through NOISE-1d shall be implemented. (LTS)*

Vibration Damage

Off-Site Buildings. Based on the buffer distances presented in Table 4.10-11, construction for the proposed project would not have the potential to generate vibration that could damage off-site buildings because there are no off-site buildings located within 18 feet of the project site.

On-Site Buildings. During construction of BioMarin Building A, the Whistlestop/Eden Housing building would be located in close proximity to the construction activity. During construction of BioMarin Building B, the Whistlestop/Eden Housing building and the BioMarin Building A would be located in close proximity to the construction activity. Therefore, on-site buildings could be subject to potentially damaging levels of vibration during construction of the proposed project. However, consideration of damage to buildings on the developer's own property is a standard part of the design and review process for a development. This process would ensure that existing buildings remain in good condition both during and after construction of the proposed project and any post-construction repairs that are necessary would be made. Therefore, the potential impact on on-site buildings from vibratory damage during project construction would be less than significant.

Cumulative Impacts

For noise and vibration, the geographic scope for assessing cumulative impacts is the near vicinity of the project. Noise and vibration dissipate with increased distance from the source; therefore, cumulative noise and vibration impacts would not be expected unless new sources of noise are located in close proximity to each other.

Cumulative Construction-Phase Impacts

The closest approved or pending project to the project site is the San Rafael Corporate Center (SRCC) project (see Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR), which is located approximately 340 feet south from project site. At this distance, cumulative construction noise and vibration could affect the off-site sensitive receptor between the two sites (multi-family residential units along 2nd Street). However, the SRCC project would be subject to San Rafael Municipal Code requirements to limit construction to daytime hours and to limit construction noise to 90 dBA L_{max} at the multi-family residential units along 2nd Street. The closest point from the multi-family residential units to the SRCC project would be at a distance of 120 feet from the proposed project. At this distance, the highest construction noise levels from the proposed project would generate noise levels of 80 dBA L_{max}.[8] Note that the closest point from the multi-family residential units to the

[8] The following propagation adjustment was applied to estimate noise levels at 120 feet, considering noise levels of 88 dBA Lmax at 50 feet from the proposed project:

dBA2 = dBA1 + 10 Log10(D1/D2)^2

Where:

dBA1 is the reference noise level at a specified distance (in this case 50 feet).

SRCC project would be on the other side of the building, which is not facing the proposed project. Therefore, construction noise from the proposed project would likely be shielded by the exterior wall of the multi-family residential units that faces the project site. A barrier would provide 5 dBA of reduction if it breaks line-of-sight from the source to the receiver, and therefore construction noise levels from the proposed project would be reduced to 75 dBA L_{max} at the closest point from the multi-family residential units to the SRCC project. Because 75 dBA L_{max} is 10 dBA or more lower than 90 dBA L_{max}, it makes no perceptible difference in what can be heard or measured. Therefore, the combination of construction noise levels from both projects at the receiver would not exceed 90 dBA L_{max}. Therefore, compliance with the San Rafael Municipal Code requirements for construction noise would reduce the potential cumulative construction noise impact of the SRCC project and the proposed project to a less-than-significant level.

All the other approved or pending projects are located at least 550 feet from the project site and would be separated from the project site by multiple blocks of buildings. As indicated in Table 4.10-10, any construction phase of the proposed project could generate noise levels of 88 dBA L_{max} at 50 feet. Noise levels at a known distance from point sources are reduced by 6 dBA for every doubling of that distance for hard surfaces. Therefore, at a distance of 550 feet, any construction phase would generate noise levels of below 70 dBA L_{max}, which is similar to ambient noise levels. In addition, multiple blocks of buildings would shield construction noise. Three rows of buildings would reduce noise by approximately 11 dBA (Charles M. Salter Associates, 1998). As a result, with the shielding provided by the multiple rows of buildings in between the project site and other cumulative project sites, construction noise from the proposed project would be 10 dBA lower than ambient noise levels and would not be audible at the other cumulative projects. Therefore, there would be no potential cumulative noise impact.

Cumulative Operational-Phase Impacts

The approved or pending projects include the construction of a parking garage, a transit center, and land uses with primarily indoor uses (office space, residences). Therefore, the primary source of permanent noise from these projects would be HVAC systems, which would be subject to the noise limits specified in the San Rafael Municipal Code (see Table 4.10-5). Compliance with the San Rafael Municipal Code requirements would reduce potential cumulative permanent noise impacts to a less-than-significant level.

Construction and operation of the approved or pending projects would include residential and commercial development that would result in increased traffic along local roadways. Under a cumulative scenario, which considers traffic generated by past, present, and probable future projects, including the proposed project, the assessment of AM and PM peak hour traffic volumes at 36 intersections in the vicinity of the project site indicates that the most affected locations (those with the highest traffic noise increase) would be:

- In the parking lot on Brooks Street to the north of 3rd Street both during AM peak hour and during PM peak hour; and
- On Brooks Street between 3rd Street and 2nd Street during AM peak hour.

dBA2 is noise levels to be calculated.
D1 is the reference distance (in this case 50 feet).
D2 is 120 feet.

As presented in **Table 4.10-12**, traffic noise is expected to increase by about 3 dB in the parking lot on Brooks Street to the north of 3rd Street both during AM peak hour and during PM peak hour. A 3 dB increase is a just-perceivable difference, and therefore there could be a noticeable increase in traffic noise in this parking lot under cumulative scenario. However, as shown in Table 4.10-12, the project's contribution to this 3 dB increase would be zero (the difference between noise levels of the cumulative-plus-project scenario and cumulative scenario). Therefore, the project would not contribute to the cumulative impact at this location.

TABLE 4.10-12 EXISTING AND CUMULATIVE PLUS PROJECT PEAK-HOUR TRAFFIC NOISE LEVELS FOR THE ROADWAY SEGMENT WITH HIGHEST INCREASE, DBA L_{EQ} AT 50 FEET

Roadway Segment	Existing Traffic Noise Levels (A)	Cumulative Traffic Noise Levels (B)	Cumulative Plus Project Traffic Noise Levels (C)	Cumulative Traffic Noise Increase (C-A)	Project Contribution (C-B)
Parking lot on Brooks Street to the north of 3rd Street (AM peak period)	39.8	42.8	42.8	3	0
Parking lot on Brooks Street to the north of 3rd Street (PM peak period)	41.6	44.6	44.6	3	0
Brooks Street between 3rd Street and 2nd Street (AM peak period)	50.8	50.8	51.5	0.7	0.7

Note: Traffic noise model outputs are included in Appendix C. FHWA TNM Version 2.5 model was used for these results.
Source: Fehr & Peers, 2019.

With regards to Brooks Street between 3rd Street and 2nd Street, traffic generated by past, present, and probable future projects, including the proposed project, is expected to result in an increase of about 0.7 dB, which would not be a perceivable noise difference.

As these are the roadway segments with the greatest predicted increase in traffic volume, traffic noise increases along other roadway segments would be less than 0.7 dB, which is below the just-perceivable threshold of 3 dB.

Therefore, while a potentially significant cumulative traffic noise increase could occur in the parking lot on Brooks Street to the north of 3rd Street both during AM peak hour and during PM peak hour, the proposed project would not result in a cumulatively considerable contribution to the impact.

REFERENCES

California Code of Regulations, Title 24, Part 2, Volume 1, Section 1207.4.

California Department of Transportation (Caltrans), 1998. Technical Noise Supplement-A Technical Supplement to the Traffic Noise Analysis Protocol.

California Department of Transportation (Caltrans), 2013. Transportation and Construction Vibration Guidance Manual, September.

California Noise Control Act, California Health & Safety Code, Sections 46000-46080

California Code of Regulations, Title 8, Subchapter 7, Group 15, Article 105.

California Office of Planning and Research (OPR), 2017. State of California General Plan Guidelines.

Charles M. Salter Associates, 1998. Acoustics – Architecture, Engineering, the Environment.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Reprinted April 28.

City of San Rafael, Municipal Code, Sections 8.13 & 14.16

Federal Aviation Administration (FAA), 2019. Airport Data and Contact Information. Effective: March 28, 2019. Database searched for both public-use and private-use facilities in Marin County. Website: http://www.faa.gov/airports/airport_safety/airportdata_5010/, accessed on April 20, 2019.

Federal Transit Administration (FTA), 2018. Transit Noise and Vibration Impact Assessment Manual. FTA Report No.0123, September.

Fehr & Peers, 2019. *Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion,* April 5.

Marin County Planning Department, 1991. *Airport Land Use Plan, Marin County Airport Gnoss Field,* June 10.

National Cooperative Highway Research Program (NCHRP), 1999. Mitigation of Nighttime Construction Noise, Vibrations, and Other Nuisances. NCHRP Synthesis 218.

4.11 PUBLIC SERVICES

INTRODUCTION

This section of the DEIR describes the existing setting and potential impacts on fire protection and police services that could result from the project.

ENVIRONMENTAL SETTING

Fire Protection and Emergency Medical Services

The San Rafael Fire Department (Fire Department) provides fire protection and emergency services within the San Rafael city limits.

Facilities

The Fire Department operates seven fire stations. The closest fire stations to the project site are Stations 51 and 52, both located about 0.5 mile from the project site. Both stations are in temporary locations while the City's new Public Safety Center at 1313 5th Avenue and other station improvements are under construction. Station 51 is temporarily located at 1151 C Street about 0.5 mile northwest of the project site. Station 52 is temporarily located at 519 Fourth Street about 0.5 mile northeast of the project site while the Station 52 facility at 210 3rd Street, about 0.7 mile east the site, is being rebuilt (San Rafael Fire Department, 2019a, 2019b; Sinnott, 2019a).

Once completed, the new 44,000-square-foot Public Safety Center located at 1309 5th Avenue will house Fire Department and Police Department operations, including the Fire Department's main station (Sinnott, 2019a). The Public Safety Center will be about 0.5 mile northwest of the project site.

Staffing

The Fire Department maintains a staff of 66 full-time firefighters, 60 of whom are certified paramedics. Six to nine paramedics are on duty at all times. The Fire Department seeks to maintain an on-duty paramedic on every fire engine company. Approximately 70 percent of all calls for Fire Department service require emergency medical services (Sinnott, 2019a).

The City of San Rafael partners with the City of Larkspur to allow the sharing of chief fire department officers across jurisdictional lines. The Fire Unified Command Agreement with the City of Larkspur permits the respective fire chiefs to assist each other's agencies (City of San Rafael, 2015).

Response Times

The Fire Department conforms to NFPA 1710 (Deployment of Fire Suppression Operations) for response time standards. Travel distance to the project site from the nearest fire station is less than 1 mile (Sinnott, 2019a).

Fire Hydrant at Project Site

A fire hydrant is located at the corner of 2nd Street and Brooks Street, immediately adjoining the project site.

Police Services

The San Rafael Police Department (Police Department) provides crime prevention and law enforcement services within the San Rafael city limits.

Facilities and Staffing

The Police Department operates one police station, located at 1400 5th Avenue in San Rafael approximately about 0.5 mile northwest of the project site (San Rafael Police Department, 2019). As noted under "Fire Protection and Emergency Medical Services" above, a new 44,000-square-foot Public Safety Center is currently under construction at 1309 5th Avenue and will house Police Department and Fire Department operations.

The Police Department employs 89 personnel comprised of 65 sworn officers and 24 civilian employees. This staffing level translates to 1.2 officers per 1,000 residents, based on San Rafael's resident population of 53,363 (Holton, 2019).

Response Times

The Police Department has response time goals of 3 minutes for Priority One calls (emergency calls, such as robbery or assault in progress), 7 minutes for Priority Two calls (primarily calls about property, car, and home burglaries), and 30 minutes for Priority Three calls (requests for information, theft reports). The Police Department currently meets service standard goals for Priority One and Priority Two calls (Nichols-Berman, 2004; Holton, 2019).

REGULATORY FRAMEWORK

Federal and State Regulations

No federal regulations related to fire protection or police services would apply to the project. The project would be required to comply with applicable California Fire Code regulations.

Local Regulations and Policies

San Rafael General Plan 2020

San Rafael General Plan 2020 (General Plan) policies that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact related to fire protection and police services consist of the following (City of San Rafael, 2017):

Policy S-26 **Fire and Police Services.** Maintain adequate cost-effective fire protection, paramedic and police services. Minimize increases in service needs from new development through fire prevention and community policing programs.

Program S-26c **Fire Prevention and Safe Design.** Through the development review process, require review by Fire Department and Police Department for fire prevention and safe design.

Policy S-32 **Safety Review of Development Projects.** Require crime prevention and fire prevention techniques in new development, including adequate access for emergency vehicles.

Program S-32a **Safe Buildings.** Continue to review development applications to insure that landscaping, lighting, building siting and design, emergency access, adequate water pressure and peak load storage capacity, and building construction materials reduce the opportunity for crime and fire hazards.

San Rafael Fire Department Standard Conditions of Approval

In its review of development proposals (including the proposed project), the Fire Department recommends standard conditions of approval that address site design and building construction, emergency access, and fire hydrant types and locations. Among other requirements, the standard conditions of approval require that the design and construction of all site alterations comply with the 2016 California Fire Code and City of San Rafael Ordinances and Amendments. The Fire Department recommends the standard conditions to ensure that projects comply with the California Code of Regulations, Title 24 (Sinnott, 2019a).

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this DEIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on public services if it would:

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services: fire protection; police protection; …

For fire protection and police services, Appendix G further provides that a project would have a significant impact if it would:

b) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or

c) Result in inadequate emergency access.

Emergency response/evacuation and emergency access issues are addressed in Section 4.7, Hazards and Hazardous Materials, and Section 4.13, Transportation, of this DEIR.

Less-than-Significant Impacts

Impacts on Fire Protection Services

The project would increase the demand for fire protection services, but not to the extent that new or physically altered fire stations would be needed.

As discussed in Chapter 3, Project Description, the Whistlestop/Eden Housing project would have approximately 80 residents (in a total of 67 units) and 17 employees who would be employed at the Healthy Aging Center, Monday through Friday from 8:00 AM to 5:00 PM. Ten of these employees would move from the existing Whistlestop building on Tamalpais Avenue.

The BioMarin project would have up to approximately 550 new employees who would work on the site generally from 8:00 AM to 5:00 PM, with some employees working outside of these standard work hours. Of the approximately 550 employees, about 140 employees would use the research and development (R&D) areas, 400 employees would be in the office areas, and 10 employees would be in the retail area. Public use could occur in the commercial (café) areas on the site (3,500 square feet) and the public plaza area. It is estimated that additional members of the public could use the BioMarin cafe during various times of the day.

The project could generate new demand for fire protection services, including increased calls for service. This new demand would not be large enough to require new or physically altered fire protection facilities or equipment, however. The project would not require the hiring of any additional firefighters, and no new or upgraded facilities would be necessary (Sinnott, 2019a).

As part of the standard development review process that applies to all projects, the project would be required to conform to Fire Department requirements for features such as building construction, emergency access, and fire hydrants. These provisions would help ensure consistency with General Plan policies and programs regarding fire protection service (see "Regulatory Framework" above). The requirements are expected to include installation of a new fire hydrant at the corner of 3rd Street and Brooks Street. The Fire Department is planning to require this new hydrant as part of a Marin Municipal Water District (MMWD) water main replacement along the portion of 3rd Street that adjoins the project site. The water main replacement would occur in 2020 (Sinnott, 2019b).

In addition, at the time of building permit issuance, the project applicants would pay development impact fees of $0.12 per square foot of commercial space, $0.06 per square foot of industrial space, and $128.50 per bedroom for residential uses. The City of San Rafael would use these funds to cover the costs of the project's impact on public facilities and services within the city, including on-going costs of fire protection services (City of San Rafael, 2018).

For these reasons, the project's impact on fire protection services would be less than significant, and no mitigation is necessary.

Impacts on Police Services

The project would increase the demand for police services, but not to the extent that new or physically altered police stations would be needed.

As discussed above and in Chapter 3, Project Description, the Whistlestop/Eden Housing project would have approximately 80 residents (in a total of 67 units) and 17 employees who would be employed at the Healthy Aging Center, Monday through Friday from 8:00 AM to 5:00 PM. Ten of these employees would move from the existing Whistlestop building on Tamalpais Avenue. The BioMarin project would have up to approximately 550 new employees who would work on the site generally from 8:00 AM to 5:00 PM, with some employees working outside of these standard work hours. Of the approximately 550 employees, about 140 employees would use the R&D areas, 400 employees would be in the office areas, and 10 employees would be in the retail area. Public use could occur in the commercial (café) areas on the site (3,500 square feet) and the public plaza area. It is estimated that additional members of the public could use the BioMarin cafe during various times of the day.

The project could generate new demand for police services, including increased calls for service and response to traffic-related issues. This new demand would not be large enough to require new or physically altered police facilities or equipment, however. The project would not require the hiring of any additional officers, and no new or upgraded police facilities would be necessary (Holton, 2019).

As part of the standard development review process that applies to all projects, the project would be required to conform to Police Department requirements for features such as emergency access, building security, and address visibility (Holton, 2019). These provisions would help ensure consistency with General Plan policies and programs regarding police service (see "Regulatory Framework" above).

In addition, at the time of building permit issuance, the project applicants would pay development impact fees of $0.12 per square foot of commercial space, $0.06 per square foot of industrial space, and $128.50 per bedroom for residential uses. The City of San Rafael would use these funds to cover the costs of the project's impact on public facilities and services within the city, including on-going costs of police services (City of San Rafael, 2018).

For these reasons, the project's impact on police services would be less than significant, and no mitigation is necessary.

Potentially Significant Impacts

The project would not have any potentially significant impacts on fire protection or police services.

Cumulative Impacts

For fire protection and police services, the geographic scope for assessing cumulative impacts is the area within the San Rafael city limits, which is served by the Fire Department and the l Police Department. In San Rafael, approved or currently pending development includes approximately 161 housing units, 72,000 square feet of office space, 2,000 square feet of retail space, a 140-room hotel, an 88-bed assisted living facility, a 600-space garage expansion, relocation of the San Rafael Transit Center (also known as the C. Paul Bettini Transportation Center), and construction of the City's new Public Safety Center (see Table 6-1 and Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR).

The project, in conjunction with other past, present, and probable future projects, could result in a cumulative increase in demand for fire protection and police services. As discussed in the above analysis, however, service demands from the project would not affect these services enough to create the need for new or expanded facilities. The project would be subject to Fire Code requirements and other standard requirements for features such as emergency access, signage, lighting, and security. Other projects in the San Rafael city limits would also be subject to these standard requirements, along with development impact fees that are used by the City to cover the cost of project impacts on public facilities and services. In addition, citywide voter approval of Measure E in 2013 has provided additional funds to preserve essential City services for a period of 20 years. Measure E funds, which are collected through sales tax, are instrumental in ensuring earthquake-safe police and fire stations and maintaining police and fire staffing and response times (City of San Rafael, 2015).

For these reasons, the project would not result in or contribute to any significant cumulative fire protection or police service impacts.

REFERENCES

City of San Rafael, 2015. *San Rafael General Plan 10-Year Status Report, Public Review Draft*, May. Website: http://docs.cityofsanrafael.org/CommDev/planning/GP2020Report/San-Rafael-GP-Status-Report.pdf, pages 4 and 5, accessed on March 14, 2019.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28, 2017, pages 280 and 282.

City of San Rafael, 2018. "Development Impact Fees." Website: https://storage.googleapis.com/proudcity/sanrafaelca/uploads/2018/09/Development-Impact-Fees-Handout.pdf, last updated September 28, 2018, accessed on March 14, 2019.

Holton, Lisa, San Rafael Police Department, 2019. E-mail re. "BioMarin EIR – Police Impacts," April 18.

Nichols-Berman, 2004. *San Rafael General Plan 2020 General Plan Update Draft Environmental Impact Report*, February, pages IV.5-3 through IV.5-4.

San Rafael Fire Department, 2019a. "Essential Facilities." Website: https://www.cityofsanrafael.org/departments/facilities/, accessed on March 14, 2019.

San Rafael Fire Department, 2019b. "Temporary Fire Station Relocations." Website: https://www.cityofsanrafael.org/temporary-fire-station-relocations/, accessed on March 14, 2019.

San Rafael Police Department, 2019. "Community Policing." Website: https://www.srpd.org/faq#About the Police Department, accessed on March 14, 2019.

Sinnott, Robert, San Rafael Fire Department, 2019a. E-mail re. "BioMarin EIR – Fire Impacts," March 28.

Sinnott, Robert, San Rafael Fire Department, 2019b. E-mail re. "MMWD 3rd Street Pipeline Replacement Project," January 15.

4.12 RECREATION

INTRODUCTION

This section of the DEIR describes park and recreation facilities in the project site vicinity and the project's potential impacts on these facilities.

ENVIRONMENTAL SETTING

City of San Rafael Parks and Recreational Facilities

The City of San Rafael provides local parks and recreational facilities within San Rafael, including 19 neighborhood parks and six community parks. The parks and recreational facilities closest to the project site include 11.5-acre Albert Park and the San Rafael Community Center about 0.5 mile south of the site. In addition, Davidson Middle School, operated by San Rafael City Schools, is located 0.5 mile south of the project site and provides recreational opportunities for the community (City of San Rafael, 2017).

County and State Parks and Recreational Facilities

The County of Marin provides eight parks in the San Rafael vicinity, including 55-acre McNear's Beach located approximately 5 miles east of the project site and 450-acre McGinnis Park located about 5 miles northeast of the site. In addition, 1,640-acre China Camp State Park is located about 6 miles northeast of the site (City of San Rafael, 2017).

San Francisco Bay Trail

The San Francisco Bay Trail alignment currently runs east-west about 0.2 mile east of the project site, along 2nd and 3rd Streets east of Tamalpais Avenue and along Tamalpais Avenue between 2nd and 3rd Streets. The San Francisco Bay Trail is a planned recreational corridor that, when complete, will encircle San Francisco and San Pablo bays. The Bay Trail is administered by the Association of Bay Area Governments (ABAG) (City of San Rafael, 2012).

Existing Project Site and Whistlestop Facilities

The project site is vacant and does not contain recreational facilities or any other development.

The existing Whistlestop facility, located at 930 Tamalpais Avenue about 0.3 mile east of the project site, provides recreational opportunities such as classes and other activities for older adults and people with disabilities in Marin County (Dyett & Bhatia, 2018).

REGULATORY FRAMEWORK

Federal and State Regulations

There are no federal or state regulations that are relevant to the project's potential impacts on parks and recreational facilities.

Local Regulations and Policies

San Rafael General Plan 2020

San Rafael General Plan 2020 policies that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact related to parks and recreational facilities consist of the following (City of San Rafael, 2017):

Policy CD-14 **Recreational Areas.** In multifamily development, require private outdoor areas and on-site common spaces for low and medium densities. In high density and mixed-use development, private and/or common outdoor spaces are encouraged. Common spaces may include recreation facilities, gathering spaces, and site amenities such as picnicking and play areas.

Program CD-14a **On-Site Recreational Areas**. Continue requirements for on-site recreational areas as specified in the zoning ordinance.

Policy PR-1 **Standards.** Maintain, and where possible exceed, a recreation standard of three acres of park and recreation facilities per 1,000 residents.

Policy PR-10 **Onsite Recreation Facilities.** Require onsite recreation facilities in new multifamily residential projects and encourage construction of onsite recreation facilities in existing multifamily residential projects, where appropriate.

Program PR-10a **Onsite Recreation Facilities**. Continue to implement zoning regulations to require appropriate recreational facilities.

Policy PR-13 **Commercial Recreation.** Encourage private sector development of commercial recreational facilities to serve community needs by: …

b. Encouraging major employers to provide for the recreational needs of their employees on site or in conjunction with City recreation facilities or programs.

Program PR-13a **Commercial Recreation**. Consider amending the zoning ordinance to allow a floor area ratio exemption for on-site recreational facilities open to the public.

Policy PR-25 **Contributions by Ownership Residential Development.** Require developers of new residential housing to provide for the recreational needs of future residents of that development in accordance with Recreation Element standards and Quimby Act Subdivision Parkland Dedication Requirements. Needs would be satisfied by the dedication of land and development of recreation facilities to serve the new residents. In-lieu fees will be required if a finding is made that dedication and development of parkland is not a feasible or appropriate option.

Program PR-25a **Parkland Dedication Ordinance.** Maintain and update as necessary the Parkland Dedication Ordinance.

Park Impact Fees

For new residential subdivisions that would create dwelling units for purchase, Chapter 15.09 of the City of San Rafael's Subdivision Ordinance requires a parkland dedication fee of $1,967.98 per dwelling unit. This fee is used for acquisition and improvement of parkland to serve the additional population generated by new development (City of San Rafael, 2018). This fee would not apply to the residential (Whistlestop) component of the proposed project, however, because the proposed dwelling units would not be for purchase. However, a bedroom tax of $127.50 per bedroom would apply.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this DEIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on parks and recreational facilities if it would:

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services;

b) Increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; or

c) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

Less-than-Significant Impacts

The project would not increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated or such that new or altered facilities would be needed.

As discussed in Chapter 3, Project Description, the Whistlestop/Eden Housing project would have approximately 80 residents (in a total of 67 units) and 17 employees who would be employed at the Healthy Aging Center, Monday through Friday from 8:00 AM to 5:00 PM, Monday through Friday. Ten of these employees would move from the existing Whistlestop building on Tamalpais Avenue. The BioMarin project would have up to approximately 550 new employees who would work on the site generally from 8:00 AM to 5:00 PM Monday through Friday, with some employees working outside of these standard work hours. Of the approximately 550 employees, about 140 employees would use the research and development (R&D) areas, 400 employees would be in the office areas, and 10 employees would be in the retail area. Public use could occur in the commercial (café) areas on the site (3,500 square feet) and the public plaza area. It is estimated that additional members of the public could use the BioMarin cafe during various times of the day.

The project would include the following on-site recreational facilities and services (Dyett & Bhatia, 2018; BioMarin and Whistlestop/Eden Housing, 2019):

- As part of the BioMarin project: (1) a 6,000-square-foot outdoor landscaped courtyard, open to the public during daytime hours, at the corner of 3rd Street and Lindaro Street; (2) a redwood grove at the corner of 2nd Street and Lindaro Street, adjacent to BioMarin Building B; and (3) a fitness center for employees.
- As part of the Whistlestop/Eden Housing project: (1) a Healthy Aging Center that would include classrooms, a dance/exercise studio, and meeting rooms; and (2) amenities for residents, including a community room, computer center, library, and landscaped courtyards with community gardens.

The proposed on-site recreational facilities and services are expected to be adequate to serve the needs of the on-site population. While the project could result in an increase in use of nearby parks and recreational facilities, this increase would not be large enough to result in the need for new or altered parks or cause deterioration of existing parks or recreational facilities. The project would not create any conflicts with San Rafael General Plan 2020 policies for recreational facilities. The impact would be less than significant, and no mitigation is necessary.

The project would include recreational facilities and would not require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

The project would include on-site recreational facilities. The environmental impacts of constructing these facilities are evaluated throughout this DEIR as part of the analysis of the project as a whole. The proposed on-site recreational facilities would not have any specific adverse physical effects on the environment. The recreational needs of the project's population would be met on-site, and the project would not create a need for construction or expansion of other recreational facilities.

Potentially Significant Impacts

The project would not have any potentially significant impacts related to recreation.

Cumulative Impacts

For recreation, the scope for assessing cumulative impacts is the area within the San Rafael city limits and immediately surrounding area, since this area contains the recreational facilities that are most likely to be used by residents, employees, and project occupants. In San Rafael, approved or currently pending development includes approximately 161 housing units, 72,000 square feet of office space, 2,000 square feet of retail space, a 140-room hotel, an 88-bed assisted living facility, a 600-space garage expansion, relocation of the San Rafael Transit Center (also known as the C. Paul Bettini Transportation Center), and construction of the City's new Public Safety Center (see Table 6-1 and Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR).

The project, in conjunction with other past, present, and probable future projects, could result in a cumulative increase in demand for recreational facilities in the area. The cumulative increase in demand would result from the project along with existing and future development in the area, particularly residential development.

As discussed in the above analysis, however, demand from the project would not result in a significant impact on recreational facilities or create the need for new or expanded facilities, because the recreational needs of residents, employees, and other project occupants would be met on-site.

In addition, anticipated residential projects in San Rafael and other cities would be subject to each city's respective standard requirements for parkland dedication or in-lieu payment of fees to fund parks and recreational facilities.

For these reasons, the project would not result in or contribute to any significant cumulative recreation impacts.

REFERENCES

BioMarin and Whistlestop/Eden Housing, 2019. "List of Needed Material for EIR," final as of April 2.

City of San Rafael, 2012. *San Rafael Downtown Station Area Plan,* Approved Final Draft, June 4, 2012, page 104.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Amended and reprinted April 8, 2017, pages 139, 252, 255, 259, 260, 262, and 263.

City of San Rafael, 2018. "Development Impact Fees." Website: https://storage.googleapis.com/proudcity/sanrafaelca/uploads/2018/09/Development-Impact-Fees-Handout.pdf, last updated September 28, 2018.

Dyett & Bhatia, 2018. "Project Description: BioMarin Planned Development Expansion and Whistlestop Healthy Aging Center and Affordable Senior Housing, 999 3rd Street San Rafael," October 5, 2018, page 1.

4.13 TRANSPORTATION

INTRODUCTION

This section describes existing transportation conditions near the project site, summarizes applicable jurisdictional laws and regulations associated with transportation, and presents the significance criteria for transportation-related environmental impacts. This section also describes analysis methodologies and identifies the potential transportation effects of the project. The transportation evaluation includes estimates of vehicle trip generation and distribution and an assessment of potential traffic impacts under near-term and cumulative growth conditions. Potential effects on pedestrians, bicycles, and public transit are also evaluated. The project's potential contribution to vehicle miles traveled (VMT) is discussed. Measures to mitigate potential transportation impacts are recommended, as appropriate.

This section references information contained in the *Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion Revised* report (Fehr & Peers, 2019) (see **Appendix D**). The phrase *Transportation Impact Study* is used within this section to reference this report.

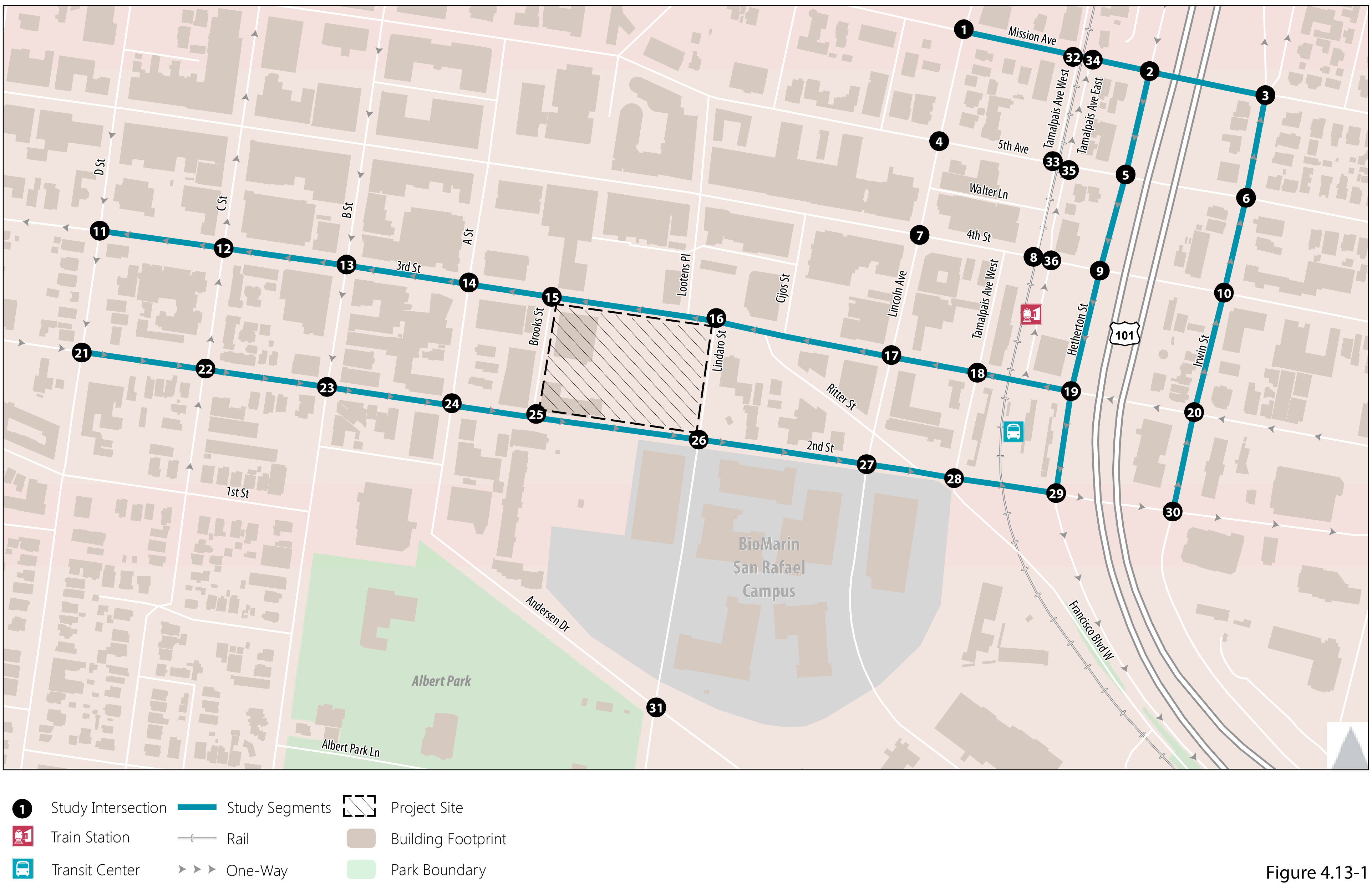
ENVIRONMENTAL SETTING

The project site is in downtown San Rafael and occupies about 3 acres, bounded by 3rd Street to the north, 2nd Street to the south, Brooks Street to the west, and Lindaro Street to the east as shown in **Figure 4.13-1**. The site is currently vacant and was formerly occupied by PG&E. The San Rafael Transit Center (also known as the C. Paul Bettini Transportation Center) and the Sonoma-Marin Area Rail Transit (SMART) San Rafael downtown train station are approximately two blocks east of the site. The U.S. Highway 101 (US 101)/2nd Street interchange is located about three blocks to the east. The site is also adjacent to the existing BioMarin San Rafael Corporate Center (SRCC) campus located south of 2nd Street.

Roadway Network and Operations

The local circulation system near the project site is shown in Figure 4.13-1. The site is in downtown San Rafael and west of US 101. The following roadways provide local access to the project site; all these streets have sidewalks along both sides unless otherwise noted:

- 3rd Street is primarily a three-lane one-way street that serves westbound traffic. 3rd Street widens from two lanes to three lanes at Grand Avenue and then continues under the freeway into downtown. At E Street, 3rd Street reduces to two lanes and then merges with 2nd Street just west of Hayes Street. On-street parking is prohibited along the north side of 3rd Street and the south side of 3rd Street east of Lindaro Street.
- 2nd Street is primarily a three-lane one-way street that serves eastbound traffic. 2nd Street separates from 3rd Street and widens to three lanes just east of Miramar Avenue and continues through downtown San Rafael. At Grand Avenue, 2nd Street reduces to two lanes and then merges with 3rd Street just west of Union Street. On-street parking is prohibited along 2nd Street.



SOURCE: Fehr & Peers, 2019

Figure 4.13-1

STUDY INTERSECTIONS AND ARTERIAL ROADWAY SEGMENTS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

There are no sidewalks on the north side of 2nd Street between Lincoln Avenue and Ritter Street and the south side of 2nd Street between Francisco Boulevard West and Irwin Street.

- Brooks Street is a one-block-long two-way street with one travel lane in each direction that runs north-south between 2nd Street and 3rd Street. On-street parking is prohibited except for three spaces along the east curb just south of 3rd Street.
- Lindaro Street is a two-way street that has one travel lane in each direction and runs north-south from 3rd Street to Woodland Avenue. The crosswalk on the west leg of the intersection with 3rd Street is unmarked. Lindaro Street passes through the existing BioMarin SRCC campus between 2nd Street and Andersen Drive. On-street parking is allowed along both the east and west sides of the street.

Thirty-six intersections were studied in the *Transportation Impact Study*. Existing weekday AM and PM peak hour traffic counts and intersection service levels are provided in the *Transportation Impact Study*. All 36 study intersections currently operate at acceptable level of service (LOS).[1] (Applicable significance criteria are discussed later in this section.)

Six arterial roadway segments were evaluated in the *Transportation Impact Study*. Each of the segments operates acceptably, except for 2nd Street between D Street and the Hetherton Street/US 101 southbound ramp intersection. During both the weekday AM and PM peak hours, this segment currently functions at LOS E with average travel speeds ranging from 7 to 9 miles per hour (mph).

The *Transportation Impact Study* assessed the operations of US 101 between I-580 and Lincoln Avenue. During the weekday peak hours, each of the segments operates acceptably except for southbound US 101 between the 2nd Street on-ramp and off-ramp to eastbound I-580. During the AM peak hour, the highway weaving segment[2] functions at LOS F.

Pedestrian and Bicycle Network

Pedestrian Network

Sidewalks are present along both sides of the roadways near the project site except for the following:

- South side of Ritter Street between Lincoln Avenue and 2nd Street
- North side of 2nd Street between Lincoln Avenue and Ritter Street
- South side of 2nd Street between Francisco Boulevard West and Irwin Street
- Sections of Tamalpais Avenue adjacent to the railroad tracks between Mission Avenue and 3rd Street

[1] Level of service (LOS) is a qualitative measure used to describe the quality of motor vehicle traffic service. Level of service is used to analyze roadways and intersections by categorizing traffic flow and assigning quality levels of traffic based on performance measures such as vehicle speed, density, and congestion.

[2] Weaving is defined as the crossing of two or more traffic streams travelling in the same general direction along a significant length of highway.

Adjacent to the project site, crosswalks are available as follows (see **Figure 4.13-2**):

- *3rd Street and Brooks Street:* No crosswalks are marked on any of the three legs of the intersection. Pedestrian crossing of 3rd Street is prohibited on both the west and east legs. The nearest available marked crossings of 3rd Street are at A Street about 220 feet to the west and at Lindaro Street about 450 feet to the east. An unmarked crosswalk[3] is also at Lootens Place, 370 feet to the east.
- *3rd Street and Lootens Place:* A crosswalk is marked on the north leg only; the west and east legs are unmarked. The nearest available marked crosswalks across 3rd Street are at Lindaro Street about 90 feet to the east and A Street about 590 feet to the west.
- *3rd Street and Lindaro Street:* Crosswalks are marked on the south and east legs only; the west leg is unmarked.
- *2nd Street and Brooks Street:* A crosswalk is marked on the north leg only; the west and east legs of the intersection, which span 2nd Street, are unmarked. The nearest available marked crosswalks across 2nd Street are at A Street about 220 feet to the west and Lindaro Street about 450 feet to the east.
- *2nd Street and Lindaro Street:* Crosswalks are marked on all four legs.

None of the curb ramps at the corners of the intersections peripheral to the project site are Americans with Disabilities Act (ADA)-compliant.

Pedestrian volumes were counted at the four intersections adjacent to the project site and are included in the *Transportation Impact Study*.

Bicycle Network

The existing bicycle network near the project site is limited to the following:

- 4th Street is classified as a Class III bikeway (bike route) between 2nd Street and Tamalpais Avenue East and between Irwin Street and Union Street; segments of this bikeway have shared lane use markings.
- Lincoln Avenue is classified as a Class III bikeway from 2nd Street to Irwin Street.
- Andersen Drive has westbound Class II bike lanes between A Street and Lindaro Street and is a Class III bikeway with shared lane use markings eastbound.
- The Puerto Suello Hill Pathway (Class I bike path) passes through the study area

The Marin County Bicycle Coalition (MCBC) map identifies Mission Avenue as the primary east-west on-street bikeway route through the study area. The MCBC map identifies Lincoln Avenue, Andersen Drive, Irwin Street, and D Street as primary north-south on-street bikeway routes.

The 2018 San Rafael *Bicycle and Pedestrian Plan Update* (City of San Rafael, 2018) proposes a feasibility study for an east-west bikeway through downtown along 4th Street. New north-south bicycle connections are proposed along D Street and C Street (Class IV protected bikeway couplet

[3] An unmarked crosswalk refers to any area, not marked, that is implicitly defined by the law as a crosswalk. For example, an unmarked crosswalk usually exists where one road meets another.

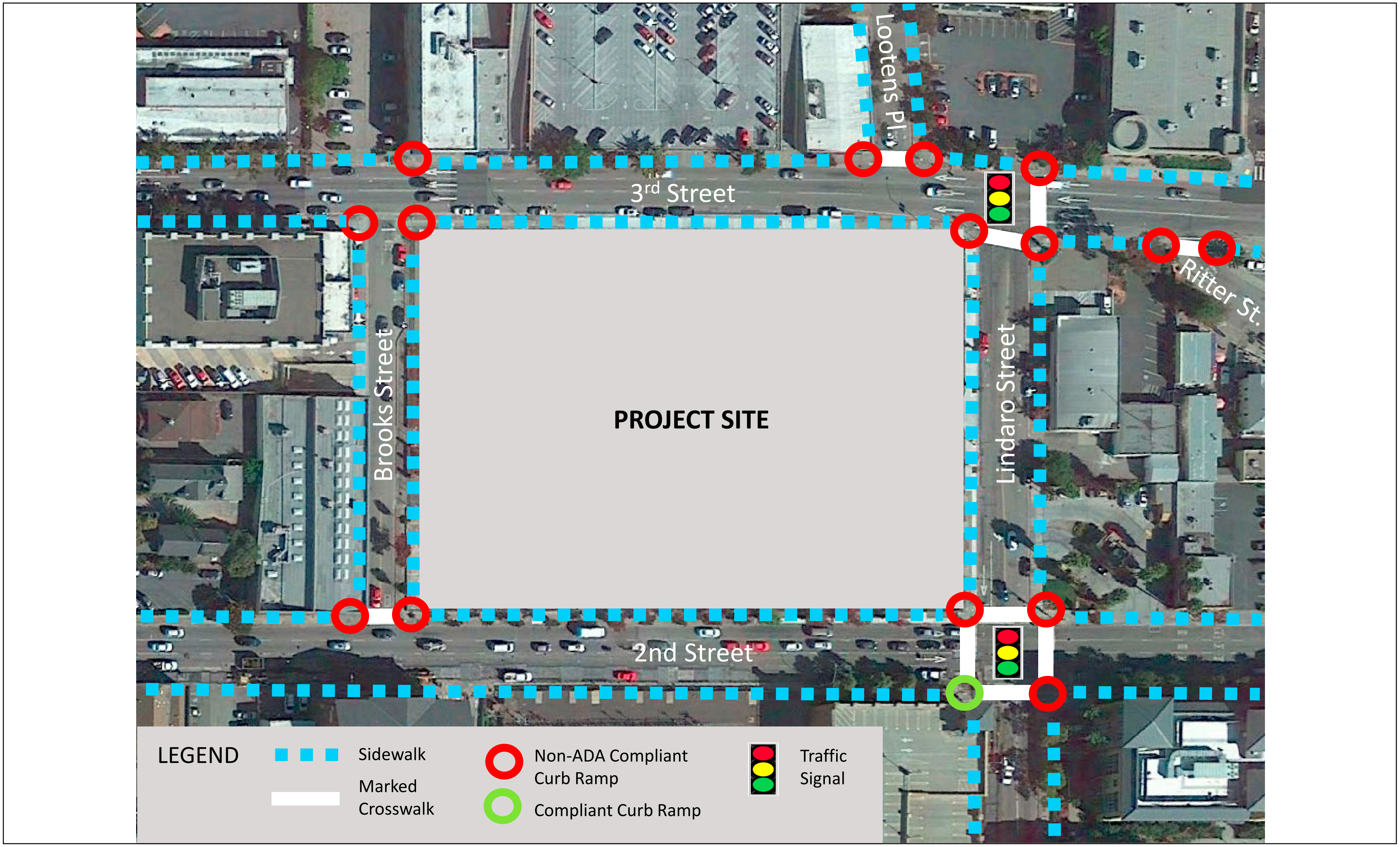


Figure 4.13-2

SOURCE: Parisi Transportation Consulting, 2019

STUDY AREA PEDESTRIAN NETWORK

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

or Class III bicycle boulevard) and Tamalpais Avenue West ((Class IV separated bikeway). The plan also proposes US 101 undercrossing improvements at 3rd Street, 4th Street, 5th Avenue, and Mission Avenue that would benefit bicyclists and pedestrians.

Public Transit Network

Existing public transit service within the study area is provided by bus at the San Rafael Transit Center on Tamalpais Avenue about two blocks, or 800 feet, east of the project site. A total of 13 Marin Transit routes, eight Golden Gate Transit routes, and one Sonoma County Transit route currently serve the transit center. Greyhound also serves the center, as do airport bus companies and taxis. The transit center includes shelters and benches.

The current transit center will be affected by the extension of the Sonoma-Marin Area Rail Transit (SMART) system to the Larkspur Ferry Terminus at Larkspur Landing, so a new transit center site will be required soon. The location of the new transit center will be in proximity to the existing center. Several alternative locations are under consideration and the ultimate site should be selected by late 2019 (Golden Gate Bridge Highway and Transportation District, 2019).

The SMART downtown station is also located about two blocks (950 feet) east of the project site. The train provides service to cities to the north, including Novato, Petaluma, Santa Rosa, and the Sonoma County Airport. SMART operates 34 daily weekday trains and 10 daily trains on weekends and holidays. Weekday trains operate every 30 minutes in each direction from about 5:30 to 10:00 AM and from 3:30 to 9:30 PM, with limited midday service. Construction work is currently underway on the SMART extension to Larkspur, necessitating temporary changes and permanent relocation of the existing San Rafael Transit Center, as previously discussed.

Collision History

Collisions reported to occur at the study intersections between 2015 and 2017 were reviewed as part of the *Transportation Impact Study*. Of the intersections adjacent to the project site, 2nd Street/Lindaro Street had four reported collisions, with the most common types being rear-end and broadside collisions and with unsafe speed cited as a collision factor. The intersection of 3rd Street and Hetherton Street had the most collisions over the three-year period, with a total of 12 reported collisions. Five of these collisions involved pedestrians or bicyclists and one of those included a pedestrian fatality.

REGULATORY FRAMEWORK

Federal and State Regulations

The California Department of Transportation (Caltrans) is responsible for planning, designing, building, operating, and maintaining California's State Highway System. US 101 is managed by Caltrans and is part of the California Freeway and Expressway System.

The Caltrans *Guide for the Preparation of Traffic Impact Studies* (Caltrans, 2002) provides guidance on the analysis of the potential impacts of a project on the State Highway System. A traffic analysis is warranted if:

- The project would generate 100 peak hour trips assigned to a State Highway System;
- The project would generate 50 to 100 peak hour trips assigned to a State Highway facility, and the affected highway facilities are experiencing a noticeable delay approaching unstable traffic flow (level of service [LOS] C or D) conditions; or
- The project would generate 1 to 49 peak hour trips assigned to a State Highway facility, and the affected highway facilities are experiencing significant delay, unstable or forced traffic flow (LOS E or F conditions) (Caltrans, 2002).

Regional Regulations

The Metropolitan Transportation Commission (MTC) is the transportation planning, coordinating, and financing agency for the nine-county San Francisco Bay Area. MTC prepares a 25-year Regional Transportation Plan that guides funding priorities for regional development of mass transit, highway, airport, seaport, railroad, bicycle, and pedestrian facilities.

Local Regulations and Policies

Transportation Authority of Marin

The Transportation Authority of Marin (TAM) is a Joint Powers Agency established between Marin County and all cities within the county, including the City of San Rafael, to address Marin's unique transportation issues and to fulfill the legislative requirements of California Propositions 111 and 116 (approved in June 1990). As the Congestion Management Agency (CMA) for Marin County, TAM maintains the Congestion Management Plan (CMP) (Transportation Authority of Marin, 2017).

As identified by TAM in the *Final Report 2017 CMP Update Marin County* (Transportation Authority of Marin, 2017), regional roadways within the project site vicinity that are part of the CMP network include both 2nd Street and 3rd Street between US 101 and Marquard Street. Eighteen of the project's study intersections are included in these segments of the CMP network. The CMP arterial level of service thresholds are consistent with those provided in the Highway Capacity Manual. Local cities and towns must consider the impacts of land use changes on the arterial level of service within the designated CMP network (Transportation Authority of Marin, 2017).

San Rafael General Plan 2020

San Rafael General Plan 2020 (General Plan) contains goals, policies, and programs that guide the City's land use and development policy. The plan addresses various state-mandated elements including, but not limited to, Circulation and Infrastructure; and Land Use, Community Design and Neighborhoods (City of San Rafael, 2017).

The Circulation Element of the General Plan contains a range of policies and implementation programs designed to maintain or improve transportation circulation within the city. Relevant policies and programs provided by the Circulation Element include the following:

Policy C-4 **Safe Roadway Design.** Design of roadways should be safe and convenient for motor vehicles, transit, bicycles and pedestrians. Place highest priority on safety. In order to maximize safety and multimodal mobility, the City Council may determine that an intersection is exempt from the applicable intersection level of service standard where it is determined that a circulation improvement is needed for public safety considerations, including bicycle and pedestrian safety, and/or transit use improvements.

Program C-4a **Street Pattern and Traffic Flow.** Support efforts by the City Traffic Engineer to configure or re-configure street patterns so as to improve traffic flow and turning movements in balance with safety considerations and the desire not to widen roads.

Program C-4b **Street Design Criteria to Support Alternative Modes.** Establish street design criteria to the extent permitted by State law to support alternative transportation modes to better meet user needs and minimize conflicts between competing modes.

Program C-4c **Appropriate LOS Standards.** At the time City Council approves a roadway improvement and safety exemption from the applicable LOS standard, the appropriate LOS will be established for the intersection.

Policy C-5 **Traffic Level of Service Standards.**

A. **Intersection LOS.** In order to ensure an effective roadway network, maintain adequate traffic levels of service (LOS) consistent with standards for signalized intersections in the AM and PM peak hours, i.e., LOS D Citywide except as noted for the Mission Avenue/Irwin Street (LOS F), and 3rd Street/Union Street (LOS E).

C. **Exemptions.** Signalized intersections at Highway 101 and Interstate 580 on-ramps and off-ramps are exempt from LOS standards because delay at these locations is affected by regional traffic and not significantly impacted by local measures.

D. **Evaluation of Project Merits.** In order to balance the City's objectives to provide affordable housing, maintain a vital economy and provide desired community services with the need to manage traffic congestion, projects that would exceed the level of service standards set forth above may be approved if the City Council finds that the benefits of the project to the community outweigh the resulting traffic impacts.

Program C-5a **LOS Methodology.** Use appropriate methodologies for calculating traffic Levels of Service, as determined by the City Traffic Engineer.

Program C-5c **Exception Review.** When the City Council finds that a project provides significant community benefits yet would result in a deviation from the LOS standards, the City Council may approve such a project through adoption of findings, based on substantial evidence, that the specific economic, social, technological and/or other benefits of the project to the community substantially outweigh the project's impacts on circulation, and that all feasible mitigation measures have been required of the project.

Policy C-7 **Circulation Improvements Funding.** Take a strong advocacy role in securing funding for planned circulation improvements. Continue to seek comprehensive funding that includes Federal, State, County, and Redevelopment funding, Local Traffic Mitigation Fees, and Assessment Districts. The local development projects' share of responsibility to fund improvements is based on: (1) the generation of additional traffic that creates the need for the improvement; (2) the improvement's role in the overall traffic network; (3) the probability of securing funding from alternative sources; and (4) the timing of the improvement.

Program C-7a **Traffic Mitigation Fees.** Continue to implement and periodically update the City's Traffic Mitigation Program.

Program C-7b **Circulation Improvements.** Seek funding for and construct circulation improvements needed for safety, to improve circulation, or to maintain traffic level of service.

Policy C-11 **Alternative Transportation Mode Users.** Encourage and promote individuals to use alternative modes of transportation, such as regional and local transit, carpooling, bicycling, walking and use of low-impact alternative vehicles. Support development of programs that provide incentives for individuals to choose alternative modes.

Program C-11e **Reduction of Single Occupancy Vehicles.** Encourage developers of new projects in San Rafael, including City projects, to provide improvements that reduce the use of single occupancy vehicles. These improvements could include preferential parking spaces for carpools, bicycle storage and parking facilities, and bus stop shelters.

City of San Rafael Bicycle and Pedestrian Master Plan Update

The City of San Rafael's *Bicycle and Pedestrian Plan Update* (City of San Rafael, 2018) documents the conditions for bicycling and walking as of 2018 and outlines steps to improve safety, act on community needs, and improve the mobility options for San Rafael residents, workers, and visitors.

Proposed projects identified in the *Bicycle and Pedestrian Plan Update* that are in the vicinity of the project site include those shown in **Table 4.13-1**.

TABLE 4.13-1 PROPOSED BICYCLE AND PEDESTRIAN PROJECTS IN CENTRAL SAN RAFAEL

ID	Corridor/ Primary	Begin/At	End	Class/Type	Notes
D-1	Downtown East-West Connection [Commercial Connector]	4th Street/2nd Street	Union Street	(to be determined)	Study the feasibility of an east-west bikeway through downtown San Rafael that can comfortably accommodate people of all ages and bicycling ability.
D-2	West Tamalpais Ave. [North/South Greenway]	2nd Street	Mission Avenue	Class IV	Convert West Tamalpais Avenue into a one-way street in the southbound direction; create a Class IV protected bikeway between West Tamalpais and SMART right-of-way.
D-8	2nd Street	US 101 Under-Crossing	Not applicable	Under-crossing	Study potential pedestrian improvements for US 101 undercrossing on 2nd Street, including walkway, lighting and public art.
D-9	2nd Street	US 101 On-Ramp	Not applicable	Intersection	Study pedestrian crossing improvements for 2nd Street at the US 101 on-ramp.
D-10	2nd Street	US 101 Off-Ramp	Not applicable	Intersection	Study pedestrian crossing improvements for 2nd Street at the US 101 off-ramp.
D-13	Andersen Drive	Lindaro Street	Not applicable	Intersection	Create diagonal path through intersection to connect the Mahon Creek Connector to the Albert Park Path.
D-18	Francisco Boulevard West	2nd Street	Andersen Drive	Class I	Extend SMART pathway from Downtown SMART station to existing Cal Park Hill Pathway.
D-19	Andersen Drive [North/South Greenway]	Francisco Boulevard West	Not applicable	Intersection	Realign Andersen Drive for at-grade rail crossing.
D-20	US 101 Under-Crossings	Not applicable	Not applicable	Intersection	Study potential lighting and public art at US 101 undercrossing, including at 3rd Street.
D-29	3rd Street	Hetherton Street	Not applicable	Intersection	Eliminate the left-turn pocket from 3rd Street onto Hetherton Street and add a leading pedestrian interval.

Source: Bicycle and Pedestrian Plan Update (City of San Rafael, 2018).

San Rafael Municipal Code

As discussed later in this section, the San Rafael Municipal Code, which includes the Zoning Ordinance, contains sections related to transportation and parking. The City's parking standards, set forth in Chapter 14.18 of the Zoning Ordinance, outline requirements for off-street vehicle parking for new construction, additions, and change in occupancy. Chapter 5.8.1 of the Municipal Code sets forth trip reduction and travel demand requirements for large employers (100 or more employees) at the site (City of San Rafael, 2016).

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

CEQA Guidelines Significance Criteria

For the purposes of this DEIR and based on CEQA Guidelines, implementation of the proposed project would have a significant effect on transportation and traffic if it would:

a) Conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities;

b) Conflict or be inconsistent with CEQA Guidelines Section 15064.3, Subdivision (b);

c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment); or

d) Result in inadequate emergency access.

CEQA Guidelines Section 15064.3, Subdivision (b) refers to guidelines relating to analyzing potential impacts using VMT as a threshold of significance. Please note that these guidelines will go into effect in the City of San Rafael by July 1, 2020. In the interim, the City of San Rafael's significant criteria related to level of service for traffic performance will still be applied and are used within this document. An assessment of the project's potential effect on VMT is included in this section for informational purposes.

City of San Rafael and Marin County Congestion Management Plan Significance Thresholds

Thresholds of significance were applied to assess if the implementation of the proposed project would result in a significant transportation impact. The General Plan and its EIR, and the Marin County Congestion Management Plan, were used to develop the following criteria and thresholds.

<u>Signalized Intersections</u>

According to the General Plan, the citywide signalized intersection level of service (LOS) standard is LOS D except as follows:

- LOS E is the standard in downtown San Rafael at Irwin Street and Grand Street between 2nd Street and Mission Avenue, 3rd Street/Union Street (maximum of 70 seconds of delay during peak hours), Andersen Drive/Francisco Boulevard West, Andersen Drive/Bellam Boulevard, Freitas Parkway/Civic Center Drive/Redwood Highway, Merrydale Road/Civic Center Drive, and Merrydale Road/Las Gallinas.
- LOS F is the standard at Mission Avenue/Irwin Street.
- Signalized intersections at US 101 and I-580 on-ramps and off-ramps are exempt from level of service standards because delay at these intersections is affected by regional traffic and is not significantly affected by local measures.

The General Plan EIR defines the following as significant impacts:

- If a signalized intersection is operating at an acceptable level of service with baseline traffic volumes and would deteriorate to an unacceptable operation with the additional of project traffic; or
- If a signalized intersection is at an unacceptable level of service with baseline traffic volumes and project traffic would cause an increase in the delay of five seconds or more.

The analysis methods used to evaluate signalized intersection performance are described in the *Transportation Impact Study*.

Unsignalized Intersections

Consistent with the General Plan EIR, a significant impact at an unsignalized intersection would occur:

- If an unsignalized intersection is operating at an acceptable level of service with baseline traffic volumes and would deteriorate to an unacceptable operation with the addition of project traffic; or
- If an unsignalized intersection is already operating at an unacceptable level of service with baseline traffic volumes and project traffic would cause an increase in the delay of five seconds or more.

The methods used to evaluate unsignalized intersection performance are described in the *Transportation Impact Study*.

Arterial Roadway Segments

According to the General Plan, the citywide level of service standard for arterial roadways is LOS D except as noted below (Congestion Management Segments are west of US 101):

- LOS E is the standard downtown, excluding Congestion Management Segments.
- LOS D is the standard on Congestion Management Segments (2nd, 3rd, and 4th Streets).
- LOS F is the standard on arterials operating at LOS E outside of Downtown, or at LOS F elsewhere.

For the arterial roadway segments in this section, the applied standard is LOS D for 2nd Street and 3rd Street, LOS E for eastbound Mission Avenue, and LOS F for all other arterial roadway segments.

For the purposes of the analysis presented herein, consistent with the General Plan and the 2017 Marin County Congestion Management Plan Update, a significant impact on an arterial roadway would occur:

- If an arterial is operating at an acceptable level of service with baseline traffic volumes and would deteriorate to an unacceptable operation with the addition of project traffic.
- If an arterial is already at an unacceptable level of service with baseline traffic volumes and the project impact would cause a decrease in the calculated average travel speed of 5 mph or more (City arterials) or 0.05 volume-to-capacity (V/C) or more (Congestion Management arterials).

The methodologies used to assess arterial roadway segment performance are described in the *Transportation Impact Study*.

Freeway Segments

The Marin County Congestion Management Plan establishes LOS E as the threshold for US 101 through San Rafael. The General Plan EIR defines the following as significant impacts:

- If a freeway segment is operating at an acceptable level of service (LOS A, B, C, D, or E) with baseline traffic volumes and would deteriorate to an unacceptable operation (LOS F) with the addition of project traffic.
- If a freeway segment is already operating at LOS F with baseline traffic volumes and there would be an increase in the V/C of 0.01 or more with the addition of project traffic.

The methods used to evaluate freeway segment performance are described in the *Transportation Impact Study*.

Pedestrian and Bicycle Facilities

The General Plan includes the following goals for bicycle and pedestrian conditions:

- *Goal 16 – Bikeways:* It is the goal of San Rafael to have safe, convenient and attractive bikeways and amenities.
- *Goal 17 – Pedestrian Paths:* It is the goal of San Rafael to have safe, convenient and pleasurable pedestrian amenities.

Consistent with these goals, bicycle and pedestrian impacts would be significant if the project:

- Would cause a substantial inconvenience or substantial reduction in quality of service for users of existing bicycle or pedestrian travel facilities;
- Would substantially reduce bicycle or pedestrian access; or
- Would substantially reduce safety for bicyclists or pedestrians.

Public Transit

The General Plan includes the following goal related to the public transit network:

- *C-14 Transit Network:* Encourage the continued development of a safe, efficient, and reliable regional and local transit network to provide convenient alternatives to driving.

Consistent with this goal, transit impacts would be significant if the project:

- Would induce substantial growth or concentration of population beyond the capacity of existing or planned public transit facilities;
- Would increase demand for public transit service to such a degree that accepted service standards are not maintained; or
- Would reduce availability of public transit to users or interfere with existing transit users.

Baseline and Baseline-Plus-Project Conditions

The Baseline scenario includes traffic volume increases and changes estimated to occur in the next few years just prior to the proposed project's opening. These increased traffic volumes would be associated with approved but not yet constructed land use developments, approved and funded transportation system improvements, and traffic increases expected due to regional growth. The traffic generated by these projects added to existing traffic would constitute the Baseline scenario. Projects included in the Baseline scenario are:

- Seagate apartments, 703 3rd Street.
- Senior assisted housing, 1203 Lincoln Avenue.
- Addition of a leading pedestrian interval to the intersection of 3rd Street and Tamalpais Avenue West.
- Addition of a second northbound-to-eastbound right-turn lane at the US 101 northbound off-ramp at 2nd Street.
- SMART train extension to Larkspur Ferry Terminus.

Baseline-Plus-Project conditions include Baseline conditions plus the project's effects on transportation, including vehicle travel, bicycle and pedestrian travel.

Vehicle Travel

Vehicle trip generation estimates for the project were developed based on several factors, including traffic counts at the existing BioMarin campus in San Rafael, travel surveys administered to current BioMarin San Rafael employees, and the consideration of trip rates from the Institute of Transportation Engineers' (ITE) *Trip Generation Manual 10th Edition* for research and development centers, senior adult housing and associated recreational community centers (Institute of Transportation Engineers, 2017). A detailed discussion of the methods used for estimating the project's vehicle trips is included in the *Transportation Impact Study*. **Table 4.13-2** summarizes the estimated vehicle trip generation for the project, including both the BioMarin facility and the senior center and housing.

TABLE 4.13-2 WEEKDAY VEHICLE TRIP GENERATION SUMMARY

		AM Peak Hour			PM Peak Hour		
Land Use	**Daily**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**
BioMarin Project	1,863	203	185	18	191	17	174
Whistlestop/Eden Housing Project (Senior Center and Housing)	590	33	19	14	45	23	22
Totals	**2,453**	**236**	**204**	**32**	**236**	**40**	**196**

Source: Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion Revised (Fehr & Peers, April 8, 2019) (see **Appendix D**).

The project is estimated to generate a total of 2,453 weekday vehicle trips, with 1,863 trips attributable to the BioMarin project and 590 trips to the Whistlestop/Eden Housing project. A total of 236 vehicle trips are estimated to be generated the AM peak hour, inclusive of 203 BioMarin trips and 33 Whistlestop/Eden Housing trips. In the PM peak hour, 236 vehicle trips are also estimated, with 191 BioMarin trips and 45 Whistlestop/Eden Housing trips.

The number of vehicle trips estimated to be generated by the BioMarin project are 13 to 16 percent less than would be estimated using ITE trip generation rates directly. As discussed in the *Transportation Impact Study*, this is due to BioMarin's location in downtown San Rafael near a regional transit center and because it is assumed BioMarin would continue to implement and promote its Transportation Demand Management (TDM) program.

As described in the *Transportation Impact Study*, the project's vehicle trips were assigned to the study area roadway and intersection network. Because parking at the project site would be limited to 29 parking spaces, most BioMarin employees would use the BioMarin garage at 775 Lindaro Street. All Whistlestop/Eden Housing employees would be assumed to use the Brooks Street driveways.

The following sections summarize Baseline and Baseline-Plus-Project conditions on the surrounding transportation network. Detailed information on expected transportation performance can be found in the *Transportation Impact Study*.

Intersections (Signalized and Unsignalized)

Under Baseline conditions, all 36 study intersections would operate at acceptable service levels. With the addition of project traffic (i.e., Baseline-Plus-Project conditions) each of the intersections would continue to operate acceptably.

Arterial Roadway Segments

Under Baseline conditions, two arterial roadway segments are expected to continue to operate unacceptably:

- *2nd Street eastbound from D Street to Hetherton Street/US 101 southbound on-ramp:* LOS F during both the AM and PM peak hours, with average speeds of 6 mph and 7 mph, respectively.
- *3rd Street westbound from Hetherton Street to D Street:* LOS E during both the AM and PM peak hours, with average speeds of 9 mph and 8 mph, respectively.

Under Baseline-Plus-Project conditions, added traffic would worsen operations on these Congestion Management arterials, as follows:

- *2nd Street eastbound from D Street to Hetherton Street/US 101 southbound on-ramp:* Operations would remain at LOS F but average speeds would be reduced to 6 mph and 5 mph during the AM and PM peak hours, respectively. However, since the V/C ratio's change of 0.008 would be less than 0.05, this degradation is not considered a significant impact.
- *3rd Street westbound from Hetherton Street to D Street:* The service levels would remain LOS E, but average speeds would be reduced to 7 mph during the AM peak hour. The V/C

ratio's change would be 0.067; therefore, this degradation is considered a significant impact and is discussed further under Impact TRANS-3.

Freeway Segments

Under Baseline conditions, one freeway segment would be expected to continue to operate unacceptably:

- *US 101 southbound between the 2nd Street on-ramp and the I-580 eastbound off-ramp:* The service level would remain at LOS F during the AM peak hour.

Under Baseline-Plus-Project conditions, added traffic would worsen operations on this freeway segment, as follows:

- *US 101 southbound between the 2nd Street on-ramp and the I-580 eastbound off-ramp:* The service level would remain at LOS F during the AM peak hour, with the V/C ratio increasing by 0.004. Since this is less than 0.01, the degradation is not considered a significant impact.

Pedestrian and Bicycle Travel

According to the *Transportation Impact Study*, the project would generate a total of 215 new pedestrian trips during the AM peak hour, 146 pedestrian trips during the lunch hour, and 213 new pedestrian trips during the PM peak hour. These trips would be most concentrated at intersections adjacent to the project site. The following factors were considered in estimating the number of pedestrian crossings at intersections:

- Trips between the BioMarin project and the Lindaro Street garage.
- Trips between the BioMarin project and the existing BioMarin campus buildings.
- Trips between the BioMarin project and the San Rafael SMART station and transit center.
- Trips between the BioMarin project and other destinations, including residences and downtown.
- Trips between the Whistlestop/Eden Housing project and the San Rafael SMART station and transit center.
- Trips between the Whistlestop/Eden Housing project and other destinations, including residences, shopping, and downtown.

The estimated added pedestrian crossings are summarized in **Table 4.13-3**.

Most of the AM and PM peak hour pedestrian trips generated by the project would be by employees traveling from and to the Lindaro Street garage. The most direct path for these pedestrians would involve using the crosswalk on the west side of the 2nd Street and Lindaro

TABLE 4.13-3 NEW PROJECT-RELATED PEDESTRIAN CROSSINGS DURING PEAK HOUR

Intersection	Leg	AM	Lunch	PM
3rd Street and Brooks Street	South	4	15	5
3rd Street and Lindaro Street	East	5	131	5
	North	5	66	5
	South	23	131	26
2nd Street and Brooks Street	North	2	5	2
2nd Street and Lindaro Street	West	181	66	168
	East	4	65	3
	North	9	65	8
	South	5	66	3

Source: Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion Revised (Fehr & Peers, April 8, 2019) (see **Appendix D**).

Street intersection. Some AM and PM peak hour pedestrian trips would cross 3rd Street to travel to and from the existing parking garage on the north side of 3rd Street as well as to and from businesses along 4th Street. Many pedestrians would likely prefer to cross 3rd Street's west leg with Lindaro Street; however, there is not a marked crosswalk or pedestrian signal there. Crossing 3rd Street at Brooks Street is currently prohibited, but if a crosswalk were added on the east leg of the intersection it is likely that between 4 and 15 crossings per hour would be made, with up to 53 daily pedestrian crossings.

Bicycle trips in the study area would also increase as a result of the proposed project. The projected increase in vehicles at the intersections in the vicinity of the proposed project could potentially result in an increase in vehicle-pedestrian and vehicle-bicycle conflicts. However, the project would not create potentially hazardous conditions for pedestrians and bicyclists, or otherwise interfere with pedestrian and bicycle accessibility to the site and adjoining areas, because the project would not remove existing facilities or prohibit the construction of proposed future facilities in the project vicinity.

The project would provide bicycle parking for both the BioMarin and the Whistlestop/Eden Housing facilities. For the BioMarin project, four bicycle racks are planned for installation on Lindaro Street and a bicycle storage room accommodating up to 34 bicycles is planned on the first floor of Building A. For the Whistlestop/Eden Housing project, four bicycle racks are proposed for 3rd Street and a bicycle storage room for six bicycles is planned for the first floor.

Cumulative and Cumulative-Plus-Project Conditions

Cumulative conditions include market-level population and employment growth, as well as expected transportation improvements for the year 2040. The Cumulative scenario includes Baseline conditions and adds the following:

- Background growth of 0.4 percent annually, derived from the Metropolitan Transportation Commission's Travel Demand Model.
- Conversion of C Street between 4th Street and 5th Street from one-way to two-way.
- Conversion of D Street between 4th Street and 5th Street from one-way to two-way.
- Conversion of Tamalpais Avenue West between Mission Avenue and 4th Street from two-way to one-way southbound.
- Conversion of Tamalpais Avenue West between 3rd Street and 4th Street from two-way to one-way northbound.
- Employing traffic signal optimization technology.

Cumulative-Plus-Project conditions include Cumulative conditions plus the project's effects on transportation, including vehicle travel, bicycle and pedestrian travel, and public transit.

Vehicle Travel

The following sections summarize Cumulative and Cumulative-Plus-Project conditions on the surrounding transportation network. Detailed information on expected transportation performance can be found in the *Transportation Impact Study*.

Intersections (Signalized and Unsignalized)

Under Cumulative conditions, all 6 study intersections would operate at acceptable service levels except for the following:

- *2nd Street and Hetherton Street/US 101 southbound on-ramp:* During the AM peak hour, this intersection would operate at LOS F with average delays of 95.9 seconds per motorist.
- *3rd Street and Tamalpais Avenue West:* During the PM peak hour, this intersection would function at LOS F with average delays of 86.4 seconds per motorist.

With added project traffic (i.e., Cumulative-Plus-Project conditions), the intersection's operations would further deteriorate:

- *2nd Street and Hetherton Street/US 101 southbound on-ramp:* In the AM peak hour, the intersection would continue to function at LOS F, but average delays would increase by 2.0 seconds per motorist. However, since the delay increase would be less than five seconds, it would not be considered a significant impact.
- *3rd Street and Tamalpais Avenue West:* The project would be expected to worsen the intersection's AM peak hour level of service from E to F, with average delays increasing from 65.6 seconds to 96.7 seconds per motorist. During the PM peak hour, the project would retain the intersection's service level at LOS F, but increase average delays from 86.4 to 94.0 seconds per motorist. This is considered a significant impact and is discussed later under Impact TRANS-4.

Arterial Roadway Segments

Under Cumulative conditions, three arterial roadway segments are expected to operate unacceptably:

- *2nd Street eastbound from D Street to Hetherton Street/US 101 southbound on-ramp:* LOS F during both the AM and PM peak hours, with average speeds of 6 mph during both the AM and PM peak hours.
- *3rd Street westbound from Hetherton Street to D Street:* LOS F during both the AM and PM peak hours, also with average speeds of 6 mph during both peak hours.
- *Mission Avenue eastbound from Lincoln Avenue to US 101 northbound on-ramp/Irwin Street:* LOS F during the AM peak hour, with an average travel speed of 7 mph.

Under Cumulative-plus-Project conditions, added traffic would worsen operations on these Congestion Management arterials, as follows:

- *2nd Street eastbound from D Street to Hetherton Street/US 101 southbound on-ramp:* Operations would remain at LOS F but average speeds would be reduced to 6 mph and 5 mph during the PM peak hour. However, since the V/C ratio's change of 0.008 would be less than 0.05, this degradation is not considered a significant impact.
- *3rd Street westbound from Hetherton Street to D Street:* The service levels would remain at LOS F, but average speeds would be reduced to 5 mph during both the AM and PM peak hours. The V/C ratio's change would be 0.067 during the AM peak hour; therefore, this degradation is considered a significant impact and discussed under Impact TRANS-3.

Mission Avenue is not a Congestion Management arterial roadway. The project's traffic would not change the roadway's peak hour service levels or average travel speeds.

Freeway Segments

Under Cumulative conditions, three freeway segments would be expected to operate unacceptably:

- *US 101 northbound between I-580 westbound on-ramp and 2nd Street off-ramp:* LOS F conditions are expected during the PM peak hour in this weaving segment between on- and off-ramps.
- *US 101 southbound at the Mission Avenue off-ramp:* LOS F conditions are estimated at the off-ramp area during both the AM and PM peak hours.
- *US 101 southbound between the 2nd Street on-ramp and the I-580 eastbound off-ramp:* LOS F conditions are expected during the AM peak hour.

Under Cumulative-plus-Project conditions, added traffic would worsen operations at the freeway locations:

- *US 101 northbound between I-580 westbound on-ramp and 2nd Street off-ramp:* LOS F conditions would continue within this weaving segment in the PM peak hour, with the V/C ratio increasing 0.004. Since this is less than 0.01, the degradation is not considered a significant impact.
- *US 101 southbound at the Mission Avenue off-ramp:* Project traffic would contribute to continued LOS F conditions at the off-ramp during both the AM and PM peak hours, with the V/C ratio increasing by 0.033 due to project traffic in the AM peak hour. This degradation is considered a significant impact and is discussed under Impact TRANS-2.
- *US 101 southbound between the 2nd Street on-ramp and the I-580 eastbound off-ramp:* The service level would remain at LOS F during the AM peak hour, with the V/C ratio increasing by 0.003. Since this is less than 0.01, the degradation is not considered a significant impact.

Pedestrian and Bicycle Travel

Please refer to "Pedestrian and Bicycle Travel" under "Baseline and Baseline-Plus-Project Conditions." Similar pedestrian and bicycle conditions would be expected under Cumulative and Cumulative-Plus-Project conditions.

Parking

While not an issue considered under CEQA, parking is a major component of the proposed project. As discussed in Chapter 3, Project Description, of this DEIR, the project by itself and without being combined with the existing SRCC campus would require a total of 293 parking spaces. As part of the project description, the BioMarin applicant is proposing a "blended" parking requirement to accurately reflect the demand and need for parking spaces related to the proposed development. As a result, the applicant has proposed that the BioMarin project have a total of 29 spaces on the project site. When combined with other SRCC parking demands, a total of 1,446 parking spaces would be required for all BioMarin parcels. For the Whistlestop/Eden Housing project, a total of 10 parking spaces would be required, and this requirement would be met by the provision of 12 ground-level parking spaces.

Table 3-4 in Chapter 3 shows that the proposed BioMarin total "blended" parking requirement is 410 spaces (264 spaces for Building A and 146 spaces for Building B) for the BioMarin portion of the project. The majority of these spaces would be provided in existing SRCC lots that are underused and within two blocks of the project site. However, under the typical parking requirement for the City of San Rafael, for the total development of 207,000 square feet, the project is required to provide 681 total parking spaces. This total does not account for the fact that 1.0 of Floor Area Ratio (FAR) is exempt from the City's parking requirements; thus, the actual number of required parking spaces would be 293.[4]

The underused parking spaces that would be assigned to the project would be located at the 755 Lindaro surface lot, the 788 Lincoln garage, and the 788 Lincoln surface lot, and 29 spaces would be provided at the project's surface lots. Based on the parking study provided by the applicant's planning consultant, an excess of 143 parking spaces would be available and no shortage of parking would occur.

The BioMarin portion of the project is proposed as a single-tenant land use. However, the City of San Rafael has identified the potential that, in the future, BioMarin or a successor landowner might not occupy the site with a single tenant or a laboratory-based land use as currently proposed. As such, as part of the City entitlement process for the BioMarin portion of the project, a condition would be included. This condition would require that based on any future new land use program, if the new project parking demand is to be met by the provision of off-site parking lots, the BioMarin applicant must propose a legally binding arrangement for those parking spaces being associated with the BioMarin portion of the project site. In this way, any future site occupancy changes would not result in a significant shortage of parking for a new occupant.

Less-than-Significant Impacts

The project would not conflict with a program, plan, ordinance, or policy addressing transit facilities or bicycle facilities.

Transit Facilities Impacts

Public transit trips in the study area would increase as a result of the project. Most employees at the project site would walk to the San Rafael Transit Center and SMART station for access to bus and rail service provided there. A total of 22 bus routes currently stop at the transit center. A survey of BioMarin employees at the SRCC campus in the spring of 2018 indicated that 16 percent of employees travel by transit on a typical day. The BioMarin employees using transit split their trips among SMART (77 percent), Golden Gate Transit (17 percent), and Marin Transit (6 percent).

[4] The FAR of 1.0 would be 118,099 square feet (the size of the BioMarin lot). This building area would be exempt from the City's parking requirements, and the requirements would be calculated on the remaining building area. This remaining area would be the total proposed building area of 207,000 square feet minus 118,099 square feet, or 88,901 square feet. Based on the City requirement of 3.3 parking spaces per 1,000 square feet of building area, 293 parking spaces would be required (88,901 square feet divided by 1,000, multiplied by 3.3).

Assuming this same use of transit for the project, it was estimated that the project would thus add 68 daily riders to SMART, 15 daily riders to Golden Gate Transit routes, and five daily riders to Marin Transit routes on a typical weekday. This level of added transit ridership would not have a significant impact on the SMART, Golden Gate Transit, or Marin Transit routes serving downtown San Rafael. Therefore, project impacts on transit facilities are considered less than significant.

Bicycle Facilities Impacts

Provisions for bicycle parking and storage are included in both the BioMarin and Whistlestop/Eden Housing projects. Therefore, project impacts on bicycle facilities are considered less than significant.

Potentially Significant Impacts

Conflicts with a Program, Plan, Ordinance, or Policy Addressing the Circulation System, including Roadway and Pedestrian Facilities

As discussed below, six potentially significant project-related impacts involving conflict with a program, plan, ordinance, or policy addressing the circulation system were identified.[5] Impacts related to pedestrian facilities are addressed under "Hazards Due to Geometric Design Features or Incompatible Uses" below.

Impact TRANS-1: The project would generate approximately 2,453 daily vehicle trips, with 236 vehicle trips during the weekday AM peak hour and 236 vehicle trips in the PM peak hour. Most of the vehicle trips would be generated by the BioMarin project (1,863 daily, 203 AM peak hour, and 191 PM peak hour trips). The project would increase single-occupancy vehicular travel and vehicular traffic along key roadways and intersections, as well as US 101. Maintaining the existing BioMarin travel mode shares would conflict with citywide policies and programs established to manage congestion and improve mobility as documented in San Rafael General Plan 2020. (PS)

The *Transportation Impact Study* assumed the project's peak hour vehicle trip generation rates would be consistent with those recently determined to apply at the existing BioMarin SRCC campus. The transportation impacts described in this section assumed the application of these rates for the proposed BioMarin project, or for any successive use at the project site.

Mitigation Measure TRANS-1: BioMarin, or any successive owner or lessor of the site, shall continue and expand the implementation of a Transportation Demand Management (TDM) program that focuses on reducing vehicle trips and improving traffic flow. BioMarin, or any successive owner or lessor of the site, shall generate at least 15 percent fewer vehicle trips on a daily, AM peak hour, and PM peak hour basis (i.e., 1,584 daily, 173 AM peak hour, and 162 PM peak hour trips) as compared to those projected by the project applicant. BioMarin and

[5] It should be noted that in the Fehr & Peers *Transportation Impact Study*, the BioMarin project was evaluated as a stand-alone project and the BioMarin and Whistlestop/Eden Housing projects were evaluated together as a combined project. The Whistlestop/Eden Housing project was not evaluated as a potential stand-alone project. While traffic would be less without the BioMarin project (and with only the Whistlestop/Eden Housing project on the site), it is not possible to know what mitigation measures should only apply to the Whistlestop/Eden Housing project. However, all mitigation measures identified for the BioMarin project alone would be similar to those identified for the combined project. Therefore, all mitigation measures are assumed to apply to the two projects combined.

any successive owner or lessor of the site shall monitor, on an annual basis, all traffic generated at the site, including single-occupant vehicles, carpools, pedestrian and bicycle trips, and public transit use, to gauge success and promote appropriate measures to retain vehicle trip rates at, or below, the current trip rates. BioMarin, or any successive owner or lessor of the site, shall submit an annual TDM monitoring report to the City of San Rafael for City review. This mitigation measure shall continue in perpetuity for the project site until the 15 percent reduction is identified for three consecutive years. This mitigation measure would reduce the impact to less than significant. (LTS)

Impact TRANS-2: Project-related traffic, under Cumulative-plus-Project conditions, would contribute to continued LOS F conditions at the US 101 southbound off-ramp to Mission Avenue, increasing the volume-to-capacity (V/C) ratio of the off-ramp by 0.033 during the AM peak hour. Traffic operations and safety at the highway ramp diverge and along the off-ramp would worsen. This condition would conflict with standards provided in the Marin County Congestion Management Plan. (PS)

The number of employees at the BioMarin site would need to be reduced by 80 percent (from 550 employees to 112 employees) compared to the proposed use to alleviate this impact. A more aggressive TDM program (see Mitigation Measure TRANS-1) than is currently undertaken at BioMarin could help reduce traffic volumes and this impact, but not to an acceptable level. Provision of a second off-ramp lane and southbound auxiliary lane on US 101 would be impractical.

Mitigation Measure TRANS-2: No feasible mitigation is available. This impact would be significant and unavoidable. (SU)

Impact TRANS-3: Project-related traffic would contribute to continued LOS E (under Baseline-Plus-Project) and LOS F (under Cumulative-Plus-Project) conditions along westbound 3rd Street between Hetherton Street and D Street during the AM peak hour, with an increase in the arterial roadway segment's volume-to-capacity (V/C) ratio of 0.067. This impact would result in a reduction in travel speeds that conflict with the Marin County Congestion Management Plan and San Rafael General Plan 2020 Policy C-5 (Traffic Level of Service Standards). (PS)

The project would increase traffic along 3rd Street between Hetherton Street and D Street, exacerbating vehicular delays and reducing travel speeds along this key arterial roadway segment. The number of employees at the BioMarin site would need to be reduced by 28.5 percent (from 550 employees to 393 employees) compared to the proposed use to alleviate this impact. A more aggressive TDM program (see Mitigation Measure TRANS-1) than is currently undertaken at BioMarin could help reduce traffic volumes and this impact, but not to an acceptable level. Widening 3rd Street to provide an additional travel lane would be impractical due to public right-of-way limitations.

Mitigation Measure TRANS-3: No feasible mitigation is available. This impact would be significant and unavoidable. (SU)

Impact TRANS-4: Under Cumulative-Plus-Project conditions, project-related traffic would worsen the service level at the 3rd Street and Tamalpais Avenue West intersection from

LOS E to LOS F during the AM peak hour, with average delays increasing from 65.6 seconds to 96.7 seconds per motorist. During the PM peak hour, the intersection's service level would remain at LOS F with project-related traffic, but the project would increase average delays from 86.4 to 94.0 seconds per motorist. This impact would create conflicts with San Rafael General Plan 2020 Policy C-5 (Traffic Level of Service Standards). (PS)

Under Cumulative-Plus-Project conditions, the project would result in added traffic back-ups along westbound 3rd Street at Tamalpais Avenue West. Implementing more aggressive TDM measures (see Mitigation Measure TRANS-1) could assist in reducing the increased traffic demand, but the impact would still be significant. Widening 3rd Street to provide an additional travel lane would be impractical due to public right-of-way limitations.

The number of employees at the BioMarin site would need to be reduced by 58.3 percent (from 550 employees to 229 employees) compared to the proposed use to alleviate this impact.

> *Mitigation Measure TRANS-4: No feasible mitigation is available. This impact would be significant and unavoidable. (SU)*

Impact TRANS-5: The project would add construction-related vehicle trips to City of San Rafael and other jurisdictional roadways, creating temporary traffic hazards. These conditions would conflict with San Rafael General Plan 2020 Program C-4a (Street Pattern and Traffic Flow). (PS)

Project construction would generate trips by trucks and other construction-related vehicles. During the construction period, construction would occur between 7:00 AM and 6:00 PM, Mondays through Fridays, and between 9:00 AM and 6:00 PM on Saturdays, and would be based on City of San Rafael restrictions. No construction would be allowed on Sundays or holidays or outside the weekday and Saturday hours described above, unless a request is made and approved by the Chief Building Official.

> *Mitigation Measure TRANS-5: Project construction shall abide by the City of San Rafael's provisions regarding transportation and parking management during construction activities. In addition, the project applicants shall develop a demolition construction traffic management plan defining hours of operation, specified truck routes, and construction parking provisions. This plan shall be prepared by the applicants and approved prior to issuance of a building permit by the City of San Rafael Department of Public Works. The project applicants shall ensure that any parking losses associated with construction vehicles do not affect parking availability on downtown streets. (LTS)*

Impact TRANS-6: Construction traffic would be staged and would use the roadway lanes adjacent to the site. This traffic would cause deterioration of pavement on 3rd Street, Brooks Street, 2nd Street and Lindaro Street. These conditions would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Road Design). (PS)

The project's construction traffic would lead to further deterioration of roadways near the project site, including along 3rd Street between Lindaro Street and Brooks Street, Brooks Street between 3rd Street and 2nd Street, 2nd Street between Brooks Street and Lindaro Street, and Lindaro Street between 2nd Street and 3rd Street.

Mitigation Measure TRANS-6: The project applicants shall improve the pavement sections of the roadways peripheral to the project site to a condition acceptable to the City Engineer. The applicants shall complete a "pre-construction" study, followed by a "post-construction" survey to determine what road improvements would be the responsibility of the applicants. These studies shall be submitted to the City Engineer for approval. (LTS)

Hazards Due to Geometric Design Features or Incompatible Uses

As discussed below, six potentially significant project-related impacts involving a potentially substantial increase in hazards due to a geometric design feature were identified.

Impact TRANS-7: Access to the project would be provided from six unsignalized driveways. Motorist, pedestrian, and bicyclist sight lines to and from these driveways would be constrained if parking is allowed next to the driveways or landscaping blocks views. These conditions would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Road Design). (PS)

One-way driveways on Lindaro Street would provide access to the east side of the BioMarin project, and a one-way entrance driveway from 3rd Street and exit driveway to Brooks Street would provide access to the west side of the BioMarin project. Parking on the ground floor of the Whistlestop/Eden Housing building would have access from one-way driveways on Brooks Street.

Mitigation Measure TRANS-7a: The project applicants shall maintain landscaping at project driveways to avoid sight distance conflicts. Shrubs shall not be higher than 30 inches and tree canopies shall be at least 7 feet from the ground.

Mitigation Measure TRANS-7b: The City of San Rafael shall prohibit parking at least 20 feet in advance and 20 feet behind each of the project's six driveways.

The combination of these two mitigation measures would reduce the impact to less than significant. (LTS)

Impact TRANS-8: The project would increase the number of pedestrians using nearby sidewalks and curb ramps, including at the corners of the following intersections peripheral to the project site where curb ramps are not Americans with Disabilities Act (ADA)-compliant: 3rd Street and Lindaro Street, 3rd Street and Brooks Street, 2nd Street and Brooks Street, and 2nd Street and Lindaro Street. These conditions are inconsistent with San Rafael General Plan 2020 Program C-4b (Street Design Criteria to Support Alternative Modes) and Policy C-11 (Alternative Transportation Mode Users). (PS)

The curb ramps at the four intersections adjacent to the project site are not in compliance with ADA design guidelines, presenting challenging travel conditions for mobility-impaired persons. The project would increase the number of pedestrians using nearby sidewalks and curb ramps, including the existing non-compliant ramps at the four intersections peripheral to the project site.

Mitigation Measure TRANS-8: The project applicants shall fund the design and construction of curb ramp improvements at all corners of the following intersections: 3rd Street and Lindaro

Street, 3rd Street and Brooks Street, 2nd Street and Brooks Street, and 2nd Street and Lindaro Street. (LTS)

Impact TRANS-9: Currently a marked crosswalk, with curb ramps and pedestrian signals, is not present on the west leg of the 3rd Street and Lindaro Street intersection. The project would increase the number of pedestrians crossing 3rd Street at this location. Pedestrians walking to or from the project site may be inclined to cross the unmarked west leg instead of taking the more circuitous marked route (i.e., crosswalks across the intersection's south leg and east leg, as well as across the Walgreens driveway on the north leg). By increasing the number of pedestrians at this location, the project would worsen hazards by creating greater potential for conflicts between pedestrians and vehicles. These conditions would be inconsistent with San Rafael General Plan 2020 Program C-4b (Street Design Criteria to Support Alternative Modes) and Policy C-11 (Alternative Transportation Mode Users). (PS)

Provision of a marked crosswalk on the west leg of the intersection would create a more direct connection to downtown for pedestrians walking to or from the project site. The intersection's level of service would not degrade with the provision of the crosswalk. Peak hour vehicular speeds along 3rd Street would remain the same with or without the western crosswalk.

Mitigation Measure TRANS-9: The project applicants shall fund the design and construction of improvements related to the provision of a crosswalk across the western leg of the 3rd Street and Lindaro Street intersection. These improvements shall include, but not be limited to, curb and roadway infrastructure work, as well as traffic and pedestrian signal modifications. They may include revisions to or removal of the driveway on the north side of the intersection. The design of these improvements would be approved by the City Engineer. (LTS)

Impact TRANS-10: Currently, pedestrian crossings of 3rd Street at Brooks Street are prohibited. The closest signalized crossing is located at A Street, which is about 240 feet to the west. The Whistlestop/Eden Housing project is expected to increase pedestrian crossing demands across 3rd Street at Brooks Street, as this route would offer the most direct path to and from downtown from the project site. Potential conflicts could arise as pedestrians use this unmarked location to cross 3rd Street's three westbound vehicular travel lanes. These conditions would be inconsistent with San Rafael General Plan 2020 Program C-4b (Street Design Criteria to Support Alternative Modes) and Policy C-11 (Alternative Transportation Mode Users). (PS)

The *Transportation Impact Study* concluded that, considering current illegal pedestrian crossings, project-related demand, and a shift of some of the pedestrians who currently cross at A Street, the warrant for the installation of a Pedestrian Hybrid Beacon across the east leg of 3rd Street and Brooks Street would be met during the weekday PM peak hour. The Pedestrian Hybrid Beacon would operate at LOS A.

Mitigation Measure TRANS-10: The project applicants shall fund the design and construction of improvements related to the provision of a Pedestrian Hybrid Beacon, or other pedestrian crossing enhancements as deemed appropriate by the City of San Rafael Department of Public Works, at the 3rd Street and Brooks Street intersection. These improvements could include, but not be limited to, curb and roadway infrastructure work, as well as traffic and pedestrian signal modifications. (LTS)

Impact TRANS-11: Vehicles turning left from southbound Brooks Street to eastbound 2nd Street currently have limited visibility to eastbound vehicles at this side-street stop sign-controlled intersection due to the siting of the building at the northwest corner of the intersection. Southbound vehicles must proceed into the crosswalk on the north leg of the intersection, blocking pedestrian crossings, to increase the motorist's view of oncoming eastbound traffic. This condition would be exacerbated by the addition of project-related traffic, resulting in an increased potential for vehicle-vehicle and vehicle-pedestrian conflicts. This condition would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Roadway Design). (PS)

By prohibiting egress from southbound Brooks Street onto 2nd Street, the limited visibility condition for vehicles turning left from southbound Brooks Street to eastbound 2nd Street would be eliminated. Some traffic would have to make additional turns, but overall impacts on adjacent intersections would be minor, with no level of service violations and with some improvements due to one-way flows. Travel speeds on 2nd Street would be negligibly affected.

> *Mitigation Measure TRANS-11: Vehicle travel on Brooks Street at 2nd Street shall be limited to one-way northbound/outbound only. Brooks Street at 3rd Street shall allow both inbound and outbound traffic to the driveway just south of the Whistlestop/Eden Housing project. The project applicants shall modify the project, as needed, to enable sufficient sight distance between westbound motorists on 3rd Street and northbound motorists, stopped behind a future marked crosswalk, on Brooks Street. Modifications may include, but not be limited to, building design changes, roadway curb extensions, or revisions to proposed hardscaping and/or landscaping. Any changes shall be approved by the City of San Rafael Department of Public Works. (LTS)*

Impact TRANS-12: The two proposed exit driveways to Brooks Street, one from the Whistlestop/Eden Housing project and the other from the BioMarin project access road, would provide limited sight lines to Brooks Street. This condition could lead to increased conflicts between egressing vehicles and other travelers on Brooks Street, including vehicles, pedestrians, and bicyclists. This condition would be inconsistent with San Rafael General Plan 2020 Policy C-4 (Safe Roadway Design). (PS)

Both egressing driveways would have limited sight lines due to the proposed buildings.

> *Mitigation Measure TRANS-12: The project applicants shall install systems that provide vehicle-activated audible and visual warnings for vehicles egressing the driveways on Brooks Street. (LTS)*

Emergency Access

Impact TRANS-13: Emergency vehicles would have access to the project site via the Lindaro Street driveways, the 3rd Street driveway, and the southernmost Brooks Street driveway. The project applicants propose to install sliding gates across the 3rd Street and southernmost Brooks Street driveways. The gates could affect emergency vehicle access if emergency services personnel could not open the gates. These conditions would be inconsistent with San Rafael General Plan 2020 Program C-4a (Street Pattern and Traffic Flow). (PS)

The sliding gates would need to be accessible by emergency service providers.

> *<u>Mitigation Measure TRANS-13</u>: The sliding gates at the 3rd Street driveway and the southern Brooks Street driveway shall be approved by the City of San Rafael Fire and Police Departments and shall enable access by emergency service providers. (LTS)*

Conflicts or Inconsistencies with CEQA Guidelines Section 15064.3, Subdivision (b)

CEQA Guidelines Section 15064.3, Subdivision (b) contains guidelines for analyzing potential impacts using VMT as a threshold of significance. These guidelines will go into effect in the City of San Rafael by July 1, 2020. In the interim, the City of San Rafael's significant criteria related to level of service for traffic performance will continue to be applied and are used in this DEIR. An assessment of the project's potential effect on VMT was included in the *Transportation Impact Study* for informational purposes.

The BioMarin project would generate about 80 percent of the project's trips, with the Whistlestop/ Eden Housing project generating the rest. However, Whistlestop/Eden Housing residents would not be able to own vehicles they park at the site (as a restriction to their leases), and the facility manager would reside in an on-site apartment. Therefore, most of the VMT would be generated by the BioMarin component of the project.

Based on data for employees at the existing BioMarin SRCC campus in San Rafael, the average vehicle trip length between home and work is 21.6 miles, equating to a round-trip distance of about 43 miles. Adjusting for mode share (i.e., discounting for those employees who travel by a non-vehicle mode), the average home-work-home daily VMT for BioMarin employees is 37 vehicle miles.

For comparison purposes, the average home-work-home VMT per worker in downtown San Rafael and other areas of San Rafael, as well as the average throughout the Bay Area, was estimated using the Metropolitan Transportation Commission (MTC) Regional Travel Model. Based on MTC's model, the average VMT is 20 miles for downtown San Rafael employees and 23 miles for employees in the rest of San Rafael. The average VMT for Bay Area employees is 17 miles.

Compared to the estimated average VMT for downtown San Rafael employees (20 miles), the VMT for BioMarin employees is 85 percent higher (37 miles).

Cumulative Impacts

Potential cumulative transportation impacts resulting from the proposed project, as well as recommended mitigation measures, were described in the previous section.

REFERENCES

Caltrans, 2002. *Guide for the Preparation of Traffic Impact Studies,* December.

CEQA Guidelines, Appendix G.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Amended and reprinted January 18.

City of San Rafael, 2016. Municipal Code Sections 14.18 and 5.8.1.

City of San Rafael, 2018. *Bicycle and Pedestrian Plan Update.*

Fehr & Peers, 2019. *Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion*, April 8.

Golden Gate Bridge Highway and Transportation District, 2019. *San Rafael Transit Center Project Page*, www.goldengate.org/SRTC/index.php, May.

Institute of Transportation Engineers (ITE), 2017. *Trip Generation, 10th Edition.*

Transportation Authority of Marin, 2017. *Final Report 2017 CMP Update*, Marin County, March.

Transportation Research Board (TRB), 2010. *Highway Capacity Manual 2010*.

4.14 TRIBAL CULTURAL RESOURCES

INTRODUCTION

This section of the DEIR describes the potential impacts of the project on tribal cultural resources. Tribal cultural resources can include sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe (California Public Resources Code [PRC] Section 21074).

This section describes existing tribal cultural resources conditions at the project site and the City's consultation efforts with California Native American tribes, pursuant to PRC Section 21080.3.1. Pertinent state laws and regulations related to tribal cultural resources are briefly described, and the project's potential impacts are evaluated.

ENVIRONMENTAL SETTING

To characterize the setting of the project site for tribal cultural resources (1) a records search was conducted at the Northwest Information Center (NWIC) to identify Native American sites, (2) the Sacred Lands File at the Native American Heritage Commission (NAHC) was reviewed, and (3) the City consulted with a local federally recognized tribe. The results of these tasks are described below.

NWIC Records Search

The NWIC database search was done to identify Native American archaeological sites and other tribal cultural resources at or adjacent to the project site. The NWIC is the state's repository for cultural resource locations and reports for Marin County.

There are no recorded Native American tribal cultural resources at the project site. There are four Native American archaeological sites within 0.25 mile of the project site.[1] None of these sites are adjacent to the project site.

NAHC Sacred Lands File

The NAHC search of the Sacred Lands File was done to determine the potential presence of Native American cultural resources that might be affected by the proposed project. The NAHC maintains the Sacred Lands File and is the official State of California repository of Native American sacred site location records in California.

Sharaya Souza, NAHC Staff Services Analyst, stated in a letter that "*A records search of the Native American Heritage Commission Sacred Lands File was completed…with negative results."*

[1] The locations of these sites are withheld in this document. The legal authority to restrict cultural resources information is in California Government Code Section 6254.10 and Section 6254(r), and California Code of Regulations Section 15120(d).

Ms. Souza also provided a Native American Contacts List that consisted of two individuals affiliated with the Federated Indians of Graton Rancheria (FIGR) that may have additional information regarding cultural resources at the project site.

Tribal Consultation

The City conducted consultation for the project, consistent with the requirements of PRC Section 21080.3.1. The City mailed a letter to FIGR notifying the tribe of their opportunity to consult for the project to identify and mitigate the project's potential impacts on tribal cultural resources. In a letter dated February 28, 2019, FIGR Tribal Historic Preservation Officer, Buffy McQuillen, formally requested consultation with the City to discuss significant effects of the project, alternatives to the project, and mitigation measures for potential impacts on tribal cultural resources.

In response to FIGR's consultation request, the City contacted Ms. McQuillen via telephone on March 29, 2019, to confirm receipt of the tribe's letter and to provide a description of the project and site remediation work conducted to date. Ms. McQuillen requested that the City update her regarding the scheduling and publishing of environmental documentation being prepared for the project. The City followed that telephone conversation with an email sent that same day to Ms. McQuillen, stating that it "will keep you updated with regards to project milestones related to the CEQA review."

REGULATORY FRAMEWORK

Federal Regulations

No federal regulations related to tribal cultural resources would apply to the proposed project.

State Regulations

California Environmental Quality Act (CEQA) Provisions

The California Environmental Quality Act (CEQA) defines a "tribal cultural resource" as any one of the following (PRC Section 21074):

- Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either (1) included in or eligible for inclusion in the California Register of Historical resources, or (2) included in a local register of historical resources.
- A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant. The lead agency shall consider the significance of the resource to a California Native American Tribe.
- A cultural landscape that meets the requirements listed above and is geographically defined in size and scope.

Archaeological sites, including those that qualify as historical resources (PRC Section 21084.1), unique archaeological resources (PRC Section 21083.2(g)), and non-unique archaeological resources (PRC Section 21083.2(h)), may qualify as tribal cultural resources.

Assembly Bill 52 (AB 52), which became law January 1, 2015, requires that local agencies formally consult with recognized California Native American Tribes during the CEQA process to discuss potential impacts on tribal cultural resources. Prior to the release of a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report, the agency must initiate consultation with tribes that are traditionally and culturally affiliated with the geographic area of the proposed project if (1) the tribe requested of the agency, in writing, to be informed through formal notification of proposed projects in the geographic area that is traditionally and culturally affiliated with the tribe; and (2) the tribe responds, in writing, in 30 days of receipt of the formal notification of a proposed project and requests consultation with the agency (PRC Section 21080.3.1(b)).

The California Office of Planning and Research's (OPR) *Tribal Consultation Guidelines* define consultation as "a process in which both the tribe and local government invest time and effort into seeking a mutually agreeable resolution for the purpose of preserving or mitigating impacts to a cultural place, where feasible" (OPR 2005:15). Consultation is concluded when the agency and tribe(s) agree to measures to mitigate or avoid significant effects on a tribal cultural resource, or if either party concludes that mutual agreement cannot be reached after a good faith and reasonable effort (PRC Section 21080.3.2(b)).

Senate Bill 18

California Government Code Section 65352.3 (adopted pursuant to the requirements of Senate Bill 18 [SB 18]) requires local governments to contact, refer plans to, and consult with tribal organizations prior to making a decision to adopt or amend a general or specific plan. The purpose of SB 18 is to obtain Native American tribal input regarding local land use planning decisions early in the planning process to avoid, or mitigate the effects on, cultural places. As this project would require a General Plan amendment, the City of San Rafael will need to comply with SB 18 tribal consultation requirements.

The tribes offered the opportunity to consult have traditional lands in a local government's jurisdiction and are identified, upon request, by the NAHC. The City must provide tribes a 90-day period to request consultation regarding the project. Subsequent to the 90-day consultation noticing requirements, local governments must also refer proposed plan amendments to tribes for a 45-day comment period, regardless of whether consultation has occurred.

Local Regulations and Policies

As described in Section 4.3, Cultural Resources, of this DEIR, the City maintains an Archaeological Resource Protection Ordinance (Municipal Code Chapter 2.19) that ensures "specific procedures and regulations [that] shall be implemented by the City to ensure the protection of archeological resources." Although this ordinance does not specially address "tribal cultural resources," pre-contact Native American archaeological sites would typically qualify as tribal cultural resources as defined under PRC Section 21074.

In addition, Policy CA-15 (Protection of Archaeological Resources) of San Rafael General Plan 2020 also serves to implement "measures to preserve and protect archaeological resources," including Native American sites.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

The proposed project would have a significant impact on tribal cultural resources if it would:

a) Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is: (i) Listed or eligible for listing in the California Register of Historical Resources or in a local register of historical resources as defined in Public Resources Code section 5020.1(k); or (ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1.

No Impact

FIGR has requested consultation with the City to address potential impacts on tribal cultural resources. Based on a discussion between the City and the FIGR Tribal Historic Preservation Officer, Buffy McQuillen, the tribe neither provided specific information regarding the presence of tribal cultural resources at the project site nor requested specific mitigation measures be implemented. Furthermore, as discussed in Section 4.3, Cultural Resources, of this DEIR, the NWIC records search did not identify Native American archaeological deposits or ancestral remains at or adjacent to the project site. The proposed project would have no impact on known tribal cultural resources that are listed or eligible for listing in the California Register of Historical Resources or a local register of historical resources. The City has not identified substantial evidence to indicate the presence of a tribal cultural resource.

Potentially Significant Impacts

The project would not have any potentially significant impacts on tribal cultural resources.

Cumulative Impacts

For tribal cultural resources, the scope for assessing cumulative impacts encompasses other past, current, or probable future projects under review by the City. The proposed project would have a significant effect on the environment if it would contribute to a significant cumulative impact on tribal cultural resources. For purposes of this analysis, a list approach was used to identify probable future projects within close proximity to the project site. Projects considered for this cumulative impact analysis are listed in Table 6-1 and their locations are shown in Figure 6-1 of this DEIR.

Based on a review of project and CEQA documentation available on the City of San Rafael website, no recent past, current, or probable future projects under review by the City (see Table 6-1 for projects included as part of the cumulative analysis) include reported tribal cultural resources as defined under PRC Section 21074.

When the City considers future development proposals, these proposals would undergo environmental review pursuant to CEQA and, when necessary, mitigation measures would be adopted as appropriate. Measures to mitigate or avoid impacts on tribal cultural resources would be drafted in consultation with FIGR. In most cases, this consultation would ensure that significant impacts on tribal cultural resources would be avoided or otherwise mitigated to less-than-significant levels.

For these reasons, the proposed project would not result in or contribute to any significant cumulative impacts on tribal cultural resources.

REFERENCES

California Office of Planning and Research (OPR), 2005. *Tribal Consultation Guidelines, Supplement to General Plan Guidelines.*

City of San Rafael (Sean Kennings), March, 29, 2019. Email to Buffy McQuillen, THPO, Federated Indians of Graton Rancheria.

Federated Indians of Graton Rancheria, February 28, 2019. *Formal Request for Tribal Consultation Pursuant to the California Environmental Quality Act (CEQA), Public Resources Code Section 21080.3.1, subds. (b), (d) and (e) for the BioMarin/Whistlestop/Eden Housing Project in San Rafael, APN 011-265-01, at 999 3rd Street, San Rafael.*

Native American Heritage Commission, November 19, 2018. *BioMarin Planned Development Expansion, San Rafael, Marin County*.

4.15 UTILITIES AND SERVICE SYSTEMS

INTRODUCTION

This section describes the existing setting and impacts on water, wastewater, solid waste disposal, and other utilities and services that could result from the project.

ENVIRONMENTAL SETTING

Water

The City of San Rafael obtains its water supply from the Marin Municipal Water District (MMWD), which provides potable water to the eastern corridor of Marin County from the Golden Gate Bridge up to but not including Novato. The incorporated cities and towns of San Rafael, Corte Madera, Mill Valley, Fairfax, San Anselmo, Ross, Larkspur, Belvedere, and Sausalito are within the MMWD service area (MMWD, 2016; MMWD, 2017).

Water Supply and Demand

The MMWD potable water supplies come from a combination of local surface water supplies and water imported from the Russian River and purchased from the Sonoma County Water Agency (SCWA). MMWD operates seven surface water storage reservoirs with a total capacity of 79,566 acre-feet (25,927 million gallons), but MMWD estimates that operational yield of the reservoirs is about 20,000 acre-feet per year (afy). The reservoir supply is supplemented with SCWA water through a contract that allows MMWD to take deliveries of up to 14,300 afy (MMWD, 2016).

Current demand for potable and raw water is 22,610 afy. Demand is expected to increase to roughly 25,860 afy by 2040 (MMWD, 2016; MMWD, 2017).

Through its commitment to water conservation, MMWD expects that water supplies will be sufficient to meet demands during normal and dry water years through 2040. However, the MMWD water rationing plan includes provisions that require MMWD customers to reduce their water usage by up to 25 percent during periods of severe drought (MMWD, 2016; MMWD, 2017).

A 2017 analysis demonstrated that MMWD's current water supply portfolio is sufficient to meet demands in each of the reliability threats modeled except the "Six-Year Severe Drought," which has a low probability of occurring. The analysis found that (1) should this type of drought occur, shortages would not be expected until the fifth year of the drought, which would provide time for MMWD to re-assess and move forward with implementation of resiliency options after the drought starts; and (2) use of supplies in emergency storage, combined with mandatory conservation/ rationing, would allow MMWD to manage supplies through the Six-Year Severe Drought condition without shortfalls (MMWD, 2017).

Water Treatment

To treat its water supply, MMWD operates three water treatment plants: the Bon Tempe Treatment Plant, the San Geronimo Treatment Plant, and the Ignacio Treatment Facility. Together, these facilities have a combined design capacity of 71 million gallons per day (mgd). Observed high flows have reached 58 mgd; however, the average daily maximum flow is approximately 25 mgd. In 2015, the total production of the three plants averaged 20.4 mgd (MMWD, 2016).

Water Distribution

Because of Marin County's hilly terrain, about 90 percent of the water must be pumped at least once before it reaches the customer's tap. The MMWD potable water distribution system includes approximately 886 miles of water mains, 94 pumping stations, and 127 treated water storage tanks with a total storage capacity of approximately 82 million gallons (MMWD, 2016).

Recycled Water System

In addition to its potable water system, MMWD owns and operates a recycled water system, which consists of nearly 25 miles of pipeline and delivers about 520 afy through 342 service connections. MMWD produces its own recycled water by treating secondary effluent provided by the Las Gallinas Valley Sanitary District (MMWD, 2016).

Water Facilities in Project Site Vicinity

The project site is currently vacant but has water service (Borjian, 2018). As noted in Chapter 3, Project Description, of this DEIR, water facilities in the vicinity include an existing 6-inch water line running along 3rd Street. In addition, 8-inch water mains are located in 2nd Street and Lindaro Street (Morrison, 2019).

Existing Water Entitlement at Project Site

MMWD uses formulas to determine the necessary water entitlement for different types of users. If, at a later date, it is determined that actual consumption is exceeding the current entitlement, additional water must be purchased to increase the property's entitlement, or the consumption must be reduced to the level consistent with the existing entitlement.

The project site is currently vacant, and no water is used at the site. MMWD records show that the total existing water entitlement for the project site is 3.57 afy (Borjian, 2018; Morrison, 2019).

Wastewater

The San Rafael Sanitation District, a member of the Central Marin Sanitation Agency (CMSA), provides wastewater services in San Rafael. CMSA, formed in 1979, is a public joint powers agency of the San Rafael Sanitation District, Sanitary District No. 2, the Ross Valley Sanitary District, and the City of Larkspur. The San Rafael Sanitation District has an eight-person crew that maintains 32 pump stations, 13 miles of force main, and 132 miles of sewer pipelines. This collection and transportation system delivers wastewater to CMSA for treatment (CMSA, 2019; Dow, 2019)

Wastewater Treatment Plant

CMSA owns and operates the CMSA Wastewater Treatment Plant, located off Interstate 580 in San Rafael. The treatment plant treats wastewater and biosolids from member districts and the San Quentin State Prison via conveyance from several remote pump stations. The treatment plant produces clean effluent, which is treated to an advanced secondary treatment level and then discharged into San Francisco Bay through an outfall structure owned and maintained by CMSA. Biosolids from the treatment process are beneficially reused as a soil enhancement on agricultural land in Sonoma County, taken to Redwood Landfill in Novato where they are used for alternative daily cover, or converted into a liquid biofertilizer by a private company in Fairfield. Some of the treated wastewater is recycled and used for washdown and irrigation at the plant site (Dow, 2019).

The treatment plant is capable of processing more than 125 mgd of wastewater during peak rainfall periods. The average dry weather flow is approximately 7.5 mgd, and permitted average dry weather flow is 10 mgd. The maximum peak wet weather flow has reached 121 mgd. The treatment plant has an additional hydraulic capacity of more than 155 mgd during maximum peak wet weather flow periods (Dow, 2019).

Wastewater Facilities in Project Site Vicinity

- The project site is currently vacant. As noted in Chapter 3, Project Description, of this DEIR, existing wastewater facilities in the project site vicinity include a 12-inch sewer line running along 3rd Street. Additional facilities in the vicinity include a 27-inch sewer line and an 18-inch sewer line on 2nd Street (Toy, 2019).

Wastewater Generation at Project Site

The project site is currently vacant, and no wastewater is generated at the site.

Solid Waste Disposal

Solid Waste Collection

Marin Sanitary Service, a privately owned waste hauler, provides solid waste collection service in San Rafael and other areas of central Marin County. Marin Sanitary Service operates a resource recovery and recycling plant, as well as a transfer station where waste is accepted and then hauled by transfer truck to Redwood Landfill (Nichols-Berman, 2004).

Landfill Capacity

Redwood Landfill, a fully permitted Class III disposal site located approximately 3.5 miles north of Novato, is the main landfill used for residential and commercial wastes generated in the San Rafael area. Redwood Landfill has a current maximum permitted capacity of 19.1 million cubic yards (mcy). According to the State of California's database, as of December 2008, the landfill had a remaining capacity of 26 mcy, which is different from the permitted capacity. The landfill has a permitted throughput of 2,300 tons per day and currently is expected to cease operation in 2024 (CalRecycle, 2019b).

Solid Waste Generation at Project Site

The project site is currently vacant, and no solid waste is generated at the site.

REGULATORY FRAMEWORK

Federal Regulations

No federal regulations related to utilities and service systems would apply to the project.

State Regulations

State Requirements for Water Supply Assessment

In 2001, the California legislature enacted Senate Bill (SB) 610, designed to achieve greater coordination between water suppliers and local land use agencies when considering certain large-scale development proposals. SB 610 requires preparation of a Water Supply Assessment for any development that involves an approval subject to the California Environmental Quality Act (CEQA) and that meets the definition of "project" under Water Code Section 10912(a)(7): a residential development project of more than 500 housing units or other types of development expected to use an equivalent amount of water.

Under SB 610, the Water Supply Assessment must describe the proposed project's water demand over a 20-year period, identify the sources of water available to meet that demand, and assess whether those water supplies are or will be sufficient to meet the demand for water associated with the proposed project, in addition to the demand of existing customers and other planned future development. If the assessment concludes that water supplies are or will be insufficient, the assessment must describe plans (if any) for acquiring additional water supplies, and the measures that are being undertaken to acquire and develop those supplies.

The project would use less water than 500 housing units or other types of development expected to use an equivalent amount of water, and therefore a Water Supply Assessment is not required for the project (Morrison, 2019).

California Integrated Waste Management Act

The California Integrated Waste Management Act of 1989 ("CIWMA") (Public Resources Code, Division 30, enacted through State Assembly Bill [AB] 939 and modified by subsequent legislation) was enacted to reduce, recycle, and reuse solid waste generated in the state to the maximum extent feasible. Specifically, the CIWMA requires city and county jurisdictions to plan and implement programs to divert 50 percent of the total waste stream from landfill disposal by the year 2000 (Public Resources Code, Section 41780). The CIWMA also requires each city and county to promote source reduction, recycling, and safe disposal or transformation. California cities and counties are required to submit annual reports to the state on their progress toward AB 939 goals.

Assembly Bill 341

In 2011, Assembly Bill 341 (Chesbro) was signed by Governor Brown and became law (Public Resources Code Sections 41730, *et seq.*, 42649, *et seq.*). The law implements a policy goal of the state that not less than 75 percent of solid waste generated be source reduced, recycled, or composted by 2020.

Local Regulations and Policies

San Rafael General Plan 2020

San Rafael General Plan 2020 policies that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact related to water, wastewater, or solid waste services consist of the following (City of San Rafael, 2017):

Policy LU-2 **Development Timing.** For health, safety and general welfare reasons, new development should only occur when adequate infrastructure is available consistent with the following findings: …

e. Sewer, water, and other infrastructure improvements will be available to serve new development by the time the development is constructed.

Program LU-2a **Development Review.** Through the development and environmental review processes, ensure that policy provisions are evaluated and implemented. The City may waive or modify any policy requirement contained herein if it determines that the effect of implementing the same in the issuance of a development condition or other approvals would be to preclude all economically viable use of a subject property.

Policy I-3 **Availability of Utilities.** Promote the availability of reliable and reasonably priced utilities necessary for businesses and residences to prosper.

Program I-3a **Capacity Management.** Work with the Central Marin Sanitation Agency and San Rafael Sanitation District to ensure completion of a Capacity Management Alternative Study to determine the scope of needed improvements, costs, and expected benefits to avoid excess of water treatment capacity.

Program I-3b **Water Supply Impacts.** Work with Marin Municipal Water District to meet the projected water demand and to ensure reduction of existing and projected water supply impacts.

Policy I-10 **Sewer Facilities.** Existing and future development needs should be coordinated with responsible districts and agencies to assure that facility expansion and/or improvement meets Federal and State standards and occurs in a timely fashion.

Policy SU-5 **Reduce Use of Non-Renewable Resources.** Reduce dependency on non-renewal resources.

Program SU-5d **Water Efficiency Programs.** Develop and implement water efficiency and conservation programs to achieve a 30% reduction in water use by 2020, including water efficient landscape regulations, PACE financing, water audits, upgrades upon resale, education and outreach.

Program SU-5e **Water Recycling.** Support the extension of recycled water distribution infrastructure. Require the use of recycled water where available.

Policy SU-10 **Zero Waste.** Reduce material consumption and waste generation, increase resource re-use and composting of organic waste, and recycle to significantly reduce and ultimately eliminate landfill disposal.

Program SU-10a **Zero Waste.** Implement and monitor the progress of actions contained in the Zero Waste Goal and Zero Waste Strategic Plan.

Program SU-10e **Recycling.** Encourage efforts to promote recycling, such as encouraging businesses to recycle building and other materials, promoting composting by restaurants, institutions and residences, and supporting Marin Conservation Corps' work to promote recycling.

Program SU-10g **Recycling for Apartments and Nonresidential Buildings**. Encourage recycling facilities and programs for apartment and nonresidential buildings. Consider the cost and benefits of expanding recycling facilities and programs for apartment and nonresidential buildings.

Program SU-10h **Demolition Waste.** Study ways to actively encourage greater recycling and reuse of demolition waste.

Policy SU-13 **Monitor Sustainability Objectives and Indicators.** Monitor success in achieving sustainability objectives and greenhouse gas reductions.

Program SU-13b **Future Development and Capital Improvements.** Evaluate future development applications and the City's Capital Improvement Program against compliance with the Sustainability Element and the GHG Emissions Reduction Strategy.

Policy S-32 **Safety Review of Development Projects.** Require…fire prevention techniques in new development…

Program S-32a **Safe Buildings.** Continue to review development applications to insure that…adequate water pressure and peak load storage capacity…reduce the opportunity for…fire hazards.

San Rafael Climate Change Action Plan

City of San Rafael Climate Change Action Plan programs that would apply to the project and were adopted for the purpose of avoiding or mitigating an environmental impact related to utilities and service systems consist of the following (City of San Rafael, 2009):

Program LF13 Encourage programs to educate and assist homeowners in composting, and the creation of facilities to convert organic waste (e.g., vegetative or food waste) to energy to significantly reduce or eliminate landfill disposal.

Program BU4 Apply green building requirements to residential, commercial and civic remodeling projects as well as new construction.

Water Conservation Requirements (MMWD and San Rafael Municipal Code)

San Rafael Municipal Code Section 14.16.370 requires that certain new construction and rehabilitation projects comply with water-efficient landscape requirements. In accordance with this Municipal Code section, the City adopts by reference MMWD's water conservation ordinance and designates MMWD to implement, enforce, and monitor the requirements of that ordinance (City of San Rafael, 2019a).

Title 13, Water Service Conditions and Water Conservation Measures, of the MMWD Code sets standards for water use in all new construction as well as certain remodels and landscape rehabilitations. MMWD's Ordinance No. 429 requires applicants for new water service to install a graywater recycling system to reuse the maximum practicable amount of graywater on site (MMWD, 2019a).

Utility Connection Fees

For water service, MMWD charges connection fees that apply to new development, changes in use, and excessive water consumption. The current connection fee is $34,180 per acre-foot of estimated annual consumption (MMWD, 2019b).

The San Rafael Sanitation District levies sewer connection fees, which are charged by dwelling unit and by the number of fixture units in commercial establishments (Toy, 2019).

CMSA levies a capacity charge for new connections to the San Rafael Sanitation District system. The charge is collected by the San Rafael Sanitation District and remitted to CMSA (Dow, 2019).

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Significance Criteria

For the purposes of this DEIR and based on Appendix G of the CEQA Guidelines, implementation of the proposed project would have a significant effect on utilities and service systems if it would:

a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects;

b) Have insufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry or multiple dry years;

c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments;

d) Generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals; or

e) Fail to comply with federal, state, and local management and reduction statutes and regulations related to solid waste.

Less-than-Significant Impacts

Relocation or Construction of Facilities

The project would not require or result in the relocation or construction of new or expanded water, wastewater treatment, or other facilities; the construction or relocation of which could cause significant environmental effects.

<u>Water Facilities</u>

As discussed in Chapter 3, Project Description, the project consists of two proposed developments:

1. The BioMarin project, a proposal to develop two buildings for research and development (R&D), office, and retail uses on an approximately 2.71-acre portion of the project site. The two buildings would contain a total of 207,000 square feet, consisting of 97,000 square feet for R&D laboratories and 110,000 square feet for offices and amenities, including 3,500 square feet of retail uses. The BioMarin project would have up to approximately 550 new employees, of whom about 140 employees would use the R&D areas, 400 employees would be in the office areas, and 10 employees would be in the retail area.
2. The Whistlestop/Eden Housing project, which would be developed by Whistlestop/Eden Housing on an approximately 0.34-acre portion of the project site. This building would contain an 18,000-square-foot "Healthy Aging Center" on the first and second floors and 67 units of affordable senior housing on the remaining floors. The Whistlestop/Eden Housing project would have approximately 80 residents (in the total of 67 units) and 17 employees who would be employed at the Healthy Aging Center. Ten of these employees would move from the existing Whistlestop building on Tamalpais Avenue.

The following water connections are proposed for the BioMarin project:

- A fire water connection to the existing 6-inch line running along 3rd Street;
- A domestic water connection to the existing 6-inch water line along 3rd Street; and
- A backflow preventer at the northwest corner of BioMarin Building A.

The following water connections are proposed for the Whistlestop/Eden Housing project:

- A fire water connection to the existing 6-inch line running along 3rd Street;
- A 6-inch water main extension for domestic water from the southwest corner of the Whistlestop/Eden Housing site, connecting to the existing 6-inch water line along 3rd Street; and
- A back-flow preventer at the southwest corner of the building, and a fire water back flow preventer at the northeast corner of the building. Both locations would be within alcoves, providing screening and unobstructed sidewalk access.

Construction of new off-site water facilities or expansion of existing facilities is not expected to be necessary. No extension of MMWD pipelines would be necessary to serve the project (Morrison, 2019). The environmental impacts of the water facilities required for the project are therefore evaluated as part of the analysis of project construction impacts throughout this DEIR. The BioMarin project would require one water meter per structure, and the Whistlestop/Eden Housing project would likely require a single meter for the building at the street with private submeters for each living unit (Morrison, 2019). These water facilities would not have any specific significant environmental impacts requiring mitigation. The project applicants would pay appropriate development impact and utility connection fees toward ongoing improvements and maintenance of the water system (MMWD, 2019b). The environmental impact would be less than significant, and no mitigation is necessary.

Water system improvements to be funded by the project applicants may include installation of a new fire hydrant at the corner of 3rd Street and Brooks Street. The San Rafael Fire Department is planning to require this new hydrant as part of an MMWD water main replacement along the portion of 3rd Street that adjoins the project site. The water main replacement would occur in 2020 (Sinnott, 2019).

Wastewater Facilities

As discussed above and in Chapter 3, Project Description, of this DEIR, the project consists of two proposed developments: the BioMarin project and the Whistlestop/Eden Housing project. Both would include sewer connections into the existing 12-inch sewer line running along 3rd Street.

Construction of new off-site wastewater facilities or expansion of existing facilities is not expected to be necessary. The environmental impacts of the wastewater facilities required for the project are therefore evaluated as part of the analysis of project construction impacts throughout this DEIR. The wastewater facilities would not have any specific significant environmental impacts requiring mitigation. The project applicants would be required to submit civil engineering plans to the San Rafael Sanitation District for approval; at that time, the capacity of each pipeline would be checked, and various options for connection would be evaluated. The lift station has adequate capacity to serve the additional flow. The project applicants would also be required to pay appropriate development impact and utility connection fees toward ongoing improvement and maintenance of the wastewater system (Toy, 2019). The environmental impact would be less than significant, and no mitigation is necessary.

Other Facilities

Impacts on storm drainage facilities are addressed in Section 4.8, Hydrology and Water Quality, of this DEIR. Impacts on electric power and natural gas facilities are addressed in Section 4.4, Energy, of this DEIR. The project would be served by existing telecommunications facilities in downtown San Rafael and is not expected to require or result in the relocation or construction of new or expanded facilities, the construction or relocation of which could cause significant environmental effects.

Sufficiency of Water Supplies

Water supplies would be sufficient to serve the project and reasonably foreseeable future development during normal, dry or multiple dry years.

The project applicants estimate that (1) for the BioMarin project, water demand would consist of approximately 1,500 gallons per day for the office use (BioMarin Building A) and approximately 3,000 gallons per day for the R&D use (BioMarin Building B); and (2) for the Whistlestop/Eden Housing project, water demand would be approximately 140,000 gallons per month for the residential component and 38,000 gallons per month for the Healthy Aging Center component (BioMarin and Whistlestop/Eden Housing, 2019).[1]

- The project would include water conservation measures.[2] As described in Chapter 3, Project Description, of this DEIR, the project would reduce landscape water demand by installing permeable paving that adds water to the subsoil for all landscape trees east of the new buildings. The project site would also be furnished with complete automatic remote control irrigation system with Model Water Efficient Landscape Ordinance (MWELO)-compliant irrigation flow sensors, valves, and controllers. Equipment would be compatible with any future reclaimed water source. In the Whistlestop/Eden Housing project, WaterSense certified kitchen and bathroom plumbing (low-flow) fixtures would be used (BioMarin and Whistlestop/Eden Housing, 2019), and the building would be designed to meet Green-Point Rated or Leadership in Energy and Environmental Design (LEED) standards of sustainability, with reduced water use.

MMWD has indicated that the project site's current water entitlement of 3.57 afy would be insufficient for the proposed project, and therefore purchase of an additional water entitlement would be required (Borjian, 2018).

Landscape irrigation on the project site would be subject to MMWD's landscape water conservation requirements, as well as State of California water conservation landscaping requirements. MMWD also recommends that the project implement Automated Meter Infrastructure (AMI) in accordance with MMWD standards on all necessary meters—residential, commercial, and irrigation. AMI-enabled meters would ensure real-time response to water leaks, backflow events that might otherwise lead to contamination of adjacent mains, and enhanced conservation ability with use of

[1] Assuming a 30-day month, the Whistlestop/Eden Housing project estimates translate to 4,667 gallons per day for the residential component and 1,267 gallons per day for the Healthy Aging Center component.

[2] These water conservation measures related to landscaping apply primarily to the BioMarin project as very little landscaping is provided for the Whistlestop/Eden Housing project due to the limited unbuilt area on the site.

MMWD's customer portal (Morrison, 2019). Compliance with these requirements would help reduce the project's water use, in compliance with San Rafael General Plan 2020 and Climate Change Action Plan policies and programs for water conservation (see Section 4.15.3, Regulatory Framework, above).

Water supplies would be sufficient to serve the project and reasonably foreseeable future development during normal, dry or multiple dry years (Morrison, 2019). The project's impact on water supplies would therefore be less than significant, and no mitigation is necessary.

Wastewater Treatment Requirements and Capacity

The project would not result in a determination by the wastewater treatment provider that serves the project site that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments.

The project would include connections to existing wastewater facilities. Wastewater would discharge into the existing 12-inch sewer line in 3rd Street and into the 27-inch and 18-inch sewer lines on 2nd Street, depending on the additional flows and pipe capacities (Toy, 2019). Sewage from the development would be conveyed through the San Rafael Sanitation District sewer system to the CMSA Wastewater Treatment Plant.

The project applicants estimate that wastewater generation for the project would be approximately as follows (BioMarin and Whistlestop/Eden Housing, 2019):

1. For the BioMarin project: approximately 1,500 gallons per day for the office use (BioMarin Building A) and approximately 3,000 gallons per day for the R&D use (BioMarin Building B).
2. For the Whistlestop/Eden Housing project: approximately 140,000 gallons per month for the residential component and 38,000 gallons per month for the Healthy Aging Center component.[3]

The CMSA Wastewater Treatment Plant would have adequate capacity to handle this increase (Dow, 2019). The project's impact would therefore be less than significant and no mitigation is necessary.

Solid Waste Disposal

The project would not generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals. The project would comply with federal, state, and local management and reduction statutes and regulations related to solid waste.

The project would involve construction of new facilities on the project site, as described in Chapter 3, Project Description, of this DEIR. Solid waste would be generated during both construction and operation of the project. Once in operation, the project would generate about 1,459 pounds per day of solid waste, as shown in **Table 4.15-1**.

[3] Assuming a 30-day month, the Whistlestop/Eden Housing project estimates translate to 4,667 gallons per day for the residential component and 1,267 gallons per day for the Healthy Aging Center component.

TABLE 4.15-1 ESTIMATED AMOUNT OF SOLID WASTE TO BE GENERATED BY PROPOSED PROJECT

Land Use Category	Solid Waste Generation Rate[a]	Development Proposed by Project	Estimated Amount of Solid Waste
BioMarin Project			
Office	6 pounds per 1,000 SF/day	110,000 SF	660 lbs/day
Research and Development (R&D)[b]	3 pounds per 1,000 SF/day	97,000 SF	291 lbs/day
Retail	0.046 pound per SF/day	3,500 SF	161 lbs/day
Subtotal			*1,112* lbs/day
Whistlestop/Eden Housing Project			
Multi-Family Residential[c]	---	67 housing units	154 lbs/day
Institutional (Healthy Aging Center)[d]	---	18,000 SF	193 lbs/day
Subtotal			*347* lbs/day
PROJECT TOTAL			**1,459 lbs/day**

Notes: SF/day = square feet per day; lbs/day = pounds per day
[a] Unless otherwise noted, source of solid waste generation rates is State of California Department of Resources Recycling and Recovery (CalRecycle) (https://www2.calrecycle.ca.gov/WasteCharacterization/General/Rates). Calculations used the general mid-point of rates listed for the “Office,” “Industrial” (R&D), and “Retail” categories, and the lowest rate listed for the “Multi-Family Residential” category (due to the small size of the proposed Whistlestop/Eden Housing project units).
[b] Estimate was provided by the BioMarin project architect (Zamanpour, 2019).
[c] Estimate is based on solid waste generation at comparable senior housing properties.
[d] Estimate is based on solid waste generation at Whistlestop’s existing operation in San Rafael: 3,000 gallons of landfill waste and 2,000 gallons of recyclables per month (BioMarin and Whistlestop/Eden Housing, 2019). Conversion of gallons to pounds assumed 1 gallon equates to 0.00576 cubic yard and 1 cubic yard equates to 202 pounds of solid waste (EPA, 2019).
Source: CalRecycle, 2019a; BioMarin and Whistlestop/Eden Housing, 2019; EPA, 2019; Criscimagna, 2019; Zamanpour, 2019.

Redwood Landfill would have sufficient capacity to accommodate the project’s solid waste disposal needs. The landfill’s maximum permitted capacity (19.1 mcy) and permitted throughput (2,300 tons per day) far exceed the net increase in solid waste that would be generated by the project (1,459 pounds per day). The impact on landfill capacity would therefore be less than significant.

The substantial quantities of waste generated by project construction and operations would have the potential to interfere with the City’s achievement of waste diversion goals mandated by the California Integrated Waste Management Act. However, the project would be subject to the California Green Building Standards Code (CALGreen Code), which has been adopted as Chapter 12.23 of the San Rafael Municipal Code (City of San Rafael, 2019b). The CALGreen Code contains requirements for waste reduction and recycling, including requirements that a minimum of 50 percent of construction waste be recycled and/or salvaged for reuse, that a construction waste management plan be prepared, and that readily accessible areas be provided to allow recycling by project occupants (CalRecycle, 2019c). The City of San Rafael would review the project to verify compliance with the CALGreen Code. The impact would therefore be less than significant, and no mitigation measure is necessary.

Potentially Significant Impacts

The project would not have any potentially significant impacts related to utilities.

Cumulative Impacts

Water

For water service, the geographic scope for assessing cumulative impacts is the area within the MMWD service area.

The project, in conjunction with other past, present, and probable future projects, could result in a cumulative increase in water demand and the need for new or expanded water facilities. As discussed in the above project-specific analysis, however, the project's water consumption would not result in a significant impact on water supply or create the need for new or expanded water facilities. MMWD expects water supply to be adequate to serve the project and reasonably foreseeable future development during normal, dry or multiple dry years (Morrison, 2019). Individual projects proposed within the MMWD service area will need to calculate precise water demands and facilities needed to provide adequate long-term water supply.

For these reasons, the effect of the project on water service, in combination with other past, present, and probable future projects, would be less than significant. The project would not result in or contribute to any significant cumulative water service impacts.

Wastewater

For wastewater service, the geographic scope for assessing cumulative impacts is the service area of the San Rafael Sanitation District and the CMSA Wastewater Treatment Plant. In San Rafael, approved or currently pending development includes approximately 161 housing units, 72,000 square feet of office space, 2,000 square feet of retail space, a 140-room hotel, an 88-bed assisted living facility, a 600-space garage expansion, relocation of the San Rafael Transit Center (also known as the C. Paul Bettini Transportation Center), and construction of the City's new Public Safety Center (see Table 6-1 and Figure 6-1 in Chapter 6, CEQA Considerations, of this DEIR).

The project, in conjunction with other past, present, and probable future projects, could result in a cumulative increase in wastewater generation, resulting in increased demand on wastewater collection and treatment facilities. As discussed in the above project-specific analysis, however, service demand from the project would not result in a significant impact on wastewater treatment plant capacity or create the need for new or expanded wastewater facilities (Dow, 2019). While sewer lateral connections would not be identified until projects are in the design stage, the existing lift station is expected to have adequate capacity to serve the additional flow (Toy, 2019).

For these reasons, the effect of the project on wastewater service, in combination with other past, present, and foreseeable projects, would be less than significant. The project would not result in or contribute to any significant cumulative wastewater service impacts.

Solid Waste Disposal

For solid waste disposal service, the geographic scope for assessing cumulative impacts consists of the service area of Redwood Landfill through 2024. The location for disposal of San Rafael's waste beyond 2024 has yet to be determined.

The project, in conjunction with past, present, and probable future projects, could result in a cumulative increase in solid waste and debris from both construction and operations. However, comprehensive implementation of state and local waste reduction and diversion requirements and programs has and would continue to reduce the potential for exceeding existing landfill capacity.

For these reasons, the project's effect on solid waste disposal service, in combination with other past, present, and probable future projects, would be less than significant. The proposed project would not result in or contribute to any significant cumulative solid waste disposal service impacts.

REFERENCES

BioMarin and Whistlestop/Eden Housing, 2019. "List of Needed Material for EIR," final as of April 2.

Borjian, Chris, Engineering Technician, Marin Municipal Water District, 2018. Letter to Sean Kennings, San Rafael Planning Department, re. "Water Availability – Redevelopment and Lot Split, Assessor's Parcel No.: 011-265-01, Location: 999 Third St., San Rafael," November 19.

California Public Resources Code Sections 41730, 41780, and 42649.

Central Marin Sanitation Agency (CMSA), 2019. "About Us." Website: http://www.cmsa.us/aboutus/, accessed on March 14, 2019.

City of San Rafael, 2009. *City of San Rafael Climate Change Action Plan*, April, pages 8 and 10.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Amended and reprinted April 28, 2017, pages 16, 201, 228-231, 234, and 282.

City of San Rafael, 2019a. Municipal Code Section 14.16.370 (Water-Efficient Landscape).

City of San Rafael, 2019b. Municipal Code Section 12.23.10 (Adoption of California Green Building Standards Code, 2016 Edition, with amendments).

Criscimagna, Associate Director – Real Estate Development, Eden Housing, 2019. E-mail re. "BioMarin EIR – Solid Waste Generation," March 26.

Dow, Jason, Central Marin Sanitation Agency (CMSA), 2019. E-mail re. "BioMarin EIR – Wastewater Impacts," April 1.

Environmental Protection Agency (EPA), 2019. "RecycleMania Volume to Weight Conversion Chart." Website: https://archive.epa.gov/wastes/conserve/tools/rogo/web/pdf/volume-weight-conversions.pdf, accessed on March 25.

Marin Municipal Water District (MMWD), 2016. *Urban Water Management Plan 2015 Update*, June, pages 1-2, 1-4, 3-3, and 7-7.

Marin Municipal Water District (MMWD), 2017. *Water Resources Plan 2040*, March, pages 1-2, 1-3, 2-1, 4-2, and 8-1.

Marin Municipal Water District (MMWD), 2019a. Website: https://www.marinwater.org/168/Water-Conservation-Requirements, accessed on March 26, 2019.

Marin Municipal Water District (MMWD), 2019b. Website: https://www.marinwater.org/284/Fees-Costs, accessed on March 26, 2019.

Morrison, Paul, Engineering Support Services Manager, Marin Municipal Water District (MMWD), 2019. E-mail re. “BioMarin EIR – Water Impacts,” April 9.

Nichols-Berman, 2004. *San Rafael General Plan 2020 General Plan Update Draft Environmental Impact Report*, February, page IV.5-7.

Sinnott, Robert, City of San Rafael, 2019. E-mail to Sean Kennings re. “MMWD 3rd Street Pipeline Replacement Project,” January 15.

State of California Department of Resources Recycling and Recovery (CalRecycle), 2019a. Estimated Solid Waste Generation Rates. Website: https://www2.calrecycle.ca.gov/WasteCharacterization/General/Rates, accessed on March 18, 2019.

State of California Department of Resources Recycling and Recovery (CalRecycle), 2019b. Solid Waste Information System (SWIS) Facility/Site Listing. Website: https://www2.calrecycle.ca.gov/swfacilities/Directory/21-AA-0001/, accessed on March 14, 2019.

State of California Department of Resources Recycling and Recovery (CalRecycle), 2019c. Frequently Asked Questions. Website: https://www.calrecycle.ca.gov/lgcentral/library/canddmodel/instruction/faq#CALGreen, accessed on April 17, 2019.

Toy, Doris, San Rafael Sanitation District, 2019. E-mail re. “BioMarin EIR – Wastewater Impacts,” April 23.

Zamanpour, Shar, BioMarin, 2019. E-mail re. “BioMarin EIR – Solid Waste Generation,” March 29.

5. ALTERNATIVES

The California Environmental Quality Act (CEQA) Guidelines (Section 15126.6) requires that an EIR describe and evaluate the comparative merits of a range of reasonable alternatives to the project, or to the location of the project, that could feasibly attain most of the basic objectives of the project. The CEQA Guidelines further require that the discussion focus on potentially feasible alternatives capable of avoiding or substantially lessening any of the significant effects of the project, including the “No Project” Alternative. Furthermore, if the environmentally superior alternative is the “No Project” Alternative, the EIR must also identify an environmentally superior alternative from among the other alternatives (14 California Code of Regulations [CCR] Section 15126.6(e)).

There is no ironclad rule governing the nature or scope of the alternatives to be discussed other than the “rule of reason” (14 CCR Section 15126.6(a)). The “rule of reason” requires that an EIR set forth only those alternatives necessary to permit a reasoned choice, and that these be limited to realistic alternatives that the lead agency determines could feasibly obtain most of the basic project objectives while avoiding or substantially lessening one or more of the significant effects (14 CCR Section 15126.6). The scope of alternatives comprising a reasonable range is in the lead agency’s discretion and will vary from case to case depending on the nature of the project under review (*Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553, 566). Pursuant to the CEQA Guidelines, “An EIR need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative” (14 CCR Section 15126.6(f)(3)).

The requirement that an EIR evaluate alternatives to the proposed project or its location is broad. The description or evaluation of alternatives does not need to be exhaustive or as detailed as that provided for the proposed project (14 CCR Section 15126.6(a) and (c)). Alternatives need be environmentally superior to the proposed project in only some respects (*Sierra Club v. City of Orange* (2008) 163 Cal.App.4th 523, 547).

The project objectives are discussed in Chapter 3, Project Description, of this DEIR. The discussion in this chapter will focus on feasible alternatives that could address potentially significant impacts. The DEIR identifies potentially significant impacts that can be reduced to less-than-significant levels with implementation of mitigation measures for aesthetics, air quality, cultural resources, hazards and hazardous materials, hydrology and water quality, land use and planning, noise, recreation, and transportation. The project would have significant and unavoidable impacts for the topics of land use and planning (conflict with San Rafael General Plan 2020 Policy LU-2) and transportation (impacts on traffic conditions, including on U.S. Highway 101 and at local intersections).

Four alternatives to the project are evaluated in this chapter:

- Alternative 1: No Project Alternative
- Alternative 2: Reduced Scale Alternative

- Alternative 3: Code-Compliant BioMarin and Off-Site Whistlestop/Eden Housing Project Alternative
- Alternative 4: Code-Compliant BioMarin and Whistlestop/Eden Housing Project Alternative

These alternatives were identified as a reasonable range of alternatives for discussion in this DEIR based on the following factors:

- The extent to which the alternative would accomplish most of the basic project objectives and purposes;
- The extent to which the alternative would reduce or eliminate one or more of the significant environmental effects of the project;
- The feasibility of the alternative, including whether the alternative could be accomplished in a successful manner within a reasonable period of time, taking into account site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, jurisdictional boundaries, and economic, environmental, legal, social, and technological factors (14 CCR Sections 15364 and 15126.6(f); Public Resources Code Section 21061.1);
- The extent to which the alternative would contribute to a "reasonable range" of alternatives necessary to permit a reasoned choice; and
- The requirement under the CEQA Guidelines to consider a No Project Alternative and to identify an "environmentally superior" alternative in addition to the No Project Alternative (14 CCR Section 15126.6(e)).

Alternatives that were considered but rejected as infeasible are discussed in Section 5.1 below. The topics covered for each alternative are those also covered for the proposed project. For example, the topics of biological resources and mineral resources are not covered because these are not relevant to the project.

The following are the primary project objectives as outlined by BioMarin and Whistlestop/Eden Housing:

- Development of an underutilized vacant site in close proximity to BioMarin's existing San Rafael headquarters to accommodate BioMarin's planned expansion of its campus through the addition of a new laboratory and office space flexible in design and built in a manner that can accommodate the necessary square footage and building heights to support the research and development (R&D) and laboratory infrastructure requirements needed for BioMarin's planned expansion, while also accommodating the needs of Whistlestop/Eden Housing and its use of a portion of the project site for its Healthy Aging Center and affordable senior housing.
- Provision of a new location for Whistlestop's existing Healthy Aging Center and Eden Housing's proposed senior housing that is affordable for the project and central to downtown San Rafael and public transit, and that avoids development on a site with potential historical significance that is proximate to the freeway and its associated air quality impacts.[1]

[1] The existing Whistlestop operation located at 930 Tamalpais Avenue (at 4th Street) does not include any residential units but does include activities for older adults. In 2017, a project was proposed to develop affordable housing units at that site, but it was determined that the site was not ideal for the proposed project. Whistlestop/Eden Housing then worked with BioMarin to identify the current project site as a preferred alternative location.

- Development of a project that will provide enhanced pedestrian experience and safety through the connection of BioMarin's existing campus and surrounding residential communities to San Rafael's downtown corridor with the use of site setbacks and landscaping along the perimeter of the project site, as well as improved sidewalks and crosswalk design.
- Remediation and revitalization of a brownfield site.
- Development of signature buildings in the heart of downtown San Rafael that are reflective of the history of San Rafael and its future growth.
- Development of a high-quality, mixed-use building comprised of a Healthy Aging Center for Whistlestop, a non-profit organization vital to the local older adult community, that will provide services for older adults in San Rafael and the greater Marin County area in a practical and cost-effective manner; and 67 affordable rental housing units for seniors in an environmentally conscious, car-free community proximately situated to public transportation and downtown businesses.
- Promotion of San Rafael's goals of encouraging alternative modes of transportation with the donation of funds to develop a bike lane on Lindaro Street from 3rd Street to Andersen Drive.
- Activation of 3rd Street as a vibrant downtown corridor, in parallel to and complementing 4th Street.
- Support for the continued growth and retention of BioMarin in San Rafael, which in turn provides local employment opportunities and significant economic benefits to the City and local businesses.
- Support for the City of San Rafael's desire to attract and retain a growing and sophisticated work force with high-paying jobs.
- Creation of transit-oriented development in line with the Downtown Station Area Plan's goals as well as the City of San Rafael's General Plan goals.
- Use of larger parking structures on the perimeter of the BioMarin campus to keep the visible bulk away from major views and to reduce car trips along 2nd and 3rd Streets, while creating an environment more easily navigated by employees and visitors.

5.1 ALTERNATIVE CONSIDERED BUT REJECTED

In addition to the alternatives included in Section 5.2, an off-site alternative was also considered for the project, for both the BioMarin and Whistlestop/Eden Housing components. However, an off-site alternative for BioMarin would not meet the co-location needs of BioMarin employees, given the existing BioMarin facilities located on the south side of 2nd Street. Alternative 3 provides for an off-site location for Whistlestop/Eden Housing because the existing Whistlestop site at 930 Tamalpais Avenue was once considered for expansion to provide affordable senior housing. When the current project site was suggested for Whistlestop/Eden Housing, this current site was found to be favorable in a number of ways such as proximity to everyday commercial needs and greater distance from U.S. Highway 101 and its associated diesel emissions and noise that could affect residents. Also, a site large enough to accommodate both projects in a central San Rafael location does not exist. In consideration of these factors, the off-site alternative for the full project was considered but rejected.

5.2 SUMMARY OF ALTERNATIVES

ALTERNATIVE 1: NO PROJECT

Overview

Alternative 1, the No Project Alternative, would leave the project site unchanged. No drainage, access, parking, or other improvements would be made to the vacant site, which was once occupied by PG&E facilities. The No Project Alternative would leave this central San Rafael location unimproved.

Impacts

Aesthetics

Under the No Project Alternative, no changes would occur. The site would remain undeveloped without any new buildings. No new landscaping would be added to the site. No conflicts would occur with City policies related to visual quality or viewsheds. Views of Mt. Tamalpais would remain open from 3rd Street.

Air Quality

Under the No Project Alternative, no development would occur on the project site and therefore no project-related air emissions would occur.

Cultural Resources

The No Project Alternative would result in no impacts on cultural resources. No ground disturbance would occur that could unearth subsurface archaeological deposits or human remains.

Energy

No change in energy demand or services would occur under the No Project Alternative. This alternative would therefore have no impact on energy demand or facilities.

Geology and Soils

The No Project Alternative would result in fewer potential geology and soils impacts than the proposed project. As no buildings would be constructed under this alternative, there would be no potential impacts from ground shaking, ground failure, or expansive and/or corrosive soils affecting those buildings, and no ground disturbance that could damage an unidentified paleontological resource.

Greenhouse Gas Emissions

As no buildings would be constructed or occupied for use under this alternative, this alternative would result in no impacts related to greenhouse gas (GHG) emissions.

Hazards and Hazardous Materials

The No Project Alternative would result in no impacts related to hazards and hazardous materials. Existing contamination in the subsurface of the project site would continue to be managed under Department of Toxic Substances Control (DTSC) oversight to ensure that the project site does not pose risks to human health or the environment.

Hydrology and Water Quality

The No Project Alternative would result in fewer potential hydrology and water quality impacts than the proposed project. As no buildings would be constructed under this alternative, there would be no potential to degrade water quality, alter drainage patterns in a manner that could exceed the capacity of the existing stormwater drainage systems, or risk the releases of pollutants due to site inundation by flooding.

Land Use and Planning

No impacts related to land use and planning would occur under the No Project Alternative, as there would be no change from existing conditions. However, the No Project Alternative would not allow the opportunity for this part of the City to be revitalized and for the downtown area to be intensified in use with new commercial and residential uses. Fewer conflicts with City policies would occur as the site would remain unchanged, but leaving the site unchanged would result in conflicts with policies related to encouraging revitalization of the downtown.

Noise

As no buildings would be constructed under this alternative, this alternative would result in no impacts related to noise and vibration.

Public Services

No change in demands for fire protection or police services would occur under the No Project Alternative. This alternative would therefore have no impact on the need for new or physically altered fire stations or police facilities.

Recreation

No change in demand for recreational facilities would occur under the No Project Alternative. This alternative would therefore have no impact on existing parks or recreational facilities or the need for new facilities. The recreational facilities included in the project would not be built.

Transportation

The No Project Alternative would not generate additional vehicle traffic nor result in transportation impacts related to traffic level of service and operations as compared to the proposed project. The No Project Alternative would not, however, allow implementation of recommended mitigation measures such as curb ramp improvements at intersections peripheral to the project site, crosswalk improvements at 3rd Street/Lindaro Street intersection, or a new crosswalk with beacon across 3rd Street at Brooks Street.

Tribal Cultural Resources

Under the No Project Alternative, no impacts would occur related to tribal cultural resources as no ground disturbance would take place.

Utilities and Service Systems

No change in water, wastewater, or solid waste demands or services would occur under the No Project Alternative. This alternative would therefore have no impact on utilities demand, capacity, or facilities.

Relationship to Project Objectives

The No Project Alternative would not meet any of the objectives of the proposed project.

ALTERNATIVE 2: REDUCED SCALE ALTERNATIVE

Overview

Alternative 2 would consist of a project that is similar to the proposed project but reduces the amount of overall proposed laboratory and office space of the BioMarin project, thereby reducing the anticipated peak hour traffic trips and other impacts. This alternative would reduce the overall number of employees at BioMarin from 550 to 229 employees, or by 58.3 percent. This reduction in employees could result in the project's significant, unavoidable traffic impacts at the following locations becoming less-than-significant impacts:

- 3rd Street/Tamalpais Avenue West intersection (cumulative-plus-project condition during AM and PM peak hour).
- 3rd Street between Hetherton Street and D Street (westbound during AM peak hour).

This alternative assumes the following square footage changes for the proposed on-site BioMarin buildings:

- **Building A:** 32,340 square feet for offices (vs. 77,000 square feet under the proposed project) plus 20,000 square feet for amenities (including retail) space (vs. 33,000 square feet under the proposed project), for a total of 52,340 square feet of office and amenities (including retail) space (vs. 110,000 square feet under the proposed project).
- **Building B:** 67,900 square feet for laboratory space (vs. 97,000 square feet under the proposed project).

Thus, the total square footage for the two BioMarin buildings under Alternative 2 would be 120,240 square feet, compared to the 207,000 square feet under the proposed project. The office portion would be reduced by a slightly larger amount than the laboratory and retail space. The alternative would include two stories for Building A (reduced to 52,340 square feet) as compared to the proposed project's four stories for Building A. Building B (67,900 square feet) would be three stories with the top floor set back and with reduced square footage (as compared to the project's four stories for Building B). Otherwise, the site plan for the overall project would be similar to that of the proposed project (see **Figure 5-1**).

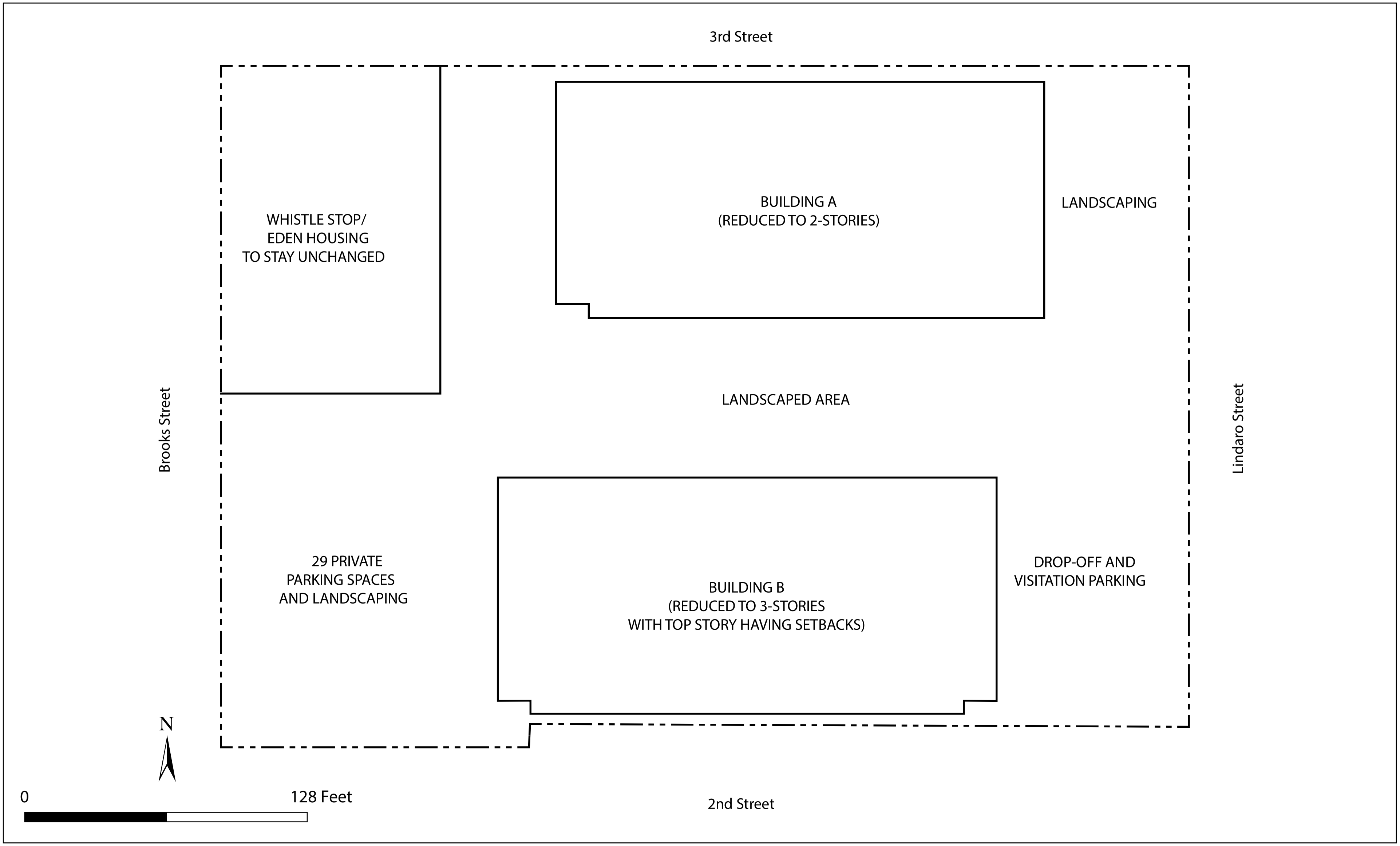


Figure 5-1

ALTERNATIVE 2 SITE PLAN

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

The project site is located within the Downtown Parking District, which waives parking requirements for the first 1.0 of Floor Area Ratio (FAR).[2] With this alternative having an FAR of 1.02, parking would be required for 2,141 square feet of the BioMarin buildings.[3] Assuming the required 3.3 parking spaces per 1,000 square feet of building area, a total of seven parking spaces would be required to be provided on the site. These spaces would be in addition to public parking that is assumed to allow the building height bonus. The site plan for this alternative (see Figure 5-1) shows 29 private parking spaces plus some visitation parking on the east side.

This alternative assumes that the Whistlestop/Eden Housing project would not be reduced in size, given the allowable density bonus provisions and the fact that few trips would be generated by the Whistlestop/Eden Housing portion of the project.

Impacts

Aesthetics

Under Alternative 2, the overall mass of the BioMarin buildings (both Building A and Building B) would be reduced from four stories to two stories for Building A, and from four stories to three stories (with reduced top floor) for Building B. This reduction in height would result in the new buildings being closer in scale to other nearby buildings. However, the overall length and width of Buildings A and B would be unchanged and if the design of the exterior of the buildings remained unchanged as compared to the proposed project, similar visual impacts would result when viewed from both 2nd Street and 3rd Street.

Air Quality

Under this alternative, the new land uses on the project site would be similar to those of the proposed project and would result in similar air quality impacts.

Cultural Resources

This alternative would result in the same impacts related to cultural resources as the proposed project because it would require a similar level of ground disturbance. This ground disturbance has the potential to unearth previously unrecorded archaeological cultural resources at the site.

Energy

Compared to the project, Alternative 2 would have similar but slightly reduced demands for energy resources and facilities. Impacts of Alternative 2 would be comparable to those of the project and would be less than significant.

[2] Per City of San Rafael Municipal Code Section 14.18.060.

[3] The total area of the project site is 133,099 square feet but the BioMarin portion is 118,099 square feet and the Whistlestop/Eden Housing portion is 15,000 square feet. Thus, under Alternative 2, 118,099 square feet of BioMarin building area would be exempt from the City's parking requirements, and the requirements would be calculated on the remaining building area. This remaining area would be the total proposed building area of 120,240 square feet minus 118,099 square feet, or 2,141 square feet. Based on the City requirement of 3.3 parking spaces per 1,000 square feet of building area, seven parking spaces would be required (2,141 square feet divided by 1,000, multiplied by 3.3).

Geology and Soils

This alternative would result in the same impacts related to geology and soils as the proposed project because it would require a similar level of ground disturbance and would result in the development of buildings that would be subject to the same hazards from ground shaking, ground failure, or expansive and/or corrosive soils as the buildings developed under the proposed project.

Greenhouse Gas Emissions

Under this alternative, the new land uses on the project site would be similar to those of the project and would result in similar less-than-significant impacts related to GHG emissions.

Hazards and Hazardous Materials

Under this alternative, the new land uses on the project site would be similar to those of the project and would result in similar impacts related to hazards and hazardous materials.

Hydrology and Water Quality

This alternative would result in the same impacts related to hydrology and water quality as the proposed project because it would require a similar level of ground disturbance and would result in the development of buildings that would have the same potential impacts on water quality, drainage patterns, and release of pollutants to flood water as under the proposed project.

Land Use and Planning

Compared to the proposed project, Alternative 2 would have a reduced land use impact related to conflict with San Rafael General Plan 2020 Policy LU-2, which specifies that new development should only occur when adequate traffic conditions and circulation improvements are available (see additional discussion under “Transportation” below). Parking demand would be significantly reduced due to the reduction in square footage for the BioMarin project, and all parking would be able to be provided on the site. Transportation impacts would be significantly reduced due to the large reduction in employees and associated trip generation.

Noise

Under this alternative, the new land uses on the project site would be similar to those of the project and would result in similar noise and vibration impacts.

Public Services

Compared to the project, Alternative 2 would have reduced demands for fire protection or police services. Impacts of Alternative 2 would be less than significant.

Recreation

Impacts of Alternative 2 would be reduced from those of the project and would be less than significant.

Transportation

Alternative 2 would generate significantly less vehicular traffic than the proposed project, due to the reduction in employees at BioMarin from 550 to 229 employees. This reduction would eliminate two significant, unavoidable traffic impacts identified for the proposed project: the impact at the 3rd Street and Tamalpais Avenue West intersection, and the impact on westbound 3rd Street between Hetherton Street and D Street. The impact at the U.S. Highway 101 southbound off-ramp to Mission Avenue would remain significant and unavoidable, as this impact could only be reduced to less than significant if the number of BioMarin employees was reduced to 112 employees.

Tribal Cultural Resources

Alternative 2 would result in the same impacts related to tribal cultural resources as the proposed project because it would require a similar level of ground disturbance. This ground disturbance has the potential to unearth previously unrecorded archaeological cultural resources at the site.

Utilities and Service Systems

Compared to the project, Alternative 2 would have reduced demands for water, wastewater, and solid waste services. Impacts of Alternative 2 would be less than significant.

Relationship to Project Objectives

Alternative 2 would meet all of the project objectives as listed at the beginning of this chapter except the following primary objective:

- Development of an underutilized vacant site in close proximity to BioMarin's existing San Rafael headquarters to accommodate BioMarin's planned expansion of its campus through the addition of a new laboratory and office space flexible in design and built in a manner that can accommodate the necessary square footage and building heights to support the R&D and laboratory infrastructure requirements needed for BioMarin's planned expansion, while also accommodating the needs of Whistlestop/Eden Housing and its use of a portion of the project site for its Healthy Aging Center and affordable senior housing.

Compared to the proposed project, the size of Alternative 2 would be significantly reduced, which would not meet the identified laboratory and office space needs for BioMarin. Whistlestop/Eden Housing would be unchanged from the proposed project; thus, the portion of this objective addressing the Healthy Aging Center and affordable senior housing would be met. However, if the BioMarin part of Alternative 2 were not developed because the project's primary objective could not be met, the Whistlestop/Eden Housing part would also not occur.

ALTERNATIVE 3: CODE-COMPLIANT BIOMARIN AND OFF-SITE WHISTLESTOP/ EDEN HOUSING PROJECT

Overview

Alternative 3 provides for a code-compliant BioMarin project with the Whistlestop/Eden Housing project located off the project site at 930 Tamalpais Avenue, the existing Whistlestop location. This alternative assumes that no General Plan amendment or rezoning for the site would be needed.

BioMarin Project under Alternative 3

Alternative 3 would reduce the building height of the BioMarin project to 54 feet to comply with existing General Plan provisions and zoning for the site, with no bonus exemptions and no rezoning to Planned Development for the BioMarin portion of the site. However, for Alternative 3, it is assumed that a height exemption for the two BioMarin buildings could occur given that no on-site parking would be required for the project (see discussion below), but BioMarin could provide some public parking on the site, thus enabling an exemption to allow a height of 66 feet (12-foot bonus).[4] The FAR would be increased from the proposed 0.90 to 1.50, as allowed by existing General Plan provisions and zoning, allowing a total of 199,649 square feet for BioMarin on the site. The 199,649 square feet on the site would be 25,351 square feet less than the project total of 225,000 square feet used for purposes of calculating FAR (207,000 square feet proposed for BioMarin and 18,000 square feet proposed for Whistlestop/Eden Housing).[5] The FAR limit would not consider combining the site with other nearby BioMarin facilities (as addressed in Table 3-3 of Chapter 3 of the DEIR).

It is assumed that the BioMarin portion of the site would consist of two buildings similar in scale to proposed Building B, or about 235 feet long by 108 feet wide (for a footprint of 25,380 square feet per building). Both buildings would be four stories in height, but one building would be 10 feet longer than the other to allow the full 199,649 square feet. Landscaping would be provided on all sides of the buildings and would meet the minimum landscaping (10 percent of the site) required by the Second/Third Streets Mixed-Use East (2/3 MUE) zoning. A general illustration of the site plan is provided in **Figure 5-2.**

The project site is located within the Downtown Parking District, which waives parking requirements for the first 1.0 of FAR.[6] With this alternative having an FAR of 1.50, parking would be required for 66,550 square feet of the BioMarin building.[7] Assuming the required 3.3 spaces per 1,000 square feet, a total of 220 parking spaces would be required to be provided on the site. This would be in addition to public parking that is assumed to allow the height bonus. If the Whistlestop/ Eden Housing portion of the site (the northwest corner that is 150 feet by 100 feet, for a total of 15,000 square feet) were used for part of the parking, it is assumed that about 240 spaces could be developed in a five-story garage, with 48 spaces at each level.[8] Given that the site would allow for some parking, and assuming that BioMarin provides some public parking to obtain the height exemption, it is assumed that both private and public parking could be provided as surface parking in the southwest and southeast ends of the site. About 29 spaces could be provided in the southwest corner, 29 spaces could be provided in the southeast corner, and an additional 29 spaces could be provided in the northeast corner. Thus, this alternative would have a total of 327 parking spaces, of which 220 would serve BioMarin in the parking structure and the remaining 107 spaces would be for the public. The public parking could be reduced by 29 spaces if the City decided to leave the northeast corner of the site devoted to a public plaza and landscaped area.

[4] The proposed project for BioMarin has a building height of 69 feet; however, it is assumed that four stories could be constructed with a maximum of 66 feet, only 3 feet lower than the proposed project.

[5] The City does not factor in residential units as part of FAR. Thus, for the bottom two floors of Whistlestop/Eden Housing that are not units, or 18,000 square feet would be counted for the FAR. There would be about 3,500 square feet on the first floor (due to large area for ground level parking) and 14,500 square feet on the second floor.

[6] Per City of San Rafael Municipal Code Section 14.18.060.

[7] The total site is 133,099 square feet. Thus, one subtracts 133,099 from 199,649 to get 66,550. Then, parking would be required at a ratio of 3.3 spaces per 1,000 square feet, for a total of 220 spaces.

[8] The five-story garage would be about 50 feet in height, assuming 10 feet per floor. This would be less than the 66-foot height of the BioMarin buildings.

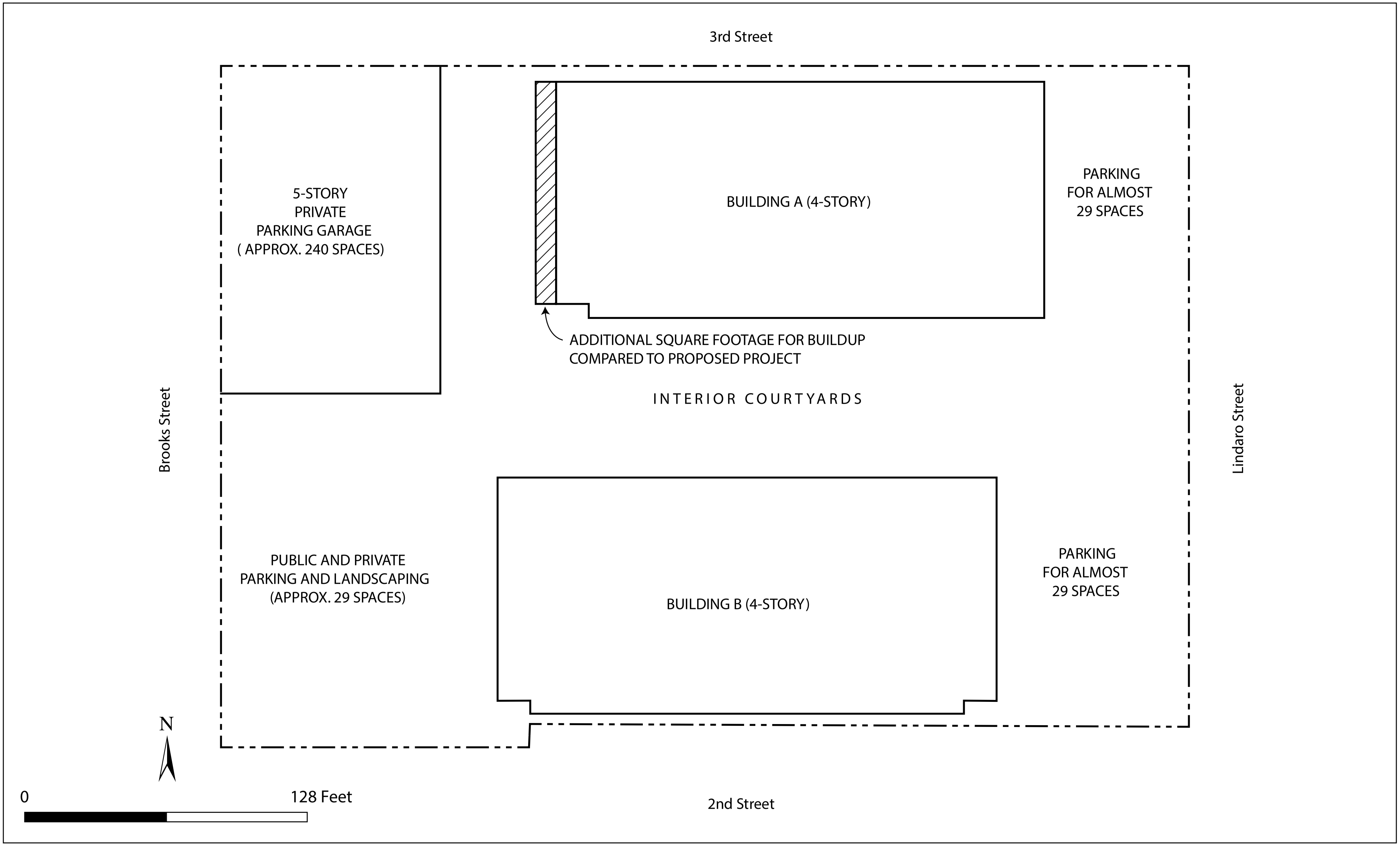


Figure 5-2

ALTERNATIVE 3 SITE PLAN

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Whistlestop/Eden Housing Project under Alternative 3

This alternative assumes that the Whistlestop/Eden Housing project would be located off the project site at 930 Tamalpais Avenue, where Whistlestop is currently located. It is assumed that 41 units of affordable senior housing (one of these would be a manager's unit) would be provided in a five-story building similar to the design proposed in 2016, as illustrated in **Figure 5-3**.[9] The existing building would be demolished for new construction. The new building would contain housing and services for seniors and would be five stories in height in a Mission Revival style with components such as arched openings, deeply set windows with sloping sills, detailed metal work in the balconies and awnings, and tile accents. The north end of the building would step down to three stories near Fourth Street. The total square footage of the new building would be 57,100+/- gross square feet (see **Figure 5-4**).

Uses within the building would include residential units on the third, fourth, and fifth floors, with communal spaces on each of these floors for residents. The second floor and a portion of the third floor would be used for the Whistlestop Active Aging Center, with classrooms, offices, and meeting rooms. The ground level would contain parking and utility uses, along with the Jackson Café, which would remain a café component serving the Whistlestop Active Aging Center as well as the general public. The café would be located at the north end of the ground floor adjoining an open-air, 1,250-square-foot outdoor plaza at the corner of Tamalpais Avenue and 4th Street. This plaza space would serve as a community gathering space as well as outdoor dining area for Jackson Café.

The building would provide 41 residential units in a mix of 13 one-bedroom units, 1 two-bedroom manager's unit, and 27 studio units. Each residential unit would include a kitchen, bathroom, and living, dining, and sleeping spaces. Amenities would include a community room, a computer center and library, outdoor courtyards (elevated and at ground level), and furnished lobbies for casual social interaction. As noted above, low-cost lunches for residents would remain available for residents at the Jackson Café on the ground floor. A central laundry room for residents' use would be provided on the upper floors.

Access to transit would be available via (1) van service (Marin's Whistlestop Wheels Para Transit) with access at the ground-level garage, (2) buses at the adjacent San Rafael Transit Center, and (3) regional rail at the SMART station located at the east edge of the site. At the San Rafael Transit Center, there are 22 bus routes operated by three carriers (Marin Transit, Golden Gate Transit, and Sonoma County Transit). A total of 20 parking spaces would be provided in a street level garage for use by Whistlestop employees and guests. A van drop-off location would be provided within the garage so that users could enter the lobby from the garage and be protected from adverse weather conditions. Other ground-floor enclosed facilities would include mechanical equipment, electrical/communications utilities, and garbage/recycling facilities. Fourteen bicycle parking spaces would also be provided.

[9] Information for the off-site Whistlestop/Eden Housing project is taken from the Notice of Preparation prepared for the old project in January 2016. Subsequently, the project was removed from consideration.

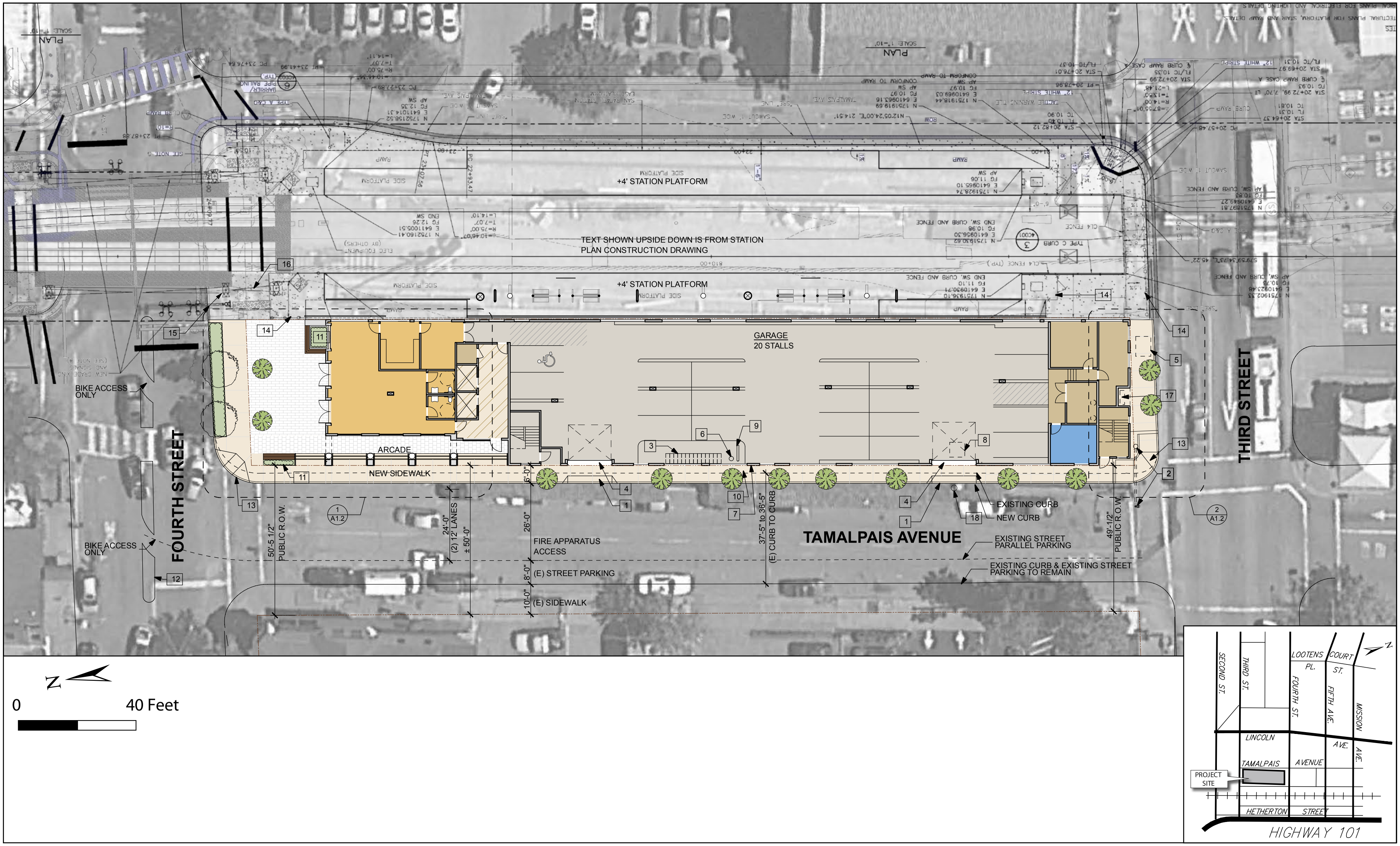


Figure 5-3

SITE PLAN FOR OFF-SITE WHISTLESTOP/EDEN HOUSING ON TAMALPAIS AVENUE

SOURCE: Van Meter, Williams, Pollack, LLP, 2015

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

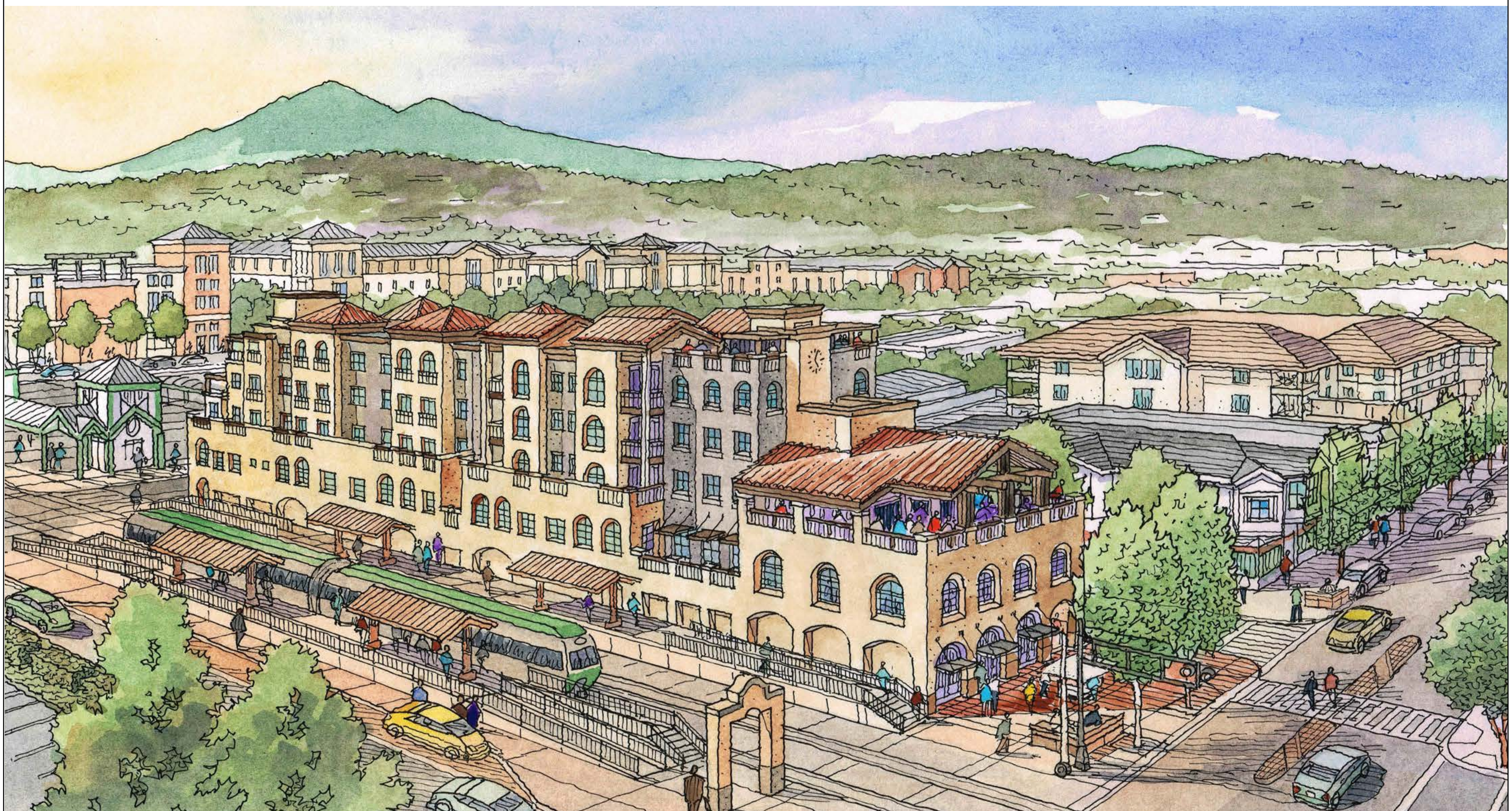


Figure 5-4

RENDERING OF OFF-SITE WHISTLESTOP/EDEN HOUSING LOOKING SOUTHWEST TOWARDS MOUNT TAMALPAIS

SOURCE: Van Meter Williams Pollack, LLP

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Impacts

Aesthetics

Alternative 3 would have slightly different visual impacts from those of the proposed project. Buildings A and B of the BioMarin project would remain as four stories. However, a new five-story parking garage would be located in the space that, under the proposed project, would be occupied by the Whistlestop/Eden Housing project. This garage would require review by the City's Design Review Board to ensure that compatible architectural features are used in the design of the garage, which would be highly visible from 3rd Street. In addition, a large portion of the undeveloped spaces around the buildings would be used for parking. Landscaping of these parking areas would be required per City code.

The off-site Whistlestop/Eden Housing project would have visual impacts near its Tamalpais Avenue location, but the proposed design shows a number of architectural details that would add visual interest for this portion of the downtown (see Figure 5-4).

Air Quality

Alternative 3 with its revised BioMarin project would result in similar impacts related to air quality as the proposed project for both the construction and operational phases.

Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would not conflict with or obstruct implementation of the applicable air quality plan or result in other emissions leading to odor adversely affecting a substantial number of people, as discussed in the analysis for the proposed project.

Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site could generate criteria air pollutants during construction and operation. The Whistlestop/Eden Housing portion of this alternative would involve similar land use as the Whistlestop/Eden Housing portion of the proposed project. However, it would involve fewer residential units (41 units for this alternative compared to 67 units for the proposed project) and less total building square footage (57,100 square feet for this alternative compared to 74,821 square feet for the proposed project) compared to the Whistlestop/Eden Housing portion of the proposed project. Therefore, the criteria air pollutants emissions generated from the relocated Whistlestop/Eden Housing project would be slightly less than the amount calculated for the proposed project for both construction and operation, and the project's impacts on air quality would be slightly reduced relative to the proposed project.

Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site could generate toxic air contaminants (TACs) and fine particulate matter ($PM_{2.5}$) and pose a health risk to nearby sensitive receptors.

Prior to construction, the Whistlestop/Eden Housing project at the existing Whistlestop site would involve demolition of the existing structure and construction of a new building, potentially generating TACs and $PM_{2.5}$ emissions from construction activities and exposing nearby sensitive receptors to a health risk. Similarly, the proposed project would generate construction-period TAC emissions (though no demolition would be required). However, with the Whistlestop/Eden Housing project and the BioMarin project constructed at different locations under this alternative, the TACs and $PM_{2.5}$ generated by this alternative would be more dispersed than under the proposed project. Therefore, impacts related to exposure of off-site receptors to TAC and $PM_{2.5}$ emissions would be reduced (and less than significant for on- and off-site receptors). In addition, one benefit of this alternative is that there would be no on-site residential receptors on the project site (as there would be for the proposed project where the Whistlestop/Eden Housing project would be constructed as part of Phase I), and therefore impacts related to exposure of on-site receptors to TAC emissions would not occur during construction.

During operation, there would be no on-site residential receptors on the project site because implementation of the Whistlestop/Eden Housing project would be located at the existing Whistlestop site (an off-site location). With regard to TAC emissions associated with the emergency generator that may be run for BioMarin, this alternative would be similar to the proposed project because no significant impacts were identified for the proposed project.

A worst-case-exposure scenario for cumulative health risks was analyzed for the proposed project at the on-site maximally exposed individual resident (MEIR) and the impact was found to be less-than-significant. As this alternative would not involve on-site receptor, the MEIR for this alternative would be located off-site and would be farther away from construction activity. In addition, the TACs and $PM_{2.5}$ generated by this alternative would be more dispersed than under the proposed project during construction. Since no cumulatively considerable contribution to a TAC emissions impact would occur, this alternative would be similar to the proposed project.

Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site could result in fugitive dust emissions during project construction. The Bay Area Air Quality Management District (BAAQMD) considers implementation of best management practices (BMPs) to control dust during construction sufficient to reduce potential impacts to a less-than-significant level. Implementation of Mitigation Measure AIR-1, which contains BAAQMD's Basic Construction Mitigation Measures for controlling dust and would be required for this alternative, would reduce the impact to a less-than-significant level (similar to the proposed project).

Cultural Resources

The revised BioMarin project under Alternative 3 would result in the same impacts related to cultural resources as the proposed project because it would require a similar level of ground disturbance. This ground disturbance has the potential to unearth previously unrecorded archaeological cultural resources at the site. Similar impacts could occur at the existing Whistlestop site. Therefore, compared to the proposed project, Alternative 3 could have a greater impact on cultural resources.

Geology and Soils

The revised BioMarin project under Alternative 3 would result in the same impacts related to geology and soils as the proposed project. Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would result in the development of a building that would be subject to similar hazards from ground shaking, ground failure, or expansive and/or corrosive soils as are found on the project site. This project would involve ground disturbance in both the

Whistlestop site and the project site, and therefore could disturb additional paleontological resources.

Energy

Compared to the project, Alternative 3 would have similar but slightly reduced demand for energy resources and facilities. Impacts of Alternative 3 would be comparable to those of the project and would be less than significant.

Greenhouse Gas Emissions

According to the BAAQMD, a project's impact related to GHG emissions may be considered less than significant if the project is located in a community with an adopted qualified GHG Reduction Strategy and if it is consistent with the GHG Reduction Strategy.

Under Alternative 3, the revised BioMarin project and the Whistlestop/Eden Housing project at the existing Whistlestop site would still be located in City of San Rafael, where a qualified GHG Reduction Strategy has been adopted. It is assumed that the reduced height BioMarin project and the Whistlestop/Eden Housing project at the existing Whistlestop site would still involve the features as described for the project in Table 4.7-1 in Section 4.7, Greenhouse Gas Emissions, of this DEIR. Under this assumption, development under this alternative would be considered consistent with the GHG Reduction Strategy and impacts related to GHG emissions would be considered less than significant, and therefore similar to the proposed project.

Hazards and Hazardous Materials

The revised BioMarin project would result in the same impacts related to hazards and hazardous materials as the proposed project. Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would involve demolition of the existing structure that may contain hazardous building materials such as lead paint and asbestos-containing materials (ACMs). Compliance with existing regulations would ensure that hazardous building materials are properly abated prior to demolition to ensure that hazardous building materials would not be released into the environment during demolition activities.

The existing Whistlestop site was historically occupied by a train depot, where maintenance of trains may have occurred, and train tracks have historically been located adjacent to the existing Whistlestop site. Contaminants commonly found in the subsurface of train maintenance and track areas include polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons (e.g., motor oil and diesel), heavy metals (e.g., lead and arsenic), and volatile organic compounds (VOCs). In accordance with policies from San Rafael General Plan 2020 (City of San Rafael, 2017), because the existing Whistlestop site has historical land uses that may have involved hazardous materials, the City would ensure that appropriate studies (e.g., site-specific investigations) are undertaken to evaluate the existing Whistlestop site for the presence of hazardous materials and the City would require remediation and cleanup in accordance with regional and local standards in order to develop on the existing Whistlestop site if hazardous materials have impacted soil or groundwater. With implementation of policies from San Rafael General Plan 2020 related to potential subsurface contamination and compliance with existing regulations related to hazardous building materials, implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would result in similar impacts related to hazards and hazardous materials as the proposed project because both the project site and the existing Whistlestop site have hazardous materials concerns that would need to be addressed during construction (and potentially operation).

Hydrology and Water Quality

The revised BioMarin project at the project site would result in the same impacts related to hydrology and water quality as the proposed project. Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would result in the development of a building that would result in similar potential impacts on water quality, drainage patterns, and release of pollutants to flood water as are found on the project site because the Whistlestop site is located in a flood hazard zone (see Figure 4.8-1 in Section 4.8, Hydrology and Water Quality, of this DEIR), and in an area that could be inundated due to sea level rise, where the stormwater drainage system is already partially or fully filled with water during high tides events. Mitigation Measures HYDRO-1 and HYDRO-2 recommended for the proposed project would ensure that peak flows from the site would not increase, and that the construction site would be prepared for flooding from the 100-year storm. These measures would reduce potential impacts from Alternative 3 to a less-than-significant level. Therefore, implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would result in similar impacts related to hydrology and water quality as the proposed project.

Land Use and Planning

Compared to the project, this alternative would have General Plan policy conflicts related to transportation, but these would be reduced due to the overall reduction in square footage for the BioMarin project. The relocated Whistlestop/Eden Housing project could have conflicts with some San Rafael General Plan 2020 policies, but these are expected to be minor.

Noise

The revised BioMarin project would result in similar impacts related to noise and vibration as the proposed project for both the construction and operational phases.

During construction, implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would involve demolition of the existing structure and construction of a new building, potentially exposing a different set of sensitive receptors to noise and vibration impacts. The closest sensitive receptor to the existing Whistlestop site is located approximately 50 feet to the west. Construction of the Whistlestop/Eden Housing project would generate similar noise levels as indicated in Table 4.11-10 in Section 4.11, Noise, of this DEIR. As indicated in Table 4.11-10, typical construction would generate noise levels of 90 dBA L_{max} within 40 feet of the project site. Because the closest sensitive receptor is located 50 feet away, construction would not have the potential to generate construction noise that would exceed 90 dBA L_{max}. One benefit of this alternative is that there would be no on-site residential receptors on the project site (as there would be for the proposed project where the Whistlestop/Eden Housing project would be constructed as part of Phase I) and therefore no construction impact on on-site receptors would occur. Similar construction vibration impacts would occur at the existing Whistlestop site, and implementation of Mitigation Measure NOISE-3 would reduce the vibration impacts to a less-than-significant level.

Operation of the Whistlestop/Eden Housing project at the existing Whistlestop site could include the use of heating, ventilation, and air conditioning (HVAC) systems, which could potentially exceed noise limits specified in the San Rafael Municipal Code (see Table 4.11-5 in Section 4.11, Noise, of this DEIR). Implementation of Mitigation Measure NOISE-1 would reduce the impact to a less-than-significant level.

Implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site could result in increased traffic along local roadways. The traffic generated by this alternative would be similar to that of the proposed project but would be more dispersed, as the Whistlestop/Eden Housing project and the BioMarin project would at different locations. Therefore, the traffic noise increase along local roadways segments would not be expected to exceed the increase analyzed for the proposed project. Therefore, the implementation of the Whistlestop/Eden Housing project at the existing Whistlestop site would not result in a significant increase in traffic noise along local area roadways.

Overall, it is expected that noise and vibration impacts of this alternative would be similar to those of the proposed project, but they would occur in two locations.

Public Services

Compared to the project, Alternative 3 would have similar but slightly reduced demands for fire protection or police services. Impacts of Alternative 3 would be comparable to those of the project and would be less than significant.

Recreation

Compared to the project, Alternative 3 would have similar but slightly reduced demands on parks and recreational facilities. Impacts of Alternative 3 would be comparable to those of the project and would be less than significant.

Transportation

Alternative 3 would generate less vehicular traffic than the proposed project, mostly due to the BioMarin project being reduced in size by about 12 percent. The Whistlestop/Eden Housing project component would be located at a different site—in the block bounded by 2nd Street, Tamalpais Avenue, 3rd Street, and the SMART station. Most of the traffic-related impacts identified for the proposed project would still occur and would be significant under this alternative, but many would be somewhat reduced compared to the impacts of the proposed project. However, the inclusion of an on-site parking garage could result in additional significant impacts along the 2nd Street, 3rd Street and Brooks Street corridors, and could potentially warrant a full traffic signal at 3rd Street/ Brooks Street and potentially at 2nd Street/Brooks Street. In addition, traffic impacts could result at 3rd Street/Tamalpais Avenue and/or 4th Street/Tamalpais Avenue due to Whistlestop/Eden Housing traffic using these intersections.

Tribal Cultural Resources

The revised BioMarin project would result in the same impacts related to tribal cultural resources as the proposed project because it would require a similar level of ground disturbance. This ground disturbance has the potential to unearth previously unrecorded archaeological cultural resources at the site. Similar impacts could occur at the existing Whistlestop site. Therefore, compared to the proposed project, Alternative 3 could have a greater impact on tribal cultural resources.

Utilities and Service Systems

Compared to the project, Alternative 3 would have similar but slightly reduced demands for water, wastewater, and solid waste services. Impacts of Alternative 3 would be comparable to those of the project and would be less than significant.

Relationship to Project Objectives

Alternative 3 would meet all of the project objectives as listed at the beginning of this chapter except the following four objectives:

- Development of an underutilized vacant site in close proximity to BioMarin's existing San Rafael headquarters to accommodate BioMarin's planned expansion of its campus through the addition of a new laboratory and office space flexible in design and built in a manner that can accommodate the necessary square footage and building heights to support the R&D and laboratory infrastructure requirements needed for BioMarin's planned expansion, while also accommodating the needs of Whistlestop/Eden Housing and its use of a portion of the project site for its Healthy Aging Center and affordable senior housing.
- Provision of a new location for Whistlestop's existing Healthy Aging Center and Eden Housing's proposed senior housing that is affordable for the project and central to downtown San Rafael and public transit, and that avoids development on a site with potential historical significance that is proximate to the freeway and its associated air quality impacts.
- Development of a high-quality, mixed-use building comprised of a Healthy Aging Center for Whistlestop, a non-profit organization vital to the local older adult community, that will provide services for older adults in San Rafael and the greater Marin County area in a practical and cost-effective manner; and 67 affordable rental housing units for seniors in an environmentally conscious, car-free community proximately situated to public transportation and downtown businesses.
- Use of larger parking structures on the perimeter of the BioMarin campus to keep the visible bulk away from major views and to reduce car trips along 2nd and 3rd Streets, while creating an environment more easily navigated by employees and visitors.

Alternative 3 would have reduced square footage for the BioMarin buildings and would not necessarily meet BioMarin's needs for R&D and laboratory infrastructure. The relocation of the Whistlestop/Eden Housing project to its Tamalpais Avenue site would conflict with the second objective above. The relocation of the senior housing would also be close to the freeway, with associated air quality impacts. This alternative would also have fewer senior housing units and thus would conflict with the goal of providing 67 affordable rental housing units for seniors. Finally, Alternative 3 would not meet the objective of keeping parking at the perimeter of the site, as parking would be located on the site (surface parking) and in a five-story structure at the corner of Brooks Street and 3rd Street.

ALTERNATIVE 4: CODE-COMPLIANT BIOMARIN AND WHISTLESTOP/EDEN HOUSING PROJECT

Overview

Under Alternative 4, the FAR would be increased from the proposed 0.90 to 1.50, allowing a total of 199,649 square feet for both BioMarin (181,649 square feet) and the non-residential portion of Whistlestop/Eden Housing (18,000 square feet). The Whistlestop/Eden Housing project would occupy 0.34 acre of the project site under this alternative and is assumed to be approximately the same as the proposed project in scale and height, given that the height bonuses allowed by the provision of affordable housing.[10] Thus, the Whistlestop/Eden Housing project under this alternative would be 74,821 square feet in total size. However, the portion affected by the FAR limit would only be 18,000 square feet (e.g., first two floors of Whistlestop/Eden Housing project). The FAR limit of this alternative would not consider combining the site with other nearby BioMarin facilities (as addressed in Table 3-3 of Chapter 3, Project Description, of this DEIR).

It is assumed that the BioMarin portion of the site would consist of two buildings similar in scale to proposed Building B, or about 235 feet long by 108 feet wide (or 23,380 square feet). With 181,649 square feet for BioMarin, both Buildings A and B would be four stories in height. This alternative may have reduced square footage for laboratory space. Landscaping would be provided on all sides of the buildings. A general illustration is provided in **Figure 5-5.**

Unlike Alternative 3, Alternative 4 is not assumed to have public parking on the site because Whistlestop/Eden Housing would be located in the northwest corner under this alternative. The project site is located within the Downtown Parking District which waives parking requirements for the first 1.0 of FAR.[11] With this alternative having an FAR of 1.50, parking required for BioMarin would be approximately 210 parking spaces.[12] However, unlike Alternative 3, which could include a parking structure in the area proposed for Whistlestop/Eden Housing under the project, this alternative would need an additional parking structure to provide the required number of on-site parking spaces.[13] It is assumed that Building B would be shifted to the west (see Figure 5-5) so that an eight-story parking structure of about 150 feet by 170 feet could be constructed on the corner of 2nd Street and Lindaro Street. The parking structure height results from the fact that only 35 cars can be provided on each floor, given circulation requirements. Assuming 10 feet per floor, this parking structure would be about 60 feet in height, or about the same size as the proposed BioMarin building height for the proposed project.

---

[10] The actual two ground floors of the proposed Whistlestop/Eden Housing project are about 18,000 square feet. This alternative could allow increasing this allowable square footage, which does not count as part of the FAR to 22,500. Given the site size constraints and the need to provide internal ground floor parking, however, this alternative assumes that the FAR would remain unchanged from the 18,000 square feet. Also, it is assumed that under this alternative only 10 parking spaces would need to be provided and Whistlestop/Eden Housing has shown that a total of 12 spaces can be provided on the ground floor (including one manager's unit). Therefore, no additional parking would be required.

[11] Per City of San Rafael Municipal Code Section 14.18.060.

[12] The BioMarin portion of the site would be 118,099 square feet, which is the total 133,099 square feet minus the portion for Whistlestop (15,000 square feet). Counting the required 0.5 FAR parking results in 63,550 square feet of building area requiring parking (181,649 square feet of building area minus 118,099 of site area is 63,550). Dividing 63,500 by 1,000 results in 63.5, and multiplying this amount by 3.3 parking spaces results in 210 parking spaces being required under this alternative.

[13] Alternative 4 also assumes that parking for Whistlestop/Eden Housing would be provided on the ground floor of the Whistlestop/Eden Housing building, as under the proposed project.

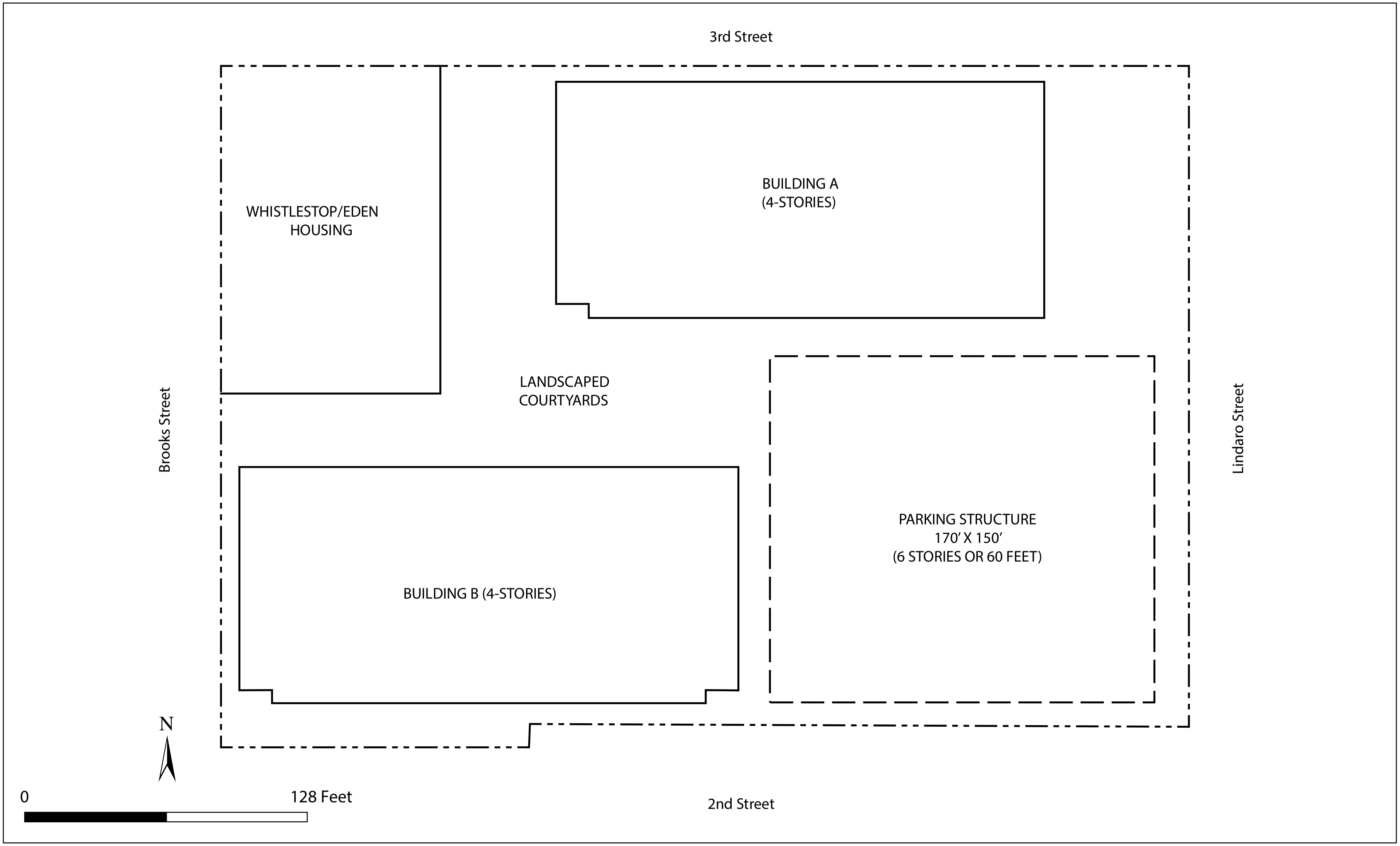


Figure 5-5

ALTERNATIVE 4 SITE PLAN

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Impacts

Aesthetics

Compared to the project, Alternative 4 would have more significant visual impacts as seen from 2nd Street because a six-story parking structure would be located at the corner of 2nd Street and Lindaro Street. Visual impacts related to architecture would be similar to those of the proposed project, given that the height of Buildings A and B would be similar. The Whistlestop/Eden Housing building would be similar to that proposed under the project. Assuming that the design of Buildings A and B would be unchanged, their visual impacts would be similar to those of the proposed project. With the addition of the large parking structure and the relocation of Building B (see Figure 5-5), there would be less on-site landscaping as an amenity in this portion of the downtown.

Air Quality

Under this alternative, the new land uses on the project site would be similar to those of the proposed project and would result in similar less-than-significant impacts related to air quality.

Cultural Resources

This alternative would result in the same impacts related to cultural resources as the proposed project because it would require a similar level of ground disturbance. This ground disturbance has the potential to unearth previously unrecorded archaeological cultural resources at the site.

Energy

Compared to the project, Alternative 4 would have similar but slightly reduced demand for energy resources and facilities. Impacts of Alternative 4 would be comparable to those of the project and would be less than significant.

Geology and Soils

This alternative would result in the same impacts related to geology and soils as the proposed project because it would require a similar level of ground disturbance, and would result in the development of buildings that would be subject to the same hazards from ground shaking, ground failure, or expansive and/or corrosive soils as the buildings developed under the proposed project.

Greenhouse Gas Emissions

Under this alternative, the new land uses on the project site would be similar to those of the proposed project and would result in similar less-than-significant impacts related to GHG emissions.

Hazards and Hazardous Materials

Under this alternative, the new land uses on the project site would be similar to those of the proposed project and would result in similar impacts related to hazards and hazardous materials.

Hydrology and Water Quality

This alternative would result in the same impacts related to hydrology and water quality as the proposed project because it would require a similar level of ground disturbance and would result in the development of buildings that would have the same potential impacts on water quality, drainage patterns, and release of pollutants to flood water as under the proposed project.

Land Use and Planning

Alternative 4 would have similar conflicts with City policy related to transportation impacts and ability to mitigate such impacts.

Noise

Under this alternative, the new land uses on the project site would be similar to those of the proposed project and would result in similar noise and vibration impacts.

Public Services

Compared to the project, Alternative 4 would have similar but slightly reduced demands for fire protection or police services. Impacts of Alternative 4 would be comparable to those of the project and would be less than significant.

Recreation

Compared to the project, Alternative 4 would have similar but slightly reduced demands on parks and recreational facilities. Impacts of Alternative 4 would be comparable to those of the project and would be less than significant.

Transportation

Alternative 4 would generate less vehicular traffic than the proposed project, due to the BioMarin project being reduced in size by about 12.2 percent. Most of the traffic-related impacts identified for the proposed project would still occur and would be significant under this alternative, but many would be somewhat reduced compared to the impacts of the proposed project. However, the inclusion of an on-site parking garage at the corner of Lindaro Street and 2nd Street could result in additional significant impacts along the 2nd Street, 3rd Street, and Lindaro Street corridors.

Tribal Cultural Resources

This alternative would result in the same impacts related to tribal cultural resources as the proposed project because it would require a similar level of ground disturbance. This ground disturbance has the potential to unearth previously unrecorded archaeological cultural resources at the site.

Utilities and Service Systems

Compared to the project, Alternative 4 would have similar but slightly reduced demands for water, wastewater, and solid waste services. Impacts of Alternative 4 would be comparable to those of the project and would be less than significant.

Relationship to Project Objectives

Alternative 4 would meet all of the project objectives as listed at the beginning of this chapter except the provision of the same square footage for laboratory space and the following objective:

- Use of larger parking structures on the perimeter of the BioMarin campus to keep the visible bulk away from major views and to reduce car trips along 2nd and 3rd Streets, while creating an environment more easily navigated by employees and visitors.

Alternative 4 would not meet the objective of keeping parking at the perimeter of the site, as parking would be located on the site (surface parking) and in an eight-story structure at the corner of Lindaro Street and 2nd Street.

ENVIRONMENTALLY SUPERIOR ALTERNATIVE

A comparison of the alternatives is provided in **Table 5-1** below.

If the environmentally superior alternative is the No Project Alternative, the CEQA Guidelines require that the EIR also identify an environmentally superior alternative from among the other alternatives. Alternative 2, the Reduced Scale Alternative, would be considered the environmentally superior alternative because the smaller scale BioMarin Buildings A and B would reduce some of the local traffic congestion. The reduction in building height for Buildings A and B would also result in slightly reduced visual impacts for the project when viewed along 2nd Street and 3rd Street. Also, Alternative 2 would retain the Whistlestop/Eden Housing project on the project site, which is a preferred site compared to its existing location at 930 Tamalpais Avenue. For these reasons, Alternative 2 would be the environmentally superior alternative.

As stated earlier, Alternative 2 would meet all of the project objectives as listed at the beginning of this chapter except the following primary objective:

- Development of an underutilized vacant site in close proximity to BioMarin's existing San Rafael headquarters to accommodate BioMarin's planned expansion of its campus through the addition of a new laboratory and office space flexible in design and built in a manner that can accommodate the necessary square footage and building heights to support the R&D and laboratory infrastructure requirements needed for BioMarin's planned expansion, while also accommodating the needs of Whistlestop/Eden Housing and its use of a portion of the project site for its Healthy Aging Center and affordable senior housing.

Compared to the proposed project, the size of Alternative 2 would be significantly reduced, which would not meet the identified laboratory and office space needs for BioMarin. Whistlestop/Eden Housing would be unchanged from the proposed project; thus, the portion of this objective addressing the Healthy Aging Center and affordable senior housing would be met. However, if

TABLE 5-1 COMPARISON OF IMPACTS OF PROJECT ALTERNATIVES (AFTER MITIGATION)

Environmental Issue Area	Proposed Project	Alternative 1 No Project	Alternative 2 Reduced Scale	Alternative 3 Code-Compliant BioMarin and Off-Site Whistlestop/ Eden Housing	Alternative 4 Code-Compliant BioMarin and Whistlestop/ Eden Housing
Aesthetics	LTS	LTS-	LTS	LTS	LTS
Air Quality	LTS	LTS-	LTS	LTS	LTS
Cultural Resources	LTS	LTS-	LTS	LTS+	LTS
Energy	LTS	LTS-	LTS-	LTS-	LTS-
Geology and Soils	LTS	LTS-	LTS	LTS+	LTS
Greenhouse Gas Emissions	LTS	LTS-	LTS	LTS	LTS
Hazards and Hazardous Materials	LTS	LTS-	LTS	LTS	LTS
Hydrology and Water Quality	LTS	LTS-	LTS	LTS	LTS
Land Use and Planning	LTS/SU	LTS-	LTS/SU-	LTS/SU-	LTS/SU
Noise	LTS	LTS-	LTS	LTS+	LTS
Public Services	LTS	LTS-	LTS-	LTS-	LTS-
Recreation	LTS	LTS-	LTS-	LTS-	LTS-
Transportation	LTS/SU	LTS-	LTS/SU-	LTS/SU	LTS/SU
Tribal Cultural Resources	LTS	LTS-	LTS	LTS+	LTS
Utilities and Service Systems	LTS	LTS-	LTS-	LTS-	LTS-

Notes: LTS = Less than Significant
SU = Significant and Unavoidable
+ = Greater adverse impact than proposed project
- = Lesser adverse impact than proposed project

the BioMarin part of Alternative 2 were not developed because the project's primary objective could not be met, the Whistlestop/Eden Housing project would also not occur.

5.3 REFERENCES

California Public Resources Code, Section 21061.1.

CEQA Guidelines, Sections 15364 and 15126.6.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28.

6. CEQA CONSIDERATIONS

As required by the California Environmental Quality Act (CEQA), this chapter identifies significant irreversible effects, significant unavoidable impacts, growth inducement, and cumulative impacts that may result from the project.

6.1 SIGNIFICANT IRREVERSIBLE EFFECTS

CEQA states that impacts associated with a proposed project may be considered to be significant and irreversible for the following reasons:

- Uses of non-renewable resources during the initial and continued phases of the project may be irreversible, since a large commitment of such resources makes the removal or non-use thereafter unlikely;
- Primary impacts and, particularly, secondary impacts (such as a highway improvement that provides access to a previously inaccessible area) generally commit future generations to similar uses; and
- Irreversible damage can result from environmental accidents associated with the project.

Pursuant to the CEQA Guidelines, irretrievable commitments of resources should also be evaluated to ensure that such current consumption is justified (CEQA Guidelines, Section 15126.2(c)).

The proposed structures at the site of the BioMarin and Whistlestop/Eden Housing Project would be permanent buildings; therefore, their installation would constitute an irreversible use of these lands, as it is unlikely that the buildings would be removed. The proposed project would irretrievably commit materials to the construction and maintenance of the new buildings. Non-renewable resources such as sand, gravel, and steel, and renewable resources such as lumber, would be consumed during project construction. In addition, the construction and operation of the proposed project would result in the use of energy, including electricity and fossil fuels. While the consumption of such resources associated with construction would end upon completion of the proposed construction, the consumption of such resources associated with operation would represent a long-term commitment of those resources.

The proposed project is not expected to result in any activities likely to result in accidents that could lead to irreversible environmental damage. While construction of proposed facilities could result in the use, transport, storage, and disposal of hazardous materials as described in Section 4.7, Hazards and Hazardous Materials, all activities would comply with applicable laws related to hazardous materials, which would significantly reduce the likelihood and severity of accidents that could result in irreversible environmental damage.

6.2 SIGNIFICANT UNAVOIDABLE IMPACTS

All potential impacts identified for the proposed project could be mitigated to a less-than-significant level except for impacts related to land use and planning (conflict with San Rafael General Plan 2020 Policy LU-2), and transportation (impacts on traffic conditions, including on U.S. Highway 101 and at local intersections). These impacts would remain significant and unavoidable.

6.3 GROWTH INDUCEMENT

The CEQA Guidelines require that an EIR evaluate the growth-inducing impacts of a proposed action (CEQA Guidelines, Section 15126.2(e)). A growth-inducing impact is defined as:

> *[T]he ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth…It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.*

A project can have direct and/or indirect growth inducement potential. Direct growth inducement would result if a project actually induced or required that additional actions or projects be implemented. An example would be a new housing development that requires the construction of new utility lines and roads to serve the development. Indirect growth inducement would occur if the project would remove an obstacle to additional growth and development. An example would be a major expansion of a public service facility that increases service capability in the area.

The proposed project would be developed on an existing disturbed but vacant site in downtown San Rafael. Services are readily available in this area. The project site is surrounded by existing commercial and residential development. The proposed project would not require wastewater or water lines that would cross undeveloped lands and create the potential for new development. No major road improvements would be associated with the proposed project except that, over the long term, some local improvements to vehicular, pedestrian, and bicycle circulation may occur.

The significant amount of proposed on-site commercial development, with 207,000 square feet of laboratory and office space for BioMarin and 18,000 square feet of health services-related facilities for Whistlestop/Eden Housing, could result in an increased demand for housing within San Rafael. According to the Marin County Community Development Agency, the rental vacancy rate in Marin County is currently below 3 percent, when a "healthy" rate is closer to 6 or 7 percent (City of San Rafael, 2019). Thus, the demand for a limited number of housing units tends to drive up prices for local housing. According to the most recent San Rafael General Plan Housing Element, more than 87 percent of those employed in San Rafael reside in other cities, implying an imbalance of jobs and housing (City of San Rafael, 2019). This imbalance leads to increased commuting demands and associated traffic, air quality, and noise impacts.

Recently, the City of San Rafael approved a project at 703-723 3rd Street that will add 120 residential units within three blocks of the project site. This residential development would help to offset the increased non-residential development of the proposed project. However, there could remain a need for more housing for project employees. In this sense, the project would have growth-inducing impacts related to the need for more local housing.

6.4 CUMULATIVE IMPACTS

Cumulative impacts have been addressed in Chapter 4 for each topic covered in this DEIR. The projects that are proposed or approved in the vicinity of the proposed project are shown in **Table 6-1** and **Figure 6-1** below. These projects were assumed to be part of "cumulative conditions" in the cumulative impact analysis for all topics except transportation. The analysis of cumulative transportation impacts used a different set of conditions, as detailed in Appendix D. For the transportation assessment, many of the projects shown in Table 6-1 were included as part of "baseline conditions" rather than "cumulative conditions" because these projects would likely all be completed at the same time as the proposed project.

TABLE 6-1 APPROVED OR PENDING CUMULATIVE PROJECTS

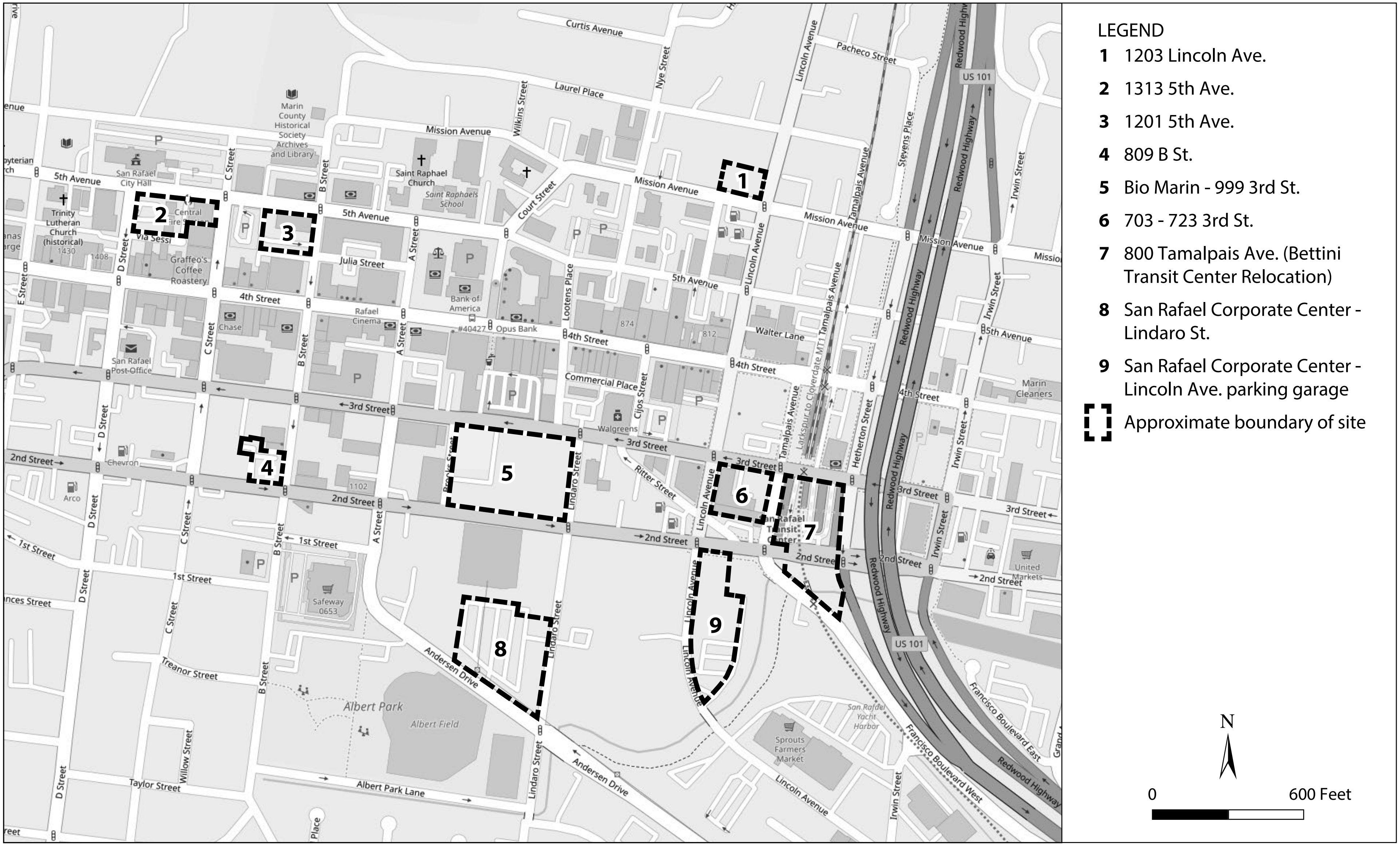
Number*	Name of Project	Address	Type of Use	Status
1	Aegis Assisted Living	1203 Lincoln Ave.	88 beds; assisted living facility	Approved
2	Public Safety Center	1313 5th Ave.	Public safety; fire and police	Under construction
3	Hotel	1201 5th Ave.	140 hotel rooms	Approved
4	Residences	809 B St.	41 residential units and 2,000 square feet retail	Approved
5	**BioMarin and Whistlestop/ Eden Housing**	**999 3rd St.**	**Office/Laboratory space and 67 units senior affordable housing**	**Under review in this DEIR**
6	Seagate Residences	703-723 3rd St.	120 residential units	Under review
7	Bettini Transit Center Relocation	800 Tamalpais Ave.	Major transit center	Under review
8	San Rafael Corporate Center	Andersen Dr.	72,000 square feet of office space (Phase 2)	Approved
9	San Rafael Corp. Center Parking Garage	Lincoln Ave. (south of 2nd St.)	600 space parking garage expansion (Phase II)	Approved

* See Figure 6-1 for location of projects.
Source: City of San Rafael Department of Community Development, March 2019.

Overall, most cumulative impacts would either be less than significant or could be mitigated through mitigation measures recommended in this DEIR. Cumulative transportation impacts would remain significant and unavoidable as addressed in Chapter 4.13, Transportation, of the DEIR.

REFERENCES

City of San Rafael, 2019. San Rafael City Council Agenda Report on "Renter Protections," February 4.



BASE MAP: OpenStreetMap, 2019

Figure 6-1

CUMULATIVE PROJECTS IN DOWNTOWN SAN RAFAEL

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

7. EIR AUTHORS

The DEIR was prepared by the following CEQA consultants under the direction of the City of San Rafael Community Development Department.

CITY OF SAN RAFAEL

Raffi Boloyan, Planning Manager, City of San Rafael

Sean Kennings, Planning Consultant to City of San Rafael Planning Division

EIR CONSULTANTS

Amy Skewes-Cox, AICP: *Overall EIR Preparation and Management, Visual Quality, Land Use*
P.O. Box 422
Ross, CA 94957
(amysc@rtasc.com)

Bruce Abelli-Amen, Baseline Environmental Consulting: *Overall EIR Preparation and Management*

Patrick Sutton, Baseline Environmental Consulting*: Air Quality, Energy and Greenhouse Gas Emissions*

Cem Atabek: *Hazards and Hazardous Materials*

Monika Krupa, Baseline Environmental Consulting*: Hydrology and Geology*

Lisa Luo, Baseline Environmental Consulting: *Air Quality, Noise, and Greenhouse Gas Emissions*

David Parisi, Parisi Transportation Consulting: *Transportation*

Natalie Macris: *Project Management Assistance and Editing; Services, Utilities, Recreation, and Energy*

Tim Jones, LSA Associates: *Cultural Resources*

Tom Camara and Ron Teitel: *Graphics*

Susan Smith, Wordsmith: *Word Processing*

8. REFERENCES

1. INTRODUCTION

California Environmental Quality Act (CEQA), Public Resources Code Sections 21000 to 21189.57, as amended January 1, 2019.

CEQA Guidelines, 14 California Code of Regulations (CCR) Sections 15000-15387, as amended December 1, 2013.

California Government Code, Section 53094, effective January 1, 2002.

3. PROJECT DESCRIPTION

BioMarin and Whistlestop/Eden Housing, 2019. "List of Needed Material for EIR," final as of April 2.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.*

City of San Rafael, 2018. Municipal Code.

Dyett & Bhatia, 2018. Project Description: *BioMarin Planned Development Expansion and Whistlestop Healthy Aging Center and Affordable Senior Housing*, 999 3rd Street San Rafael.

Luk and Associates, 2018. *Preliminary Grading Plan,* Drawing C-4.1 of Application Packet, August.

Miller Pacific Engineering Group, 2018. *Geotechnical Feasibility Report: BioMarin Office Buildings, 999 3rd Street, San Rafael, California,* August 24.

4.1 AESTHETICS

California Department of Transportation, 2019. Website: http://www.dot.ca.gov/hq/LandArch/16_livability/scenic_highways/, accessed on February 26.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28, 2017.

City of San Rafael, 2019. Municipal Code. Website: https://library.municode.com/ca/san_rafael/codes/code_of_ordinances?nodeId=TIT14ZO_DIVIVREAPALSEDI_CH14.16SIUSRE_14.16.227LIGL; accessed on April 17.

City of San Rafael, 2019a. Website on current projects: https://www.cityofsanrafael.org/?page_id=32061&preview=true, accessed on April 18.

4.2 AIR QUALITY

Bay Area Air Quality Management District (BAAQMD), 2019a. BAAQMD Health Risk Calculator (Beta Version 2.0).

Bay Area Air Quality Management District (BAAQMD), 2019b. BAAQMD's Risk & Hazard Stationary Source Inquiry Form. May 6.

Bay Area Air Quality Management District (BAAQMD), 2019c. Personal communication between Patrick Sutton, Baseline Environmental Consulting, and Areana Flores, BAAQMD, February 5.

Bay Area Air Quality Management District (BAAQMD), 2017a. California Environmental Quality Act Air Quality Guidelines, May.

Bay Area Air Quality Management District (BAAQMD), 2017b. Air Quality Standards and Attainment Status. Website: http://www.baaqmd.gov/research-and-data/air-quality-standards-and-attainment-status, accessed on April 10, 2019. Last updated January 5, 2017.

Bay Area Air Quality Management District (BAAQMD), 2017c. 2017 Clean Air Plan: Spare the Air, Cool the Climate, April 19.

Bay Area Air Quality Management District (BAAQMD), 2016a. Planning Healthy Places; A Guidebook for Addressing Local Sources of Air Pollutants in Community Planning, May.

Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator, April 16.

Bay Area Air Quality Management District (BAAQMD), 2014. BAAQMD Planning Healthy Places Highway, Major Street, and Rail health risk raster files, 2014.

Bay Area Air Quality Management District (BAAQMD), 2012a. Recommended Methods for Screening and Modeling Local Risks and Hazards, May.

Bay Area Air Quality Management District (BAAQMD), 2012b. Diesel Internal Combustion Engine Distance Multiplier Tool, June 13.

Bay Area Air Quality Management District (BAAQMD), 2012c. Stationary Source Screening Analysis Tool, May 30.

Bay Area Air Quality Management District (BAAQMD), 2012d. Gasoline Dispensing Facility Distance Multiplier Tool, June 13.

Bay Area Air Quality Management District (BAAQMD), 2009. Revised Draft Options and Justification Report; California Environmental Quality Act Thresholds of Significance, October.

California Air Resources Board (CARB), 2018. Speciation Profiles Used in ARB Modeling. PMPROF spreadsheet for particulate matter chemical profiles for source categories. Website: https://www.arb.ca.gov/ei/speciate/speciate.htm#assnfrac, accessed on January 29, 2018.

California Air Resources Board (CARB), 1998. Initial Statement of Reasons for Rulemaking; Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant, June.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Reprinted April 28, 2017.

Office of Environmental Health Hazard Assessment (OEHHA), 2015. Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, February.

Pacific Gas and Electric (PG&E), 2018. Independent Registry Confirms Record Low Carbon Emissions for PG&E., March 26.

Transportation Authority of Marin (TAM), 2017. Accept 2016 System Monitoring Report and the 2017 Congestion Management Program Report (Action), Agenda Item No. 11. Exhibit A Travel Data Summaries.

4.3 CULTURAL RESOURCES

Barrett, Samuel A., 1908. The Ethno-geography of the Pomo and Neighboring Indians. *University of California Publications in American Archaeology and Ethnology* 6(1). Berkeley.

Bieling, David G., 2000. *Archaeological Investigations at CA-MRN-255/H, Larkspur, Marin County, California*. San Francisco: Holman & Associates.

Kelly, Isabel, 1978. Native Languages of California. In *California*, edited by Robert F. Heizer, pp. 80-90. Handbook of North American Indians, Volume 8, William C. Sturtevant, General Editor. Washington, D.C.: Smithsonian Institution.

Kroeber, Alfred L., 1955. Nature of the Land-Holding Group. *Ethnohistory* 2:303-314.

Miller Pacific Engineering Group, 2018. *Geotechnical Feasibility Report: BioMarin Office Buildings, 999 3rd Street, San Rafael, California,* August 24.

Milliken, Randall et al., 2007. Punctuated Culture Change in the San Francisco Bay Area, in *California Prehistory: Colonization, Culture, and Complexity*, edited by T.L. Jones and K.A. Klar, pp. 99-123, Lanham, MD: Alta Mira Press.

Sanborn Map Company, 1887. *San Rafael, California.*

Sanborn Map Company, 1907. *San Rafael, Marin County, California.*

Sanborn Map Company, 1924. *San Rafael, Marin County, California.*

Schneider, Tsim Duncan, 2010. *Placing Refuge: Shell Mounds and the Archaeology of Colonial Encounters in the San Francisco Bay Area, California.* PhD dissertation, Department of Anthropology, University of California, Berkeley.

Stewart, Suzanne B., 1999. *Archaeological Test Excavations at CA-MRN-644/H, San Rafael, Marin County, California*. Rohnert Park, CA: Anthropological Studies Center.

Witter, Robert C., et al., 2006. *Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California*.

4.4 ENERGY

BioMarin and Whistlestop/Eden Housing, 2019. “List of Needed Material for EIR,” final as of April 2.

California Code of Regulations, Title 13, Section 2485, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling.

California Energy Commission, 2018. “2019 Building Energy Efficiency Standards,” March.

City of San Rafael, 2009. *City of San Rafael Climate Change Action Plan*, pages 8 and 10, April.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*, pages 61, 227, 228, 229, and 234. Amended and reprinted April 28,

Marin Clean Energy (MCE), 2019. Website: https://www.mcecleanenergy.org/faq/, accessed on April 26.

Nichols-Berman, 2004. *San Rafael General Plan 2020 General Plan Update Draft Environmental Impact Report,* page IV.5-7, February.

Sustainable San Rafael, 2019. Letter re. “BioMarin/Whistlestop EIR Scoping Comments,” March 11.

4.5 GEOLOGY AND SOILS

Association of Bay Area Governments (ABAG), 2019. Marin County Earthquake Hazard Map-Liquefaction Susceptibility. Available at: http://resilience.abag.ca.gov/earthquakes/marin/, accessed on April 11, 2019.

Bailey, Edgar Herbert, W.P. Irwin, and David Lawrence Jones, 1964. Franciscan and Related Rocks and their Significance in the Geology of Western California. San Francisco: California Division of Mines and Geology.

California Geological Survey (CGS), 2002a. California Geomorphic Provinces, Note 36.

California Geological Survey (CGS), 2002b. How Earthquakes and Their Effects are Measured, Note 32.

City of San Rafael, 2017. General Plan 2020, Reprinted April 28, 2017.CSW/Stuber-Stroeh Engineering Group, Inc., 2018. Preliminary Investigation and Recommendations, FEMA Requirements, and Sea Level Rise for BioMarin, July 26.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018a. Preliminary Investigation and Recommendation, FEMA Requirements, and Sea Level Rise, July 26.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018b. Preliminary Hydrology Study, October 1.

Miller Pacific Engineering Group, 2018. Geotechnical Feasibility Report, BioMarin Office Buildings, 999 3rd Street, San Rafael, California, August 24.

Norris, Robert M. and Robert W. Webb, 1976. Geology of California, 2nd Edition. J. Wiley & Sons, Inc.

Terra Pacific Group, 2018. Remedial Action Completion Report, former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California, November 19.

United States Geological Survey (USGS), 2006. Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region. Website: http://pubs.usgs.gov/of/2006/1037/, accessed on April 11, 2019.

United States Geological Survey (USGS), 2016. Earthquake Outlook for the San Francisco Bay Region 2014-2043, USGS Fact Sheet 2016-3020. Revised August.

United States Geological Survey (USGS), 2019. Earthquake Hazard Program, Magnitude/Intensity Comparison. Website: https://earthquake.usgs.gov/learn/topics/mag_vs_int.php, accessed on April 11, 2019.

4.6 GREENHOUSE GAS EMISSIONS

Bay Area Air Quality Management District (BAAQMD), 2015. Bay Area Emissions Inventory Summary Report: Greenhouse Gases, Base Year 2011, January.

Bay Area Air Quality Management District (BAAQMD), 2017a. California Environmental Quality Act Air Quality Guidelines, May.

Bay Area Air Quality Management District (BAAQMD), 2017b. Final 2017 Clean Air Plan, April 19.

California Air Resources Board (CARB), 2018. California Greenhouse Gas Emissions for 2000 to 2016 – Trends of Emissions and Other Indicators, July 11.

California Air Resources Board (CARB), 2019. Advanced Clean Cars Program: About. Website: https://ww2.arb.ca.gov/index.php/our-work/programs/advanced-clean-cars-program/about, accessed on April 15, 2019.

City of San Rafael, 2009. *City of San Rafael Climate Change Action Plan,* April.

City of San Rafael, 2018a. San Rafael City Council Agenda Report: Receive and Accept San Rafael Greenhouse Gas Reduction Strategy Report, March 19.

City of San Rafael, 2019. *Climate Change Action Plan 2030*, April 23.

Intergovernmental Panel on Climate Change (IPCC), 2013. Climate Change 2013; the Physical Science Basis; Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG), 2017. Plan Bay Area 2040. Regional Transportation Plan and Sustainable Communities Strategy for the San Francisco Bay Area 2017–2040. Adopted July 26.

National Aeronautics and Space Administration (NASA), 2019. 2018 Fourth Warmest Year in Continued Warming Trend, According to NASA, NOAA. Website: https://www.giss.nasa.gov/research/news/20190206/, posted February 6.

United States Environmental Protection Agency (EPA), 2010. Regulatory Announcement: EPA and NHTSA Finalize Historic National Program to Reduce Greenhouse Gases and Improve Fuel Economy for Cars and Trucks.

United States Environmental Protection Agency (EPA), 2012. Regulatory Announcement: EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017-2025 Cars and Light Trucks, August.

4.7 HAZARDS AND HAZARDOUS MATERIALS

California Department of Education, 2019. California Schools Directory. Website: https://www.cde.ca.gov/schooldirectory/, accessed on March 25.

California Environmental Protection Agency (CalEPA), 2019. Cortese List data Resources. Website: https://calepa.ca.gov/sitecleanup/corteselist/, accessed on March 25.

CAL FIRE, 2008. Marin County Very High Fire Hazard Severity Zones in LRA, October 16.

City of San Rafael, 2007. City of San Rafael Wildland-Urban Interface (WUI), July 2.

City of San Rafael, 2017. *General Plan 2020.* Reprinted April 28, 2017.

Department of Toxic Substances Control (DTSC), 2011. Vapor Intrusion Mitigation Advisory, Final Revision 1, October.

Department of Toxic Substances Control (DTSC), 2018a. Letter to Ms. Sharon Reackhof of PG&E regarding approval of Remedial Action Completion Report, November 30.

Department of Toxic Substances Control (DTSC), 2018b. Letter to Ms. Sharon Reackhof of PG&E regarding approval of Final Operation and Maintenance Plan, November 30.

Department of Toxic Substances Control (DTSC), 2018c. Docket No. HSA-FY18/19-053, Voluntary Oversight Agreement, December 14.

Department of Toxic Substances Control (DTSC), 2018d. Letter to Mr. Donald Clark of BioMarin regarding CEQA requirements, December 18.

Department of Toxic Substances Control (DTSC), 2019a. Letter to Mr. Donald Clark of BioMarin regarding approval of Final Report Pre-Design Subsurface Investigation, April 15.

Department of Toxic Substances Control (DTSC), 2019b. Work Notice, Former San Rafael Manufactured Gas Plant Site, 999 3rd Street, San Rafael, CA 94901, February. DTSC, 2019c. Letter to Ms. Sharon Reackhof of PG&E regarding approval of Soil Gas Sampling Workplan Addendum, March 18.

Department of Toxic Substances Control (DTSC), 2019d. Addendum to the Negative Declaration for the Former San Rafael Manufactured Gas Plant – Remedial Action Plan, State Clearinghouse Number: 2012102020, Site Code: 202210.

Geologica, 2019a. Final Report Pre-Design Subsurface Investigation, Former Office, Telecom & Warehouse Buildings ,999 Third Street San Rafael, California 94901. February 21.

Geologica, 2019b. Explanation of Significant Differences, Final Remedial Action Plan, Extension of Remedial Soil Excavation to Parcel 4 West, Former PG&E Manufactured Gas Plant (MGP) Site, 999 3rd Street, San Rafael, CA, May 1.

Regional Water Board, 2019. Environmental Screening Levels, January 24.

Marin County Planning Department, 1991. *Airport Land Use Plan, Marin County Airport Gnoss Field,* June 10.

Terra Pacific Group (TPG), 2018a. Remedial Action Completion Report, Former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California, November 19.

Terra Pacific Group (TPG), 2018b. Final Operation and Maintenance Plan, Former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California, November 20.

4.8 HYDROLOGY AND WATER QUALITY

Bay Area Stormwater Management Agencies Association (BASMAA), 2019. Design Guidance for Stormwater Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties, January.

Borrero, Jose, et al, 2006. Numerical Modeling of Tsunami Effects at Marine Oil Terminals in San Francisco Bay, Report prepared for Marine Facilities Division of the California State Lands Commission, June 8.

California Department of Water Resources, 2019. Bulletin 118. Website: https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118, accessed on April 16, 2019.

California Emergency Management Agency (CalEMA), 2009. Tsunami Inundation map for Emergency Planning, San Rafael Quadrangle/San Quentin Quadrangle, July 1.

City of San Rafael, 2014. *Climate Adaptation – Sea Level Rise, San Rafael, CA,* White Paper, January.

City of San Rafael, 2017. *General Plan 2020.* Reprinted April 28, 2017.

Clearwater Hydrology, 2015. *Marin Countywide Plan Flooding Technical Background Report,* November.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018a. Preliminary Investigation and Recommendation, FEMA Requirements, and Sea Level Rise, July 26.

CSW/Stuber-Stroeh Engineering Group, Inc. (CSW-ST2), 2018b. *Preliminary Hydrology Study,* October 1.

Federal Emergency Management Agency (FEMA), 2016. Flood Insurance Rate Map, Marin County California, Map Number 06041C0457E, March 16.

Federal Emergency Management Agency (FEMA), 2017. Flood Insurance Study, Marin County California, Study Number 06041CV001D, August 15.Marin County, 2017. Marin County Sea Level Rise Vulnerability Assessment, June.

Marin Watershed Program, 2019. San Rafael Creek. Website: https://www.marinwatersheds.org/creeks-watersheds/san-rafael-creek, accessed on April 16, 2019.

Miller Pacific Engineering Group, 2018. *Geotechnical Feasibility Report, BioMarin Office Buildings, 999 3rd Street, San Rafael, California,* August 24.

National Research Council of the National Academies, 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future,* Chapter 4.

San Francisco Bay Regional Water Quality Control Board (Regional Water Board), 2017. *San Francisco Bay Basin Water Quality Control Plan (Basin Plan),* May 4.

State Water Resources Control Board (State Water Board), 2010. 2010 Integrated Report (Clean Water Act Section 303(d) List 305(b) Report). Website: https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml, accessed on April 16, 2019.

Terra Pacific Group, 2018. *Remedial Action Completion Report, Former San Rafael Manufactured Gas Plant Site, 999 Third Street, San Rafael, California,* November 19.

United States Environmental Protection Agency (EPA), 2016. *Waterbody Quality Assessment Report for San Pablo Bay.* Website: https://ofmpub.epa.gov/waters10/attains_waterbody.control?p_au_id=CAB2061001019980928100945&p_list_id=CAB2061001019980928100945&p_cycle=2016, accessed on April 16, 2019.

Western Regional Climate Center (WRCC), 2016. San Rafael Civic Center, California (047880), Period of Record Monthly Climate Summary, 01/01/1894 to 06/10/2016. Website: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7880, accessed on April 16, 2019.

4.9 LAND USE AND PLANNING

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28.

4.10 NOISE

California Code of Regulations, Title 24, Part 2, Volume 1, Section 1207.4.

California Department of Transportation (Caltrans), 1998. Technical Noise Supplement-A Technical Supplement to the Traffic Noise Analysis Protocol.

California Department of Transportation (Caltrans), 2013. Transportation and Construction Vibration Guidance Manual, September.

California Noise Control Act, California Health & Safety Code, Sections 46000-46080

California Code of Regulations, Title 8, Subchapter 7, Group 15, Article 105.

California Office of Planning and Research (OPR), 2017. State of California General Plan Guidelines.

Charles M. Salter Associates, 1998. Acoustics – Architecture, Engineering, the Environment.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Reprinted April 28.

City of San Rafael, Municipal Code, Sections 8.13 & 14.16

Federal Aviation Administration (FAA), 2019. Airport Data and Contact Information. Effective: March 28, 2019. Database searched for both public-use and private-use facilities in Marin County. Website: http://www.faa.gov/airports/airport_safety/airportdata_5010/, accessed on April 20, 2019.

Federal Transit Administration (FTA), 2018. Transit Noise and Vibration Impact Assessment Manual. FTA Report No.0123, September.

Fehr & Peers, 2019. *Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion,* April 5.

Marin County Planning Department, 1991. *Airport Land Use Plan, Marin County Airport Gnoss Field,* June 10.

National Cooperative Highway Research Program (NCHRP), 1999. Mitigation of Nighttime Construction Noise, Vibrations, and Other Nuisances. NCHRP Synthesis 218.

4.11 PUBLIC SERVICES

City of San Rafael, 2015. *San Rafael General Plan 10-Year Status Report, Public Review Draft*, May. Website: http://docs.cityofsanrafael.org/CommDev/planning/GP2020Report/San-Rafael-GP-Status-Report.pdf, pages 4 and 5, accessed on March 14, 2019.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28, 2017, pages 280 and 282.

City of San Rafael, 2018. "Development Impact Fees." Website: https://storage.googleapis.com/proudcity/sanrafaelca/uploads/2018/09/Development-Impact-Fees-Handout.pdf, last updated September 28, 2018, accessed on March 14, 2019.

Holton, Lisa, San Rafael Police Department, 2019. E-mail re. "BioMarin EIR – Police Impacts," April 18.

Nichols-Berman, 2004. *San Rafael General Plan 2020 General Plan Update Draft Environmental Impact Report*, February, pages IV.5-3 through IV.5-4.

San Rafael Fire Department, 2019a. "Essential Facilities." Website: https://www.cityofsanrafael.org/departments/facilities/, accessed on March 14, 2019.

San Rafael Fire Department, 2019b. "Temporary Fire Station Relocations." Website: https://www.cityofsanrafael.org/temporary-fire-station-relocations/, accessed on March 14, 2019.

San Rafael Police Department, 2019. "Community Policing." Website: https://www.srpd.org/faq#About the Police Department, accessed on March 14, 2019.

Sinnott, Robert, San Rafael Fire Department, 2019a. E-mail re. "BioMarin EIR – Fire Impacts," March 28.

Sinnott, Robert, San Rafael Fire Department, 2019b. E-mail re. "MMWD 3rd Street Pipeline Replacement Project," January 15.

4.12 RECREATION

BioMarin and Whistlestop/Eden Housing, 2019. "List of Needed Material for EIR," final as of April 2.

City of San Rafael, 2012. *San Rafael Downtown Station Area Plan,* Approved Final Draft, June 4, 2012, page 104.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Amended and reprinted April 8, 2017, pages 139, 252, 255, 259, 260, 262, and 263.

City of San Rafael, 2018. "Development Impact Fees." Website: https://storage.googleapis.com/proudcity/sanrafaelca/uploads/2018/09/Development-Impact-Fees-Handout.pdf, last updated September 28, 2018.

Dyett & Bhatia, 2018. "Project Description: BioMarin Planned Development Expansion and Whistlestop Healthy Aging Center and Affordable Senior Housing, 999 3rd Street San Rafael," October 5, 2018, page 1.

4.13 TRANSPORTATION

Caltrans, 2002. *Guide for the Preparation of Traffic Impact Studies,* December.

CEQA Guidelines, Appendix G.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Amended and reprinted January 18.

City of San Rafael, 2016. Municipal Code Sections 14.18 and 5.8.1.

City of San Rafael, 2018. *Bicycle and Pedestrian Plan Update.*

Fehr & Peers, 2019. *Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion*, April 8.

Golden Gate Bridge Highway and Transportation District, 2019. *San Rafael Transit Center Project Page*, www.goldengate.org/SRTC/index.php, May.

Institute of Transportation Engineers (ITE), 2017. *Trip Generation, 10th Edition.*

Transportation Authority of Marin, 2017. *Final Report 2017 CMP Update*, Marin County, March.

Transportation Research Board (TRB), 2010. *Highway Capacity Manual 2010*.

4.14 TRIBAL CULTURAL RESOURCES

California Office of Planning and Research (OPR), 2005. *Tribal Consultation Guidelines, Supplement to General Plan Guidelines.*

City of San Rafael (Sean Kennings), March, 29, 2019. Email to Buffy McQuillen, THPO, Federated Indians of Graton Rancheria.

Federated Indians of Graton Rancheria, February 28, 2019. *Formal Request for Tribal Consultation Pursuant to the California Environmental Quality Act (CEQA), Public Resources Code Section 21080.3.1, subds. (b), (d) and (e) for the BioMarin/Whistlestop/Eden Housing Project in San Rafael, APN 011-265-01, at 999 3rd Street, San Rafael.*

Native American Heritage Commission, November 19, 2018, *BioMarin Planned Development Expansion, San Rafael, Marin County*.

4.15 UTILITIES AND SERVICE SYSTEMS

BioMarin and Whistlestop/Eden Housing, 2019. “List of Needed Material for EIR,” final as of April 2.

Borjian, Chris, Engineering Technician, Marin Municipal Water District, 2018. Letter to Sean Kennings, San Rafael Planning Department, re. “Water Availability – Redevelopment and Lot Split, Assessor’s Parcel No.: 011-265-01, Location: 999 Third St., San Rafael,” November 19.

California Public Resources Code Sections 41730, 41780, and 42649.

Central Marin Sanitation Agency (CMSA), 2019. “About Us.” Website: http://www.cmsa.us/aboutus/, accessed on March 14, 2019.

City of San Rafael, 2009. *City of San Rafael Climate Change Action Plan*, April, pages 8 and 10.

City of San Rafael, 2017. *City of San Rafael General Plan 2020.* Amended and reprinted April 28, 2017, pages 16, 201, 228-231, 234, and 282.

City of San Rafael, 2019a. Municipal Code Section 14.16.370 (Water-Efficient Landscape).

City of San Rafael, 2019b. Municipal Code Section 12.23.10 (Adoption of California Green Building Standards Code, 2016 Edition, with amendments).

Criscimagna, Associate Director – Real Estate Development, Eden Housing, 2019. E-mail re. “BioMarin EIR – Solid Waste Generation,” March 26.

Dow, Jason, Central Marin Sanitation Agency (CMSA), 2019. E-mail re. “BioMarin EIR – Wastewater Impacts,” April 1.

Environmental Protection Agency (EPA), 2019. “RecycleMania Volume to Weight Conversion Chart.” Website: https://archive.epa.gov/wastes/conserve/tools/rogo/web/pdf/volume-weight-conversions.pdf, accessed on March 25.

Marin Municipal Water District (MMWD), 2016. *Urban Water Management Plan 2015 Update*, June, pages 1-2, 1-4, 3-3, and 7-7.

Marin Municipal Water District (MMWD), 2017. *Water Resources Plan 2040*, March, pages 1-2, 1-3, 2-1, 4-2, and 8-1.

Marin Municipal Water District (MMWD), 2019a. Website: https://www.marinwater.org/168/Water-Conservation-Requirements, accessed on March 26, 2019.

Marin Municipal Water District (MMWD), 2019b. Website: https://www.marinwater.org/284/Fees-Costs, accessed on March 26, 2019.

Morrison, Paul, Engineering Support Services Manager, Marin Municipal Water District (MMWD), 2019. E-mail re. “BioMarin EIR – Water Impacts,” April 9.

Nichols-Berman, 2004. *San Rafael General Plan 2020 General Plan Update Draft Environmental Impact Report*, February, page IV.5-7.

Sinnott, Robert, City of San Rafael, 2019. E-mail to Sean Kennings re. “MMWD 3rd Street Pipeline Replacement Project,” January 15.

State of California Department of Resources Recycling and Recovery (CalRecycle), 2019a. Estimated Solid Waste Generation Rates. Website: https://www2.calrecycle.ca.gov/WasteCharacterization/General/Rates, accessed on March 18, 2019.

State of California Department of Resources Recycling and Recovery (CalRecycle), 2019b. Solid Waste Information System (SWIS) Facility/Site Listing. Website: https://www2.calrecycle.ca.gov/swfacilities/Directory/21-AA-0001/, accessed on March 14, 2019.

State of California Department of Resources Recycling and Recovery (CalRecycle), 2019c. Frequently Asked Questions. Website: https://www.calrecycle.ca.gov/lgcentral/library/canddmodel/instruction/faq#CALGreen, accessed on April 17, 2019.

Toy, Doris, San Rafael Sanitation District, 2019. E-mail re. “BioMarin EIR – Wastewater Impacts,” April 23.

Zamanpour, Shar, BioMarin, 2019. E-mail re. “BioMarin EIR – Solid Waste Generation,” March 29.

5. ALTERNATIVES

California Public Resources Code, Section 21061.1.

CEQA Guidelines, Sections 15364 and 15126.6.

City of San Rafael, 2017. *City of San Rafael General Plan 2020*. Amended and reprinted April 28.

6. CEQA CONSIDERATIONS

City of San Rafael, 2019. San Rafael City Council Agenda Report on “Renter Protections,” February 4.

APPENDIX A
NOTICE OF PREPARATION, NOTICE OF PREPARATION COMMENTS, AND SCOPING MEETING COMMENTS

SAN RAFAEL

THE CITY WITH A MISSION

NOTICE OF PREPARATION

Date of Mailing: February 8, 2019

TO:	Office of Planning and Research State Clearinghouse 1400 Tenth Street, Room 212 Sacramento, CA 95814	**FROM:**	Sean Kennings, Contract Planner LAK Associates, LLC City of San Rafael Community Development Department Attn: Sean Kennings, Contract Planner 1400 Fifth Ave San Rafael, CA 94901
	Responsible and Trustee Agencies, Utility Providers, Organizations, Neighboring Property Owners, Neighboring Occupants, and Interested Parties		

NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT AND SCHEDULED SCOPING MEETING FOR THE BIOMARIN AND WHISTLESTOP/EDEN HOUSING PROJECT EIR

The City of San Rafael (City) is preparing an Environmental Impact Report (EIR) for the BioMarin (a global biotechnology company) and Whistlestop Senior Center/Eden Housing Project (project), which consists of a proposed expansion of the BioMarin/San Rafael Corporate Center campus (750/770/790 Lindaro St and 781/791 Lincoln Ave) onto 999 3rd St and the construction of the Whistlestop/Eden Housing Healthy Aging Center and Affordable Housing project on a 3.05-acre site located at 999 3rd Street, San Rafael, California. The California Environmental Quality Act (CEQA) requires that the City conduct environmental review of the project, which has the potential to result in physical change in the environment. The City is the "Lead Agency" for the project and is the public agency with the principal responsibility for approving and carrying out the project. The City has determined that an EIR will be the required CEQA document for the project.

The City is issuing this Notice of Preparation (NOP) to invite comments on the scope and content of study for the EIR. This NOP is being sent to local agencies, nearby residents, and other interested parties. When the draft EIR is published, it will be sent to all parties who respond to this NOP or who otherwise indicate that they would like to receive a copy of the draft EIR.

RESPONDING TO THIS NOP: Responses to this NOP and any related questions or comments regarding the scope or content of the Draft EIR must be directed in writing to: **Sean Kennings, Contract Planner, City of San Rafael, 1400 Fifth Avenue, San Rafael, CA 94901 or by e-mail to sean@lakassociates.com**

Comments on the NOP must be received at the above mailing or e-mail address within 30 days of receipt of this notice, or **before Monday, March 11, 2019, at 5:00 PM**. Please reference the project title of "BioMarin/Whistlestop" in all correspondence.

Responses to this NOP should focus, specific to this project, on the potentially significant environmental effects that the project may have on the physical environment, ways in which those effects might be minimized, and potential alternatives to the project that should be addressed in the EIR. This focus aligns with the purpose of the EIR to inform the public about these aspects of the project.

EXISTING CONDITIONS: The 3.05-acre project site (Assessor's Parcel Number 011-265-01) is currently vacant and paved with an asphalt surface. The site was previously used by Pacific Gas & Electric Company (PG&E) as a manufactured gas plant and has been undergoing environmental remediation. In late 2017, PG&E completed soil excavation as defined in its Remedial Action Plan (RAP) on two acres of the 3-acre project site, backfilled the excavation with clean material, restored the project site, and conducted soil vapor sampling. The project site is now paved with asphalt and monitors are in place to test groundwater. The western portion of the project site, where buildings were once located, has yet to be remediated, and BioMarin will be responsible for this second phase of remediation (site soils and soil vapor monitoring and all other remediation except groundwater for which PG&E will remain responsible).

The surrounding neighborhood is largely commercial. The existing BioMarin campus is located immediately southeast of the project site, and Whistlestop operates an active aging center in a building next to the Sonoma Marin Area Rail Transit (SMART) station about one-quarter mile east of the project site. The two main transportation arterials in the vicinity are 3rd Street and 2nd Street. Smaller collector streets such as Brooks Street and Lindaro Street intersect with these one-way arterials. The 4th Street downtown core is one block north of the project site. Residential uses are located southwest of the site.

PROJECT DESCRIPTION: The BioMarin portion of the project would be constructed in two phases as follows:

- ***Phase I*** would consist of construction of Building A, which would be located on the north side of the project site and would include 77,000 square feet of office space and 33,000 square feet of amenities for employees and visitors of the overall BioMarin campus. The 33,000 square feet of amenities would be located on the ground floor and would include lobbies, conference rooms, a fitness center, dining space, and retail space. The retail space, consisting of about 3,500 square feet, would be open to the public. Additional public use space would be an adjacent landscaped plaza (approximately 6,000 square feet) that could be an outdoor public gathering area during daytime hours.
- ***Phase II*** would consist of construction of Building B, which would provide 97,000 square feet of laboratory (research and development [R&D]) space in the southern portion of the project site.

Both Building A and Building B would be 69 feet (four stories) in height. Building A would have approximately 262 feet of frontage on 3rd Street and 180 feet of frontage on Lindaro Street. Building B would have approximately 244 feet of frontage on 2nd Street and 109 feet of frontage on Lindaro Street.

Whistlestop/Eden Housing would develop its building on 0.34 acre at the northeast corner of the project site. The building would provide approximately 18,000 square feet of space for a Healthy Aging Center and 67 affordable senior housing units. The building would be developed at the same time as BioMarin Building A (Phase I). The proposed 67 housing units would be leased at affordable rents to those aged 62 and over who earn less than 60 percent of the area median income. Residential amenities would include a community room, dance/exercise studio, computer center and library, and landscaped courtyards with community gardens for residents to grow vegetables and herbs. A roof deck would be provided on the northwest and southwest corners of the sixth floor.

A total of 22 surface parking spaces would be provided for the BioMarin portion of the project at the southwest corner of the site, with access from 3rd Street. Cars would enter the site from 3rd Street, travel south to the parking area, and then exit onto Brooks Street. The 12 ground-floor parking spaces provided within the Whistlestop/Eden Housing project would have ingress and egress points on Brooks Street, north of the exit point for the surface parking area. In Phase I, when only BioMarin Building A and the Whistlestop/Eden Housing project would be located on the site, a total of 78 surface parking spaces would be provided since space would be available where Building B (Phase II) is proposed.

Approvals requested for the project include a General Plan amendment to modify the maximum intensity of non-residential development and a rezoning to expand the Planned Development District boundary.

Project plans, project description and technical studies for this project can be found on the project web page at https://www.cityofsanrafael.org/999-3rd/

POTENTIAL ENVIRONMENTAL EFFECTS: The EIR will address the following potential environmental effects: Aesthetics, Air Quality, Biological Resources, Cultural Resources, Energy, Geology/Soils, Hazards, Noise, Public Services, Recreation, Greenhouse Gas Emissions, Hydrology and Water Quality, Land Use, Transportation/Traffic, and Utilities. The EIR will examine project and cumulative effects and a reasonable range of alternatives to the project that may be capable or reducing or avoiding potential environmental effects that may be identified for the project. The topics of Agricultural and Forestry Resources, Mineral Resources, and Population/Housing will not be addressed in the EIR as these do not apply to the project or project site.

SCOPING MEETING: A scoping meeting will be held before the City of San Rafael Planning Commission on **Tuesday, March 12, 2019 at 7 PM at the City Council Chambers at 1400 Fifth Avenue, San Rafael, CA**. This meeting will include a brief overview of the EIR process and allow time for oral comments on the scope of the EIR.

For More Information: For additional information on the project or if you wish to be placed on a mailing list to receive further information as the project progresses, please contact Sean Kennings, Contract Planner, at (415) 533-2111, sean@lakassociates.com or the mailing address above.

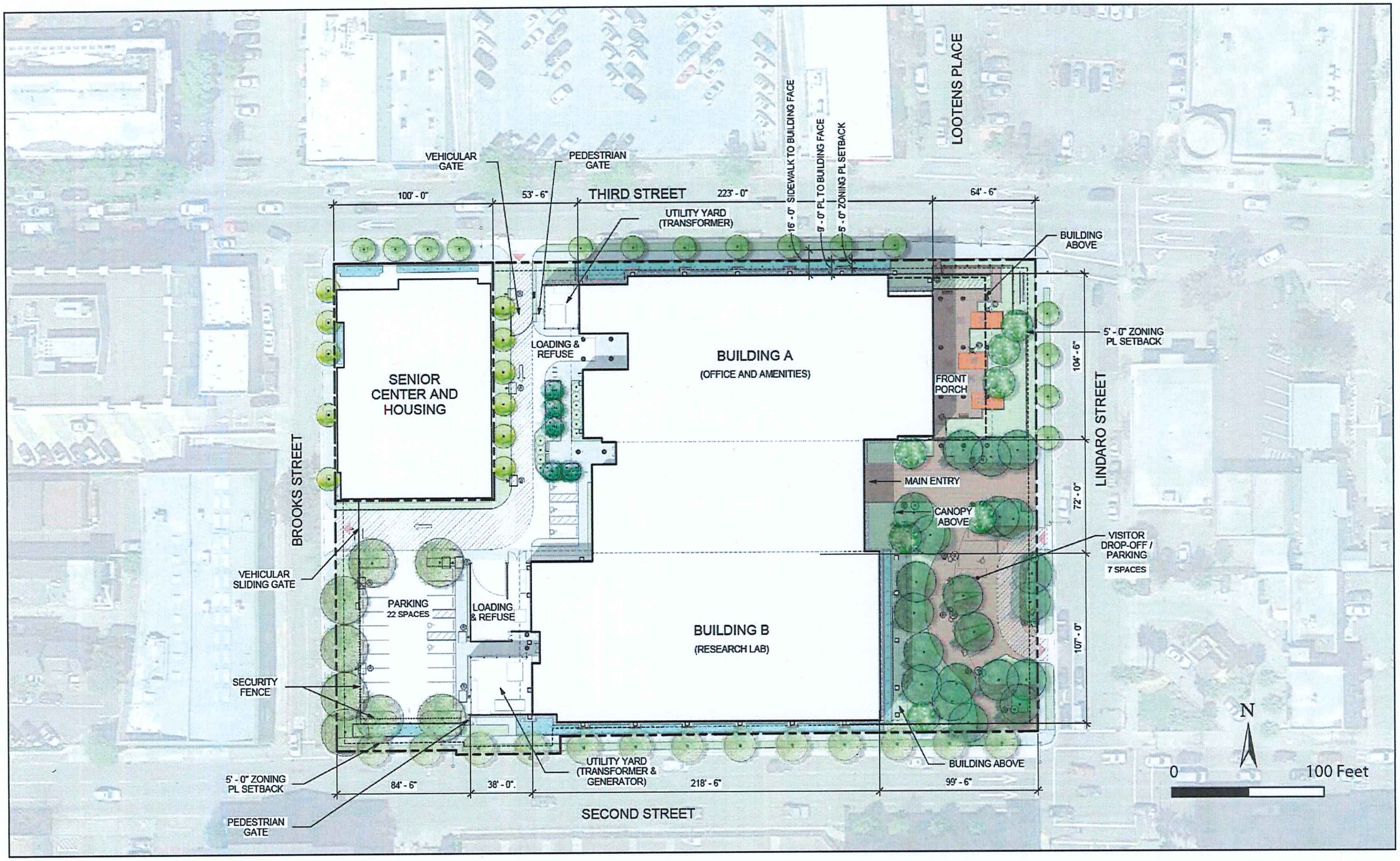
Date: February 8, 2019 Signature:
Name/Title: Raffi Boloyan, *Planning Manager*

Reference: California Code of Regulations, Title 14, (State CEQA Guidelines) Sections 15082(A), 15103, 15375

Sign Language and interpretation and assistive listening devices may be requested by calling (415) 485-3085 (voice) or (415) 485-3198 (TDD) at least 72 hours in advance. Copies of documents are available in accessible formats upon request.

Public transportation to City Hall is available through Golden Gate Transit, Line 22 or 23. Para-transit is available by calling Whistlestop Wheels at (415) 454-0964.

To allow individuals with environmental illness or multiple chemical sensitivity to attend the meeting/hearing, individuals are requested to refrain from wearing scented products.



PROPOSED SITE PLAN

SOURCE: Johnson Fain, 2018

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Gavin Newsom
Governor

STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Kate Gordon
Director

Notice of Preparation

February 8, 2019

To: Reviewing Agencies

Re: Biomarin and Whistlestop/Eden Housing Project
SCH# 2019029046

Attached for your review and comment is the Notice of Preparation (NOP) for the Biomarin and Whistlestop/Eden Housing Project draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Sean Kennings
City of San Rafael
1400 Fifth Avenue
San Rafael, CA 94901

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

RECEIVED
FEB 13 2018
PLANNING

FEB 13 2018
PLANNING

Attachments
cc: Lead Agency

Document Details Report
State Clearinghouse Data Base

SCH# 2019029046
Project Title Biomarin and Whistlestop/Eden Housing Project
Lead Agency San Rafael, City of

Type **NOP** Notice of Preparation

Description The BioMarin portion of the project would be constructed in two phases as follows:
- Phase I would consist of construction of Building A, which would be located on the north side of the project site and would include 77,000 sf of office space and 33,000 sf of amenities for employees and visitors of the overall BioMarin campus. The 33,000 sf of amenities for employees and visitors of the overall BioMarin campus. The 33,000 sf of amenities would be located on the ground floor and would include lobbies, conference rooms, a fitness center, dining space, and retail space. The retail space, consisting of about 3,500 sf, would be open to the public. Additional public use space would be an adjacent landscaped plaza (approx 6,000 sf) that could be an outdoor public gathering area during daytime hours.
- Phase II would consist of construction of Building B, which would provide 97,000 sf of laboratory (research and development [R&D]) space in the southern portion of the project site.

Both Building A & B would be 69 ft (4 stories) in height. Building A would have approx 262 ft of frontage on 3rd St and 180 ft of frontage on Lindaro St. Building B would have approx 244 ft of frontage on 2nd St and 109 ft of frontage on Lindaro St.

Lead Agency Contact

Name Sean Kennings
Agency City of San Rafael
Phone 415 485-3095 **Fax**
email sean@lakassociates.com
Address 1400 Fifth Avenue
City San Rafael **State** CA **Zip** 94901

Project Location

County Marin
City San Rafael
Region
Cross Streets
Lat / Long
Parcel No. 011-265-01
Township **Range** **Section** **Base**

Proximity to:

Highways
Airports
Railways
Waterways
Schools
Land Use

Project Issues Aesthetic/Visual; Air Quality; Biological Resources; Soil Erosion/Compaction/Grading; Toxic/Hazardous; Noise; Public Services; Recreation/Parks; Water Quality; Landuse; Traffic/Circulation; Other Issues

---

Reviewing Agencies Resources Agency; Department of Conservation; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Wildlife, Region 3; Native American Heritage Commission; Department of Housing and Community Development; Public Utilities Commission; Caltrans, District 4; Regional Water Quality Control Board, Region 2; Air Resources Board, Transportation Projects; State Water Resources Control Board, Division of Water Quality; Department of Toxic Substances Control

Note: Blanks in data fields result from insufficient information provided by lead agency.

NOP Distribution List

County: Sonoma OR **SCH#** 2019029046

Resources Agency

- [ ] **Resources Agency**
  Nadell Gayou
- [ ] **Dept. of Boating & Waterways**
  Denise Peterson
- [ ] **California Coastal Commission**
  Allyson Hitt
- [ ] **Colorado River Board**
  Elsa Contreras
- [x] **Dept. of Conservation**
  Crina Chan
- [ ] **Cal Fire**
  Dan Foster
- [ ] **Central Valley Flood Protection Board**
  James Herota
- [ ] **Office of Historic Preservation**
  Ron Parsons
- [ ] **Dept of Parks & Recreation**
  Environmental Stewardship Section
- [ ] **S.F. Bay Conservation & Dev't. Comm.**
  Steve Goldbeck
- [x] **Dept. of Water Resources**
  Resources Agency
  Nadell Gayou

Fish and Game

- [ ] **Depart. of Fish & Wildlife**
  Scott Flint
  Environmental Services Division
- [ ] **Fish & Wildlife Region 1**
  Curt Babcock
- [ ] **Fish & Wildlife Region 1E**
  Laurie Harnsberger
- [ ] **Fish & Wildlife Region 2**
  Jeff Drongesen
- [x] **Fish & Wildlife Region 3**
  Craig Weightman
- [ ] **Fish & Wildlife Region 4**
  Julie Vance
- [ ] **Fish & Wildlife Region 5**
  Leslie Newton-Reed
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6**
  Tiffany Ellis
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6 I/M**
  Heidi Calvert
  Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Wildlife M**
  William Paznokas
  Marine Region

Other Departments

- [ ] **California Department of Education**
  Lesley Taylor
- [ ] **OES (Office of Emergency Services)**
  Monique Wilber
- [ ] **Food & Agriculture**
  Sandra Schubert
  Dept. of Food and Agriculture
- [ ] **Dept. of General Services**
  Cathy Buck
  Environmental Services Section
- [x] **Housing & Comm. Dev.**
  CEQA Coordinator
  Housing Policy Division

Independent Commissions, Boards

- [ ] **Delta Protection Commission**
  Erik Vink
- [ ] **Delta Stewardship Council**
  Anthony Navasero
- [ ] **California Energy Commission**
  Eric Knight
- [x] **Native American Heritage Comm.**
  Debbie Treadway
- [x] **Public Utilities Commission**
  Supervisor
- [ ] **Santa Monica Bay Restoration**
  Guangyu Wang
- [ ] **State Lands Commission**
  Jennifer Deleong
- [ ] **Tahoe Regional Planning Agency (TRPA)**
  Cherry Jacques

Cal State Transportation Agency CalSTA

- [ ] **Caltrans - Division of Aeronautics**
  Philip Crimmins
- [ ] **Caltrans – Planning HQ LD-IGR**
  Christian Bushong
- [ ] **California Highway Patrol**
  Suzann Ikeuchi
  Office of Special Projects

Dept. of Transportation

- [ ] **Caltrans, District 1**
  Rex Jackman
- [ ] **Caltrans, District 2**
  Marcelino Gonzalez
- [ ] **Caltrans, District 3**
  Susan Zanchi
- [x] **Caltrans, District 4**
  Patricia Maurice
- [ ] **Caltrans, District 5**
  Larry Newland
- [ ] **Caltrans, District 6**
  Michael Navarro
- [ ] **Caltrans, District 7**
  Dianna Watson
- [ ] **Caltrans, District 8**
  Mark Roberts
- [ ] **Caltrans, District 9**
  Gayle Rosander
- [ ] **Caltrans, District 10**
  Tom Dumas
- [ ] **Caltrans, District 11**
  Jacob Armstrong
- [ ] **Caltrans, District 12**
  Maureen El Harake

Cal EPA

Air Resources Board

- [ ] **Airport & Freight**
  Jack Wursten
  - [x] **Transportation Projects**
    Nesamani Kalandiyur
  - [ ] **Industrial/Energy Projects**
    Mike Tollstrup
- [ ] **California Department of Resources, Recycling & Recovery**
  Kevin Taylor/Jeff Esquivel
- [ ] **State Water Resources Control Board**
  Regional Programs Unit
  Division of Financial Assistance
- [ ] **State Water Resources Control Board**
  Cindy Forbes – Asst Deputy
  Division of Drinking Water
- [ ] **State Water Resources Control Board**
  Div. Drinking Water #________
- [x] **State Water Resources Control Board**
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [ ] **State Water Resouces Control Board**
  Phil Crader
  Division of Water Rights
- [x] **Dept. of Toxic Substances Control Reg. #________**
  CEQA Tracking Center
- [ ] **Department of Pesticide Regulation**
  CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
  Cathleen Hudson
  North Coast Region (1)
- [x] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] **RWQCB 3**
  Central Coast Region (3)
- [ ] **RWQCB 4**
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)
- [ ] **Other** ________________
  ____
  ____
- [ ] ________________
  Conservancy

FEDERATED INDIANS OF
GRATON
RANCHERIA

Submitted via electronic email: Sean Jennings (sean@lakassociates.com)

February 28, 2019

RE: Formal Request for Tribal Consultation Pursuant to the California Environmental Quality Act (CEQA), Public Resources Code section 21080.3.1, subds. (b), (d) and (e) for the BioMarin/Whistelstop/Eden Housing Project in San Rafael, APN 011-265-01, at 999 3rd Street, San Rafael.

Dear Agency Representative:

This letter constitutes a formal request for tribal consultation under the provisions of the California Environmental Quality Act (CEQA) (Public Resources Code section 21080.3.1 subdivisions (b), (d) and (e) for the mitigation of potential project impacts to tribal cultural resource for a project within the Federated Indians of Graton Rancheria's ancestral lands.

Receiving this letter sets forth the Tribe's formal request for consultation on the following topics checked below, which shall be included in consultation if requested (Public Resources Code section 21080.3.2, subd. (a):

___x__ Alternatives to the project
___x__ Recommended mitigation measures
___x__ Significant effects of the project

The Tribe also requests consultation on the following discretionary topics checked below (Public Resources Code section 21080.3.2, subd. (a):

___x__ Type of environmental review necessary
___x__ Significance of tribal cultural resources, including any regulations, policies or standards used by your agency to determine significance of tribal cultural resources
___x__ Significance of the project's impacts on tribal cultural resources
___x__ Project alternatives and/or appropriate measures for preservation or mitigation that we may recommend, including, but not limited to:

(1) Avoidance and preservation of the resources in place, pursuant to Public Resources Code section 21084.3, including, but not limited to, planning and construction to avoid the resources and protect the cultural and natural context, or planning greenspace, parks or other open space, to incorporate the resources with culturally appropriate protection and management criteria;
(2) Treating the resources with culturally appropriate dignity taking into account the tribal

cultural values and meaning of the resources, including but not limited to the following:
a. Protecting the cultural character and integrity of the resource;
b. Protection the traditional use of the resource; and
c. Protecting the confidentiality of the resource.

(3) Permanent conservation easements or other interests in real property, with culturally Appropriate management criteria for the purposes of preserving or utilizing the resources or places.

(4) Protecting the resource.

Additionally, the Tribe would like to receive any cultural resources assessments or other assessments that have been completed on all or part of the project's potential "area of project effect" (APE), including, but not limited to:

1).The results of any record search(es) conducted at an archaeological information center of the California Historical Resources Information System (CHRIS), including, but not limited to:

(a) Any known cultural resources that have already been recorded on or adjacent to the potential APE;
(b) Whether the probability is low, moderate or high that cultural resources are located in the potential APE; and
(c) If a survey is required to determine whether previously unrecorded cultural resources are present in the potential APE.

2). The results of any archaeological inventory survey that was conducted of all or part of the potential APE, including, but not limited to:

(a) Any report that may contain site forms, site significance, and suggested mitigation measures.

3). The results of any Sacred Lands File searches conducted through the Native American Heritage Commission for all or part of the potential APE;

4). Any ethnographic studies conducted for any area including all or part of the potential APE; and

5) Any geotechnical reports regarding all or part of the potential APE.

We would like to remind your agency that CEQA Guidelines section 15126.4, subdivision (b)(3) states that preservation in place is the preferred manner of mitigating impacts to archaeological sites. Section 15126.4, subd. (b)(3) of the CEQA Guidelines has been interpreted by the California Court of Appeal to mean that "feasible preservation in place must be adopted to mitigate impacts to historical resources of an archaeological nature unless the lead agency determines that another form of mitigation is available and provides superior mitigation of impacts." *Madera Oversight Coalition v. County of Madera* (2011) 199 Cal.App.4th 48,

FEDERATED INDIANS OF
GRATON
RANCHERIA

disapproved on other grounds, *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority* (2013) 57 Cal.4th 439.

The Tribe would like to begin consultation within 30 days of your receipt of this letter. Please contact my office at (707) 566-2288 or by email at bmcquillen@gratonrancheria.com as the person who will serve as the lead contact on behalf of the Tribe.

Sincerely,

Buffy McQuillen

Buffy McQuillen, THPO/NAGPRA
Federated Indians of Graton Rancheria

6400 Redwood Drive, Suite 300 • Rohnert Park, CA • 94928 • Office: 707.566.2288 • Fax: 707.566.2291
www.gratonrancheria.com

Summary of Scoping Meeting Comments

BioMarin and Whistlestop/Eden Housing Project EIR
March 12, 2019
San Rafael City Council Chambers
City of San Rafael Planning Commission Public Hearing

A presentation was made on the project by Sean Kennings (Contract Planner for City of San Rafael), followed by a summary of the EIR process by Amy Skewes-Cox (EIR Project Manager). Three members of the public made comments at the hearing and these included J.R. Hastings, Bill Carney, and Matt Butler. The following comments were made:[1]

- 3rd Street is a speedway and there is no crossing from Walgreens to A Street
- On Brooks Street, one can't exit on either end easily; lack of visibility and both cross streets are speedways
- Concerned about sunshine/solar access for building to west; 4 floors will block sunlight and could block solar access
- Noise and air quality are concerns
- Noise could be major with pile driving
- Air quality during construction could impact office occupants nearby
- Sustainable San Rafael submitted letter, but additional concern on historic/cultural impacts associated with Whistlestop moving away from existing Tamalpais site
- In terms of transportation, the Transit Center relocation could add to cumulative impacts
- Need for workforce housing and in-lieu fee to reduce transportation demands
- Concerns on hydrology and water quality; groundwater issues at BioMarin site where property tax break may occur (as with many parcels in San Rafael); will there be a tax break for BioMarin site?

The public hearing was closed and Planning Commissioners then commented with the following concerns related to the EIR:

- Sustainable San Rafael letter responding to Notice of Preparation was very comprehensive
- Public services are important to address
- Traffic on 3rd Street and safety are concerns
- Impact on employee housing
- Potential for more workforce housing
- Confusion of LOS vs. VMT methodology
- General Plan EIR will be after the BioMarin/Whistlestop EIR
- Pedestrian safety is major concern

[1] Comments are summarized.

- Effect of on-site food service and demand for travel to downtown
- Hydrology and groundwater: requirement to build above flood zone and predictions for sea level rise to address
- Traffic and pedestrian safety are big issues
- Issue of one organization (BioMarin) occupying so many buildings and what if they decide to relocate
- Issue of embodied carbon emissions (e.g., are there options such as low carbon concrete?)
- Pedestrian safety
- Possibility of café being open to the public
- Is any retail proposed?

APPENDIX B
AIR QUALITY AND ENERGY BACKGROUND DATA

BioMarin and Whistlestop/Eden Housing Project

Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	110.00	1000sqft	2.53	110,000.00	0
Research & Development	97.00	1000sqft	2.23	97,000.00	0
Enclosed Parking Structure	12.00	Space	0.11	4,800.00	0
Parking Lot	29.00	Space	0.26	11,600.00	0
Health Club	18.00	1000sqft	0.41	18,000.00	0
Congregate Care (Assisted Living)	67.00	Dwelling Unit	4.19	57,000.00	80

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	69
Climate Zone	5			**Operational Year**	2028
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	294	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Opereational Year at full buildout = 2028
CO2 Intensity Factor = PG&E's most recent CO2 Intensity Factor value from 2016.

Land Use - The project is 3.05 acres, but the larger default acreage was used to create a more conservative estimate of construction emissions. Residential population based on project description. Total square footage includes amenities.

Construction Phase - No demolition.

Off-road Equipment - Added a drill rig for driving piles.

Demolition - No demolition.

Grading - About 1,400 cubic yards of off-haul of soil is anticipated.

Woodstoves - No woodstoves. The default number of total fireplaces (21.44) assumed to all be gas and not wood.

Water And Wastewater - Marin Municipal Water District does not use septic tanks or lagoons for wastewater treatment.

Stationary Sources - Emergency Generators and Fire Pumps - 1 operational emergency diesel generator (500 kW) is proposed.

Vehicle Trips - Based on Transportation Impact Study

Table Name	Column Name	Default Value	New Value
tblFireplaces	NumberGas	10.05	21.44
tblFireplaces	NumberWood	11.39	0.00
tblGrading	MaterialExported	0.00	1,440.00
tblLandUse	LandUseSquareFeet	67,000.00	57,000.00
tblLandUse	Population	192.00	80.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	294
tblVehicleTrips	ST_TR	2.20	2.28
tblVehicleTrips	ST_TR	2.46	2.11
tblVehicleTrips	ST_TR	20.87	14.07
tblVehicleTrips	ST_TR	1.90	2.11
tblVehicleTrips	SU_TR	2.44	2.53
tblVehicleTrips	SU_TR	1.05	1.23
tblVehicleTrips	SU_TR	26.73	18.02
tblVehicleTrips	SU_TR	1.11	1.23

tblVehicleTrips	WD_TR	2.74	2.84
tblVehicleTrips	WD_TR	11.03	9.00
tblVehicleTrips	WD_TR	32.93	22.20
tblVehicleTrips	WD_TR	8.11	9.00
tblWater	AerobicPercent	87.46	100.00
tblWater	AerobicPercent	87.46	100.00
tblWater	AerobicPercent	87.46	100.00
tblWater	AerobicPercent	87.46	100.00
tblWater	AerobicPercent	87.46	100.00
tblWater	AerobicPercent	87.46	100.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWater	SepticTankPercent	10.33	0.00
tblWoodstoves	NumberCatalytic	1.34	0.00
tblWoodstoves	NumberNoncatalytic	1.34	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.3697	3.3899	2.8270	6.3800e-003	0.3119	0.1579	0.4698	0.1257	0.1480	0.2737	0.0000	571.2061	571.2061	0.0920	0.0000	573.5066
2021	1.5930	0.1324	0.1586	2.6000e-004	3.1100e-003	7.0600e-003	0.0102	8.3000e-004	6.5700e-003	7.4000e-003	0.0000	23.2525	23.2525	6.0600e-003	0.0000	23.4041
Maximum	**1.5930**	**3.3899**	**2.8270**	**6.3800e-003**	**0.3119**	**0.1579**	**0.4698**	**0.1257**	**0.1480**	**0.2737**	**0.0000**	**571.2061**	**571.2061**	**0.0920**	**0.0000**	**573.5066**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.3697	3.3899	2.8270	6.3800e-003	0.3119	0.1579	0.4698	0.1257	0.1480	0.2737	0.0000	571.2057	571.2057	0.0920	0.0000	573.5062
2021	1.5930	0.1324	0.1586	2.6000e-004	3.1100e-003	7.0600e-003	0.0102	8.3000e-004	6.5700e-003	7.4000e-003	0.0000	23.2525	23.2525	6.0600e-003	0.0000	23.4041
Maximum	**1.5930**	**3.3899**	**2.8270**	**6.3800e-003**	**0.3119**	**0.1579**	**0.4698**	**0.1257**	**0.1480**	**0.2737**	**0.0000**	**571.2057**	**571.2057**	**0.0920**	**0.0000**	**573.5062**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	1-1-2020	3-31-2020	1.0694	1.0694
2	4-1-2020	6-30-2020	0.8886	0.8886
3	7-1-2020	9-30-2020	0.8984	0.8984
4	10-1-2020	12-31-2020	0.8962	0.8962
5	1-1-2021	3-31-2021	1.7297	1.7297
		Highest	1.7297	1.7297

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.2756	8.0600e-003	0.5004	4.0000e-005		2.9500e-003	2.9500e-003		2.9500e-003	2.9500e-003	0.0000	3.4939	3.4939	8.4000e-004	5.0000e-005	3.5296
Energy	0.0300	0.2707	0.2162	1.6300e-003		0.0207	0.0207		0.0207	0.0207	0.0000	637.4737	637.4737	0.0393	0.0124	642.1500
Mobile	0.3449	1.0755	3.7099	0.0148	1.6806	0.0130	1.6936	0.4503	0.0121	0.4625	0.0000	1,353.6774	1,353.6774	0.0408	0.0000	1,354.6977
Stationary	0.0275	0.0768	0.0701	1.3000e-004		4.0400e-003	4.0400e-003		4.0400e-003	4.0400e-003	0.0000	12.7567	12.7567	1.7900e-003	0.0000	12.8014
Waste						0.0000	0.0000		0.0000	0.0000	55.4998	0.0000	55.4998	3.2799	0.0000	137.4983
Water						0.0000	0.0000		0.0000	0.0000	25.7125	59.6234	85.3359	0.0944	0.0571	104.7211
Total	**1.6780**	**1.4311**	**4.4967**	**0.0166**	**1.6806**	**0.0407**	**1.7213**	**0.4503**	**0.0398**	**0.4902**	**81.2123**	**2,067.0251**	**2,148.2374**	**3.4571**	**0.0696**	**2,255.3982**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.2756	8.0600e-003	0.5004	4.0000e-005		2.9500e-003	2.9500e-003		2.9500e-003	2.9500e-003	0.0000	3.4939	3.4939	8.4000e-004	5.0000e-005	3.5296
Energy	0.0300	0.2707	0.2162	1.6300e-003		0.0207	0.0207		0.0207	0.0207	0.0000	637.4737	637.4737	0.0393	0.0124	642.1500
Mobile	0.3449	1.0755	3.7099	0.0148	1.6806	0.0130	1.6936	0.4503	0.0121	0.4625	0.0000	1,353.6774	1,353.6774	0.0408	0.0000	1,354.6977
Stationary	0.0275	0.0768	0.0701	1.3000e-004		4.0400e-003	4.0400e-003		4.0400e-003	4.0400e-003	0.0000	12.7567	12.7567	1.7900e-003	0.0000	12.8014
Waste						0.0000	0.0000		0.0000	0.0000	55.4998	0.0000	55.4998	3.2799	0.0000	137.4983
Water						0.0000	0.0000		0.0000	0.0000	25.7125	59.6234	85.3359	0.0944	0.0571	104.7211
Total	**1.6780**	**1.4311**	**4.4967**	**0.0166**	**1.6806**	**0.0407**	**1.7213**	**0.4503**	**0.0398**	**0.4902**	**81.2123**	**2,067.0251**	**2,148.2374**	**3.4571**	**0.0696**	**2,255.3982**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/1/2020	1/14/2020	5	10	
2	Grading	Grading	1/15/2020	2/11/2020	5	20	
3	Building Construction	Building Construction	2/12/2020	12/29/2020	5	230	
4	Paving	Paving	12/30/2020	1/26/2021	5	20	
5	Architectural Coating	Architectural Coating	1/27/2021	2/23/2021	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0.37

Residential Indoor: 115,425; Residential Outdoor: 38,475; Non-Residential Indoor: 337,500; Non-Residential Outdoor: 112,500; Striped Parking Area: 984 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Bore/Drill Rigs	1	8.00	221	0.50
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	7	18.00	0.00	180.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	129.00	47.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	26.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0204	0.2121	0.1076	1.9000e-004		0.0110	0.0110		0.0101	0.0101	0.0000	16.7153	16.7153	5.4100e-003	0.0000	16.8505
Total	**0.0204**	**0.2121**	**0.1076**	**1.9000e-004**	**0.0903**	**0.0110**	**0.1013**	**0.0497**	**0.0101**	**0.0598**	**0.0000**	**16.7153**	**16.7153**	**5.4100e-003**	**0.0000**	**16.8505**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.1000e-004	2.2000e-004	2.1300e-003	1.0000e-005	7.1000e-004	0.0000	7.1000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6323	0.6323	1.0000e-005	0.0000	0.6327
Total	**3.1000e-004**	**2.2000e-004**	**2.1300e-003**	**1.0000e-005**	**7.1000e-004**	**0.0000**	**7.1000e-004**	**1.9000e-004**	**0.0000**	**1.9000e-004**	**0.0000**	**0.6323**	**0.6323**	**1.0000e-005**	**0.0000**	**0.6327**

3.2 Site Preparation - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0204	0.2121	0.1076	1.9000e-004		0.0110	0.0110		0.0101	0.0101	0.0000	16.7153	16.7153	5.4100e-003	0.0000	16.8505
Total	**0.0204**	**0.2121**	**0.1076**	**1.9000e-004**	**0.0903**	**0.0110**	**0.1013**	**0.0497**	**0.0101**	**0.0598**	**0.0000**	**16.7153**	**16.7153**	**5.4100e-003**	**0.0000**	**16.8505**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.1000e-004	2.2000e-004	2.1300e-003	1.0000e-005	7.1000e-004	0.0000	7.1000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6323	0.6323	1.0000e-005	0.0000	0.6327
Total	**3.1000e-004**	**2.2000e-004**	**2.1300e-003**	**1.0000e-005**	**7.1000e-004**	**0.0000**	**7.1000e-004**	**1.9000e-004**	**0.0000**	**1.9000e-004**	**0.0000**	**0.6323**	**0.6323**	**1.0000e-005**	**0.0000**	**0.6327**

3.3 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0656	0.0000	0.0656	0.0337	0.0000	0.0337	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0271	0.2991	0.1813	3.9000e-004		0.0138	0.0138		0.0127	0.0127	0.0000	34.3124	34.3124	0.0111	0.0000	34.5898
Total	**0.0271**	**0.2991**	**0.1813**	**3.9000e-004**	**0.0656**	**0.0138**	**0.0794**	**0.0337**	**0.0127**	**0.0463**	**0.0000**	**34.3124**	**34.3124**	**0.0111**	**0.0000**	**34.5898**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.7000e-004	0.0263	7.6100e-003	7.0000e-005	1.5100e-003	9.0000e-005	1.6000e-003	4.2000e-004	8.0000e-005	5.0000e-004	0.0000	6.8767	6.8767	4.0000e-004	0.0000	6.8867
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	4.3000e-004	4.2600e-003	1.0000e-005	1.4200e-003	1.0000e-005	1.4300e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2646	1.2646	3.0000e-005	0.0000	1.2654
Total	**1.4000e-003**	**0.0267**	**0.0119**	**8.0000e-005**	**2.9300e-003**	**1.0000e-004**	**3.0300e-003**	**8.0000e-004**	**9.0000e-005**	**8.9000e-004**	**0.0000**	**8.1413**	**8.1413**	**4.3000e-004**	**0.0000**	**8.1520**

3.3 Grading - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0656	0.0000	0.0656	0.0337	0.0000	0.0337	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0271	0.2991	0.1813	3.9000e-004		0.0138	0.0138		0.0127	0.0127	0.0000	34.3123	34.3123	0.0111	0.0000	34.5898
Total	**0.0271**	**0.2991**	**0.1813**	**3.9000e-004**	**0.0656**	**0.0138**	**0.0794**	**0.0337**	**0.0127**	**0.0463**	**0.0000**	**34.3123**	**34.3123**	**0.0111**	**0.0000**	**34.5898**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.7000e-004	0.0263	7.6100e-003	7.0000e-005	1.5100e-003	9.0000e-005	1.6000e-003	4.2000e-004	8.0000e-005	5.0000e-004	0.0000	6.8767	6.8767	4.0000e-004	0.0000	6.8867
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	4.3000e-004	4.2600e-003	1.0000e-005	1.4200e-003	1.0000e-005	1.4300e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2646	1.2646	3.0000e-005	0.0000	1.2654
Total	**1.4000e-003**	**0.0267**	**0.0119**	**8.0000e-005**	**2.9300e-003**	**1.0000e-004**	**3.0300e-003**	**8.0000e-004**	**9.0000e-005**	**8.9000e-004**	**0.0000**	**8.1413**	**8.1413**	**4.3000e-004**	**0.0000**	**8.1520**

3.4 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2438	2.2064	1.9376	3.1000e-003		0.1285	0.1285		0.1208	0.1208	0.0000	266.3515	266.3515	0.0650	0.0000	267.9760
Total	**0.2438**	**2.2064**	**1.9376**	**3.1000e-003**		**0.1285**	**0.1285**		**0.1208**	**0.1208**	**0.0000**	**266.3515**	**266.3515**	**0.0650**	**0.0000**	**267.9760**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0235	0.5959	0.2208	1.4400e-003	0.0353	3.0500e-003	0.0384	0.0102	2.9100e-003	0.0131	0.0000	138.7210	138.7210	6.9700e-003	0.0000	138.8953
Worker	0.0518	0.0355	0.3507	1.1500e-003	0.1169	8.0000e-004	0.1177	0.0311	7.4000e-004	0.0318	0.0000	104.2241	104.2241	2.4700e-003	0.0000	104.2858
Total	**0.0753**	**0.6313**	**0.5715**	**2.5900e-003**	**0.1522**	**3.8500e-003**	**0.1560**	**0.0413**	**3.6500e-003**	**0.0450**	**0.0000**	**242.9451**	**242.9451**	**9.4400e-003**	**0.0000**	**243.1811**

3.4 Building Construction - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2438	2.2064	1.9376	3.1000e-003		0.1285	0.1285		0.1208	0.1208	0.0000	266.3512	266.3512	0.0650	0.0000	267.9757
Total	**0.2438**	**2.2064**	**1.9376**	**3.1000e-003**		**0.1285**	**0.1285**		**0.1208**	**0.1208**	**0.0000**	**266.3512**	**266.3512**	**0.0650**	**0.0000**	**267.9757**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0235	0.5959	0.2208	1.4400e-003	0.0353	3.0500e-003	0.0384	0.0102	2.9100e-003	0.0131	0.0000	138.7210	138.7210	6.9700e-003	0.0000	138.8953
Worker	0.0518	0.0355	0.3507	1.1500e-003	0.1169	8.0000e-004	0.1177	0.0311	7.4000e-004	0.0318	0.0000	104.2241	104.2241	2.4700e-003	0.0000	104.2858
Total	**0.0753**	**0.6313**	**0.5715**	**2.5900e-003**	**0.1522**	**3.8500e-003**	**0.1560**	**0.0413**	**3.6500e-003**	**0.0450**	**0.0000**	**242.9451**	**242.9451**	**9.4400e-003**	**0.0000**	**243.1811**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.3600e-003	0.0141	0.0147	2.0000e-005		7.5000e-004	7.5000e-004		6.9000e-004	6.9000e-004	0.0000	2.0028	2.0028	6.5000e-004	0.0000	2.0190
Paving	3.0000e-005					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**1.3900e-003**	**0.0141**	**0.0147**	**2.0000e-005**		**7.5000e-004**	**7.5000e-004**		**6.9000e-004**	**6.9000e-004**	**0.0000**	**2.0028**	**2.0028**	**6.5000e-004**	**0.0000**	**2.0190**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	4.0000e-005	3.5000e-004	0.0000	1.2000e-004	0.0000	1.2000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1054	0.1054	0.0000	0.0000	0.1055
Total	**5.0000e-005**	**4.0000e-005**	**3.5000e-004**	**0.0000**	**1.2000e-004**	**0.0000**	**1.2000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1054**	**0.1054**	**0.0000**	**0.0000**	**0.1055**

3.5 Paving - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.3600e-003	0.0141	0.0147	2.0000e-005		7.5000e-004	7.5000e-004		6.9000e-004	6.9000e-004	0.0000	2.0028	2.0028	6.5000e-004	0.0000	2.0190
Paving	3.0000e-005					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**1.3900e-003**	**0.0141**	**0.0147**	**2.0000e-005**		**7.5000e-004**	**7.5000e-004**		**6.9000e-004**	**6.9000e-004**	**0.0000**	**2.0028**	**2.0028**	**6.5000e-004**	**0.0000**	**2.0190**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	4.0000e-005	3.5000e-004	0.0000	1.2000e-004	0.0000	1.2000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1054	0.1054	0.0000	0.0000	0.1055
Total	**5.0000e-005**	**4.0000e-005**	**3.5000e-004**	**0.0000**	**1.2000e-004**	**0.0000**	**1.2000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1054**	**0.1054**	**0.0000**	**0.0000**	**0.1055**

3.5 Paving - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0113	0.1163	0.1319	2.1000e-004		6.1000e-003	6.1000e-003		5.6100e-003	5.6100e-003	0.0000	18.0211	18.0211	5.8300e-003	0.0000	18.1668
Paving	3.1000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0116**	**0.1163**	**0.1319**	**2.1000e-004**		**6.1000e-003**	**6.1000e-003**		**5.6100e-003**	**5.6100e-003**	**0.0000**	**18.0211**	**18.0211**	**5.8300e-003**	**0.0000**	**18.1668**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.4000e-004	2.9000e-004	2.9100e-003	1.0000e-005	1.0600e-003	1.0000e-005	1.0700e-003	2.8000e-004	1.0000e-005	2.9000e-004	0.0000	0.9153	0.9153	2.0000e-005	0.0000	0.9158
Total	**4.4000e-004**	**2.9000e-004**	**2.9100e-003**	**1.0000e-005**	**1.0600e-003**	**1.0000e-005**	**1.0700e-003**	**2.8000e-004**	**1.0000e-005**	**2.9000e-004**	**0.0000**	**0.9153**	**0.9153**	**2.0000e-005**	**0.0000**	**0.9158**

3.5 Paving - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0113	0.1163	0.1319	2.1000e-004		6.1000e-003	6.1000e-003		5.6100e-003	5.6100e-003	0.0000	18.0211	18.0211	5.8300e-003	0.0000	18.1668
Paving	3.1000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0116**	**0.1163**	**0.1319**	**2.1000e-004**		**6.1000e-003**	**6.1000e-003**		**5.6100e-003**	**5.6100e-003**	**0.0000**	**18.0211**	**18.0211**	**5.8300e-003**	**0.0000**	**18.1668**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.4000e-004	2.9000e-004	2.9100e-003	1.0000e-005	1.0600e-003	1.0000e-005	1.0700e-003	2.8000e-004	1.0000e-005	2.9000e-004	0.0000	0.9153	0.9153	2.0000e-005	0.0000	0.9158
Total	**4.4000e-004**	**2.9000e-004**	**2.9100e-003**	**1.0000e-005**	**1.0600e-003**	**1.0000e-005**	**1.0700e-003**	**2.8000e-004**	**1.0000e-005**	**2.9000e-004**	**0.0000**	**0.9153**	**0.9153**	**2.0000e-005**	**0.0000**	**0.9158**

3.6 Architectural Coating - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.5779					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.1900e-003	0.0153	0.0182	3.0000e-005		9.4000e-004	9.4000e-004		9.4000e-004	9.4000e-004	0.0000	2.5533	2.5533	1.8000e-004	0.0000	2.5576
Total	**1.5801**	**0.0153**	**0.0182**	**3.0000e-005**		**9.4000e-004**	**9.4000e-004**		**9.4000e-004**	**9.4000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.8000e-004**	**0.0000**	**2.5576**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.5000e-004	5.6000e-004	5.6100e-003	2.0000e-005	2.0500e-003	1.0000e-005	2.0600e-003	5.4000e-004	1.0000e-005	5.6000e-004	0.0000	1.7628	1.7628	4.0000e-005	0.0000	1.7638
Total	**8.5000e-004**	**5.6000e-004**	**5.6100e-003**	**2.0000e-005**	**2.0500e-003**	**1.0000e-005**	**2.0600e-003**	**5.4000e-004**	**1.0000e-005**	**5.6000e-004**	**0.0000**	**1.7628**	**1.7628**	**4.0000e-005**	**0.0000**	**1.7638**

3.6 Architectural Coating - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.5779					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.1900e-003	0.0153	0.0182	3.0000e-005		9.4000e-004	9.4000e-004		9.4000e-004	9.4000e-004	0.0000	2.5533	2.5533	1.8000e-004	0.0000	2.5576
Total	**1.5801**	**0.0153**	**0.0182**	**3.0000e-005**		**9.4000e-004**	**9.4000e-004**		**9.4000e-004**	**9.4000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.8000e-004**	**0.0000**	**2.5576**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.5000e-004	5.6000e-004	5.6100e-003	2.0000e-005	2.0500e-003	1.0000e-005	2.0600e-003	5.4000e-004	1.0000e-005	5.6000e-004	0.0000	1.7628	1.7628	4.0000e-005	0.0000	1.7638
Total	**8.5000e-004**	**5.6000e-004**	**5.6100e-003**	**2.0000e-005**	**2.0500e-003**	**1.0000e-005**	**2.0600e-003**	**5.4000e-004**	**1.0000e-005**	**5.6000e-004**	**0.0000**	**1.7628**	**1.7628**	**4.0000e-005**	**0.0000**	**1.7638**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.3449	1.0755	3.7099	0.0148	1.6806	0.0130	1.6936	0.4503	0.0121	0.4625	0.0000	1,353.6774	1,353.6774	0.0408	0.0000	1,354.6977
Unmitigated	0.3449	1.0755	3.7099	0.0148	1.6806	0.0130	1.6936	0.4503	0.0121	0.4625	0.0000	1,353.6774	1,353.6774	0.0408	0.0000	1,354.6977

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Congregate Care (Assisted Living)	190.28	152.76	169.51	420,240	420,240
Enclosed Parking Structure	0.00	0.00	0.00		
General Office Building	990.00	232.10	135.30	1,815,325	1,815,325
Health Club	399.60	253.26	324.36	635,687	635,687
Parking Lot	0.00	0.00	0.00		
Research & Development	873.00	204.67	119.31	1,678,821	1,678,821
Total	2,452.88	842.79	748.48	4,550,072	4,550,072

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Congregate Care (Assisted	10.80	4.80	5.70	31.00	15.00	54.00	86	11	3
Enclosed Parking Structure	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4
Health Club	9.50	7.30	7.30	16.90	64.10	19.00	52	39	9
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Research & Development	9.50	7.30	7.30	33.00	48.00	19.00	82	15	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Congregate Care (Assisted Living)	0.604980	0.037625	0.197129	0.106677	0.013568	0.005237	0.010915	0.012384	0.002048	0.002456	0.005559	0.000740	0.000682
Enclosed Parking Structure	0.604980	0.037625	0.197129	0.106677	0.013568	0.005237	0.010915	0.012384	0.002048	0.002456	0.005559	0.000740	0.000682
General Office Building	0.604980	0.037625	0.197129	0.106677	0.013568	0.005237	0.010915	0.012384	0.002048	0.002456	0.005559	0.000740	0.000682
Health Club	0.604980	0.037625	0.197129	0.106677	0.013568	0.005237	0.010915	0.012384	0.002048	0.002456	0.005559	0.000740	0.000682
Parking Lot	0.604980	0.037625	0.197129	0.106677	0.013568	0.005237	0.010915	0.012384	0.002048	0.002456	0.005559	0.000740	0.000682
Research & Development	0.604980	0.037625	0.197129	0.106677	0.013568	0.005237	0.010915	0.012384	0.002048	0.002456	0.005559	0.000740	0.000682

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	340.9049	340.9049	0.0336	6.9600e-003	343.8189
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	340.9049	340.9049	0.0336	6.9600e-003	343.8189
NaturalGas Mitigated	0.0300	0.2707	0.2162	1.6300e-003		0.0207	0.0207		0.0207	0.0207	0.0000	296.5688	296.5688	5.6800e-003	5.4400e-003	298.3311
NaturalGas Unmitigated	0.0300	0.2707	0.2162	1.6300e-003		0.0207	0.0207		0.0207	0.0207	0.0000	296.5688	296.5688	5.6800e-003	5.4400e-003	298.3311

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Congregate Care (Assisted Living)	584939	3.1500e-003	0.0270	0.0115	1.7000e-004		2.1800e-003	2.1800e-003		2.1800e-003	2.1800e-003	0.0000	31.2146	31.2146	6.0000e-004	5.7000e-004	31.4001
Enclosed Parking Structure	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
General Office Building	2.1263e+006	0.0115	0.1042	0.0876	6.3000e-004		7.9200e-003	7.9200e-003		7.9200e-003	7.9200e-003	0.0000	113.4675	113.4675	2.1700e-003	2.0800e-003	114.1418
Health Club	445500	2.4000e-003	0.0218	0.0183	1.3000e-004		1.6600e-003	1.6600e-003		1.6600e-003	1.6600e-003	0.0000	23.7736	23.7736	4.6000e-004	4.4000e-004	23.9149
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Research & Development	2.40075e+006	0.0130	0.1177	0.0989	7.1000e-004		8.9400e-003	8.9400e-003		8.9400e-003	8.9400e-003	0.0000	128.1132	128.1132	2.4600e-003	2.3500e-003	128.8745
Total		**0.0300**	**0.2707**	**0.2162**	**1.6400e-003**		**0.0207**	**0.0207**		**0.0207**	**0.0207**	**0.0000**	**296.5688**	**296.5688**	**5.6900e-003**	**5.4400e-003**	**298.3311**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Congregate Care (Assisted Living)	584939	3.1500e-003	0.0270	0.0115	1.7000e-004		2.1800e-003	2.1800e-003		2.1800e-003	2.1800e-003	0.0000	31.2146	31.2146	6.0000e-004	5.7000e-004	31.4001
Enclosed Parking Structure	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
General Office Building	2.1263e+006	0.0115	0.1042	0.0876	6.3000e-004		7.9200e-003	7.9200e-003		7.9200e-003	7.9200e-003	0.0000	113.4675	113.4675	2.1700e-003	2.0800e-003	114.1418
Health Club	445500	2.4000e-003	0.0218	0.0183	1.3000e-004		1.6600e-003	1.6600e-003		1.6600e-003	1.6600e-003	0.0000	23.7736	23.7736	4.6000e-004	4.4000e-004	23.9149
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Research & Development	2.40075e+006	0.0130	0.1177	0.0989	7.1000e-004		8.9400e-003	8.9400e-003		8.9400e-003	8.9400e-003	0.0000	128.1132	128.1132	2.4600e-003	2.3500e-003	128.8745
Total		**0.0300**	**0.2707**	**0.2162**	**1.6400e-003**		**0.0207**	**0.0207**		**0.0207**	**0.0207**	**0.0000**	**296.5688**	**296.5688**	**5.6900e-003**	**5.4400e-003**	**298.3311**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Congregate Care (Assisted Living)	282873	37.7229	3.7200e-003	7.7000e-004	38.0453
Enclosed Parking Structure	27216	3.6294	3.6000e-004	7.0000e-005	3.6604
General Office Building	1.3728e+006	183.0713	0.0181	3.7400e-003	184.6362
Health Club	136080	18.1471	1.7900e-003	3.7000e-004	18.3022
Parking Lot	4060	0.5414	5.0000e-005	1.0000e-005	0.5461
Research & Development	733320	97.7927	9.6500e-003	2.0000e-003	98.6286
Total		**340.9049**	**0.0336**	**6.9600e-003**	**343.8188**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Congregate Care (Assisted Living)	282873	37.7229	3.7200e-003	7.7000e-004	38.0453
Enclosed Parking Structure	27216	3.6294	3.6000e-004	7.0000e-005	3.6604
General Office Building	1.3728e+006	183.0713	0.0181	3.7400e-003	184.6362
Health Club	136080	18.1471	1.7900e-003	3.7000e-004	18.3022
Parking Lot	4060	0.5414	5.0000e-005	1.0000e-005	0.5461
Research & Development	733320	97.7927	9.6500e-003	2.0000e-003	98.6286
Total		**340.9049**	**0.0336**	**6.9600e-003**	**343.8188**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.2756	8.0600e-003	0.5004	4.0000e-005		2.9500e-003	2.9500e-003		2.9500e-003	2.9500e-003	0.0000	3.4939	3.4939	8.4000e-004	5.0000e-005	3.5296
Unmitigated	1.2756	8.0600e-003	0.5004	4.0000e-005		2.9500e-003	2.9500e-003		2.9500e-003	2.9500e-003	0.0000	3.4939	3.4939	8.4000e-004	5.0000e-005	3.5296

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1578					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.1024					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	2.7000e-004	2.3100e-003	9.8000e-004	1.0000e-005		1.9000e-004	1.9000e-004		1.9000e-004	1.9000e-004	0.0000	2.6766	2.6766	5.0000e-005	5.0000e-005	2.6925
Landscaping	0.0152	5.7500e-003	0.4995	3.0000e-005		2.7700e-003	2.7700e-003		2.7700e-003	2.7700e-003	0.0000	0.8174	0.8174	7.9000e-004	0.0000	0.8372
Total	**1.2756**	**8.0600e-003**	**0.5004**	**4.0000e-005**		**2.9600e-003**	**2.9600e-003**		**2.9600e-003**	**2.9600e-003**	**0.0000**	**3.4939**	**3.4939**	**8.4000e-004**	**5.0000e-005**	**3.5296**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1578					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.1024					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	2.7000e-004	2.3100e-003	9.8000e-004	1.0000e-005		1.9000e-004	1.9000e-004		1.9000e-004	1.9000e-004	0.0000	2.6766	2.6766	5.0000e-005	5.0000e-005	2.6925
Landscaping	0.0152	5.7500e-003	0.4995	3.0000e-005		2.7700e-003	2.7700e-003		2.7700e-003	2.7700e-003	0.0000	0.8174	0.8174	7.9000e-004	0.0000	0.8372
Total	**1.2756**	**8.0600e-003**	**0.5004**	**4.0000e-005**		**2.9600e-003**	**2.9600e-003**		**2.9600e-003**	**2.9600e-003**	**0.0000**	**3.4939**	**3.4939**	**8.4000e-004**	**5.0000e-005**	**3.5296**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	85.3359	0.0944	0.0571	104.7211
Unmitigated	85.3359	0.0944	0.0571	104.7211

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Congregate Care (Assisted Living)	4.36532 / 2.75205	5.9789	5.7500e-003	3.4500e-003	7.1506
Enclosed Parking Structure	0 / 0	0.0000	0.0000	0.0000	0.0000
General Office Building	19.5507 / 11.9827	26.6176	0.0258	0.0154	31.8638
Health Club	1.06458 / 0.652482	1.4494	1.4000e-003	8.4000e-004	1.7351
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Research & Development	47.6943 / 0	51.2901	0.0615	0.0374	63.9717
Total		**85.3360**	**0.0944**	**0.0571**	**104.7211**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Congregate Care (Assisted Living)	4.36532 / 2.75205	5.9789	5.7500e-003	3.4500e-003	7.1506
Enclosed Parking Structure	0 / 0	0.0000	0.0000	0.0000	0.0000
General Office Building	19.5507 / 11.9827	26.6176	0.0258	0.0154	31.8638
Health Club	1.06458 / 0.652482	1.4494	1.4000e-003	8.4000e-004	1.7351
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Research & Development	47.6943 / 0	51.2901	0.0615	0.0374	63.9717
Total		**85.3360**	**0.0944**	**0.0571**	**104.7211**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	55.4998	3.2799	0.0000	137.4983
Unmitigated	55.4998	3.2799	0.0000	137.4983

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Congregate Care (Assisted Living)	61.14	12.4109	0.7335	0.0000	30.7474
Enclosed Parking Structure	0	0.0000	0.0000	0.0000	0.0000
General Office Building	102.3	20.7660	1.2272	0.0000	51.4468
Health Club	102.6	20.8269	1.2308	0.0000	51.5977
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Research & Development	7.37	1.4960	0.0884	0.0000	3.7064
Total		**55.4998**	**3.2799**	**0.0000**	**137.4983**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Congregate Care (Assisted Living)	61.14	12.4109	0.7335	0.0000	30.7474
Enclosed Parking Structure	0	0.0000	0.0000	0.0000	0.0000
General Office Building	102.3	20.7660	1.2272	0.0000	51.4468
Health Club	102.6	20.8269	1.2308	0.0000	51.5977
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Research & Development	7.37	1.4960	0.0884	0.0000	3.7064
Total		**55.4998**	**3.2799**	**0.0000**	**137.4983**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type
Emergency Generator	1	1	50	670	0.73	Diesel

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

10.1 Stationary Sources

Unmitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	tons/yr										MT/yr					
Emergency Generator - Diesel (600 - 750 HP)	0.0275	0.0768	0.0701	1.3000e-004		4.0400e-003	4.0400e-003		4.0400e-003	4.0400e-003	0.0000	12.7567	12.7567	1.7900e-003	0.0000	12.8014
Total	**0.0275**	**0.0768**	**0.0701**	**1.3000e-004**		**4.0400e-003**	**4.0400e-003**		**4.0400e-003**	**4.0400e-003**	**0.0000**	**12.7567**	**12.7567**	**1.7900e-003**	**0.0000**	**12.8014**

11.0 Vegetation

Summary of ISCST3 Model Parameters, Assumptions, and Results for DPM and $PM_{2.5}$ Emissions during Construction

ISCST3 Model Parameters and Assumptions			
Source Type	**Units**	**Value**	**Notes**
Volume Source: Off-Road Equipment Exhaust for Construction of the BioMarin and Whistlestop/Eden Housing Project			
Work Hours/Week	hours/week	64	7AM-6PM Monday-Friday and 9AM-6PM on Saturday
DPM Emission Rate	gram/second	0.00243	Exhaust PM_{10} from off-road equipment
Number of Sources	count	95	SMAQMD, 2015
Emission Rate/Source	gram/second	0.000026	
Release Height	meters	5.0	SMAQMD, 2015
Length of Side	meters	10.0	SMAQMD, 2015
Initial Lateral Dimension	meters	2.3	ISCST3 Calculator
Initial Vertical Dimension	meters	1.0	SMAQMD, 2015
Volume Source: Off-Road Equipment Exhaust for Construction of only the BioMarin Project			
Work Hours/Week	hours/week	64	7AM-6PM Monday-Friday and 9AM-6PM on Saturday
DPM Emission Rate	gram/second	0.00170	Exhaust PM_{10} from off-road equipment = Total x 42 mo/60 mo
Number of Sources	count	63	SMAQMD, 2015
Emission Rate/Source	gram/second	0.000027	
Release Height	meters	5.0	SMAQMD, 2015
Length of Side	meters	10.0	SMAQMD, 2015
Initial Lateral Dimension	meters	2.3	ISCST3 Calculator
Initial Vertical Dimension	meters	1.0	SMAQMD, 2015

ISCST3 Model Results				
Location Type	**Emissions Source**	**Pollutant**	**Annual Average Concentration**	**Notes**
Residential	Construction of the BioMarin and Whistlestop/Eden Housing Project	DPM (μg/m^{3})	0.017	Offsite MEIR (Ground level residential receptor)
		$PM_{2.5}$ (μg/m^{3})	0.016	Offsite MEIR (Ground level residential receptor)
	Construction of only the BioMarin Project	DPM (μg/m^{3})	0.029	Onsite MEIR (Ground level residential receptor)
		$PM_{2.5}$ (μg/m^{3})	0.027	Onsite MEIR (Ground level residential receptor)

Notes:
DPM = diesel particulate matter
PM_{10} = particulate matter with aerodynamic resistance diameters equal to or less than 10 microns
$PM_{2.5}$ = particulate matter with aerodynamic resistance diameters equal to or less than 2.5 microns
μg/m^{3} = micrograms per cubic meter
Sacramento Metropolitan Air Quality Management District (SMAQMD), 2015. *Guide to Air Quality Assessment in Sacramento County* . June.

Summary of Health Risk Assessment for the Offsite MEIR during Construction

DPM Emissions from Construction of the BioMarin and Whistlestop/Eden Housing Project					
Inhalation Cancer Risk Assessment for DPM		**Age Group**			
	Units	**3rd Trimester**	**0-2 Years**	**2-9 Years**	**Notes**
DPM Concentration (C)	μg/m^3	0.017	0.017	0.017	ISCST3 Annual Average
Daily Breathing Rate (DBR)	L/kg-day	361	1090	861	95th percentile (OEHHA, 2015)
Inhalation absorption factor (A)	unitless	1.0	1.0	1.0	OEHHA, 2015
Exposure Frequency (EF)	unitless	0.96	0.96	0.96	350 days/365 days in a year (OEHHA, 2015)
Dose Conversion Factor (CF_D)	mg-m^3/μg-L	0.000001	0.000001	0.000001	Conversion of μg to mg and L to m^3
Dose (D)	mg/kg/day	0.000006	0.000018	0.000014	C*DBR*A*EF*CF_D (OEHHA, 2015)
Cancer Potency Factor (CPF)	(mg/kg/day)$^{-1}$	1.1	1.1	1.1	OEHHA, 2015
Age Sensitivity Factor (ASF)	unitless	10	10	3	OEHHA, 2015
Annual Exposure Duration (ED)	years	0.25	2.00	3.00	Based on total construction period of 60 months
Averaging Time (AT)	years	70	70	70	70 years for residents (OEHHA, 2015)
Fraction of time at home (FAH)	unitless	0.85	0.85	0.72	OEHHA, 2015
Cancer Risk Conversion Factor (CF)	unitless	1000000	1000000	1000000	Chances per million (OEHHA, 2015)
Cancer Risk	per million	0.20	4.74	1.43	D*CPF*ASF*ED/AT*FAH*CF (OEHHA, 2015)
Total Cancer Risk	**per million**	**6.37**			**At Offsite MEIR location**
Hazard Index for DPM	**Units**	**Value**	**Notes**		
Chronic REL	μg/m^3	5.0	OEHHA, 2015		
Chronic Hazard Index for DPM	**unitless**	**0.003**	**At Offsite MEIR location**		

Summary of Health Risk Assessment for the Onsite MEIR during Construction

DPM Emissions from Construction of only the BioMarin Project					
Inhalation Cancer Risk Assessment for DPM		**Age Group**			
	Units	**16-70 Years**	**--**	**--**	**Notes**
DPM Concentration (C)	μg/m^3	0.029	--	--	ISCST3 Annual Average
Daily Breathing Rate (DBR)	L/kg-day	290	--	--	95th percentile (OEHHA, 2015)
Inhalation absorption factor (A)	unitless	1.0	--	--	OEHHA, 2015
Exposure Frequency (EF)	unitless	0.96	--	--	350 days/365 days in a year (OEHHA, 2015)
Dose Conversion Factor (CF_D)	mg-m^3/μg-L	0.000001	--	--	Conversion of μg to mg and L to m^3
Dose (D)	mg/kg/day	0.000008	--	--	C*DBR*A*EF*CF_D (OEHHA, 2015)
Cancer Potency Factor (CPF)	(mg/kg/day)$^{-1}$	1.1	--	--	OEHHA, 2015
Age Sensitivity Factor (ASF)	unitless	1	--	--	OEHHA, 2015
Annual Exposure Duration (ED)	years	3.5	--	--	Based on total construction period of 42 months
Averaging Time (AT)	years	70	--	--	70 years for residents (OEHHA, 2015)
Fraction of time at home (FAH)	unitless	0.73	--	--	OEHHA, 2015
Cancer Risk Conversion Factor (CF)	unitless	1000000	--	--	Chances per million (OEHHA, 2015)
Cancer Risk	per million	0.32	--	--	D*CPF*ASF*ED/AT*FAH*CF (OEHHA, 2015)
Total Cancer Risk	**per million**	**0.32**			**At Onsite MEIR location**
Hazard Index for DPM	**Units**	**Value**	**Notes**		
Chronic REL	μg/m^3	5.0	OEHHA, 2015		
Chronic Hazard Index for DPM	**unitless**	**0.0058**	**At Onsite MEIR location**		

Notes:

DPM = diesel particulate matter

REL = reference exposure level

μg/m^3 = micrograms per cubic meter

L/kg-day = liters per kilogram-day

m^3/L = cubic meters per liter

(mg/kg/day)$^{-1}$ = 1/milligrams per kilograms per day

MEIR = maximum exposed individual resident

Office of Environmental Health Hazard Assessment (OEHHA), 2015. *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. February.*

	Step 1: **Enter Facility Data**
Plant Name	**Project site and offsite MEIR**
Plant No.	**Future Emergency Generator**

Step 3: **Estimate Distance**	
What is the distance (m) from the facility boundary to the MEI?	**50**

Step 4: **Specify Source Type**	
Does facility have only diesel backup generators?	**yes**
Is this analysis for a gas station?	**no**

Step 5: **Read Estimates**	
Total Cancer Risk	**5.0**
Total Chronic Hazard	**0.00**
Total PM2.5 Concentration	**0.01**

Step 2: **Enter Emissions Data**

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		6.75E-03			0.01
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS[3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	0.00E+00			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00			
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00			
CHLOROBENZENE	108907	0.00E+00			
CHLOROFORM[1]	67663	0.00E+00			
Chlorophenols	87865	0.00E+00			
PENTACHLOROPHENOL	87865	0.00E+00			
2,4,6-TRICHLOROPHENOL	88062	0.00E+00			
CHLOROPICRIN	76062	0.00E+00			
p-CHLORO-o-TOLUIDINE	95692	0.00E+00			
CHROMIUM 6+[2]	18540299	0.00E+00			
Barium chromate[2]	10294403	0.00E+00			
Calcium chromate[2]	13765190	0.00E+00			
Lead chromate[2]	7758976	0.00E+00			
Sodium dichromate[2]	10588019	0.00E+00			
Strontium chromate[2]	7789062	0.00E+00			
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00			
COPPER AND COMPOUNDS	7440508	0.00E+00			
p-CRESIDINE	120718	0.00E+00			
CRESOLS	1319773	0.00E+00			
M-CRESOL	108394	0.00E+00			
O-CRESOL	95487	0.00E+00			
P-CRESOL	106445	0.00E+00			
CUPFERRON	135206	0.00E+00			
Cyanide And Compounds (inorganic)	57125	0.00E+00			
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00			
2,4-DIAMINOANISOLE	615054	0.00E+00			
2,4-DIAMINOTOLUENE	95807	0.00E+00			
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00			
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00			
3,3-DICHLOROBENZIDINE	91941	0.00E+00			
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00			
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00			
DIETHANOLAMINE	111422	0.00E+00			
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00			
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00			
2,4-DINITROTOLUENE	121142	0.00E+00			
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00			
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00			
1,2-EPOXYBUTANE	106887	0.00E+00			
ETHYL BENZENE	100414	0.00E+00			
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00			
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00			
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00			
ETHYLENE GLYCOL	107211	0.00E+00			
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00			
ETHYLENE THIOUREA	96457	0.00E+00			
Fluorides	1101	0.00E+00			
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00			
FORMALDEHYDE	50000	0.00E+00			

GLUTARALDEHYDE	111308	0.00E+00			
GLYCOL ETHERS	107211	0.00E+00			
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER – EGEE[1]	110805	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA[1]	111159	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER – EGME[1]	109864	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00			
HEXACHLOROBENZENE	118741	0.00E+00			
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00			
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00			
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00			
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00			
n-HEXANE	110543	0.00E+00			
HYDRAZINE	302012	0.00E+00			
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00			
HYDROGEN SULFIDE	7783064	0.00E+00			
ISOPHORONE	78591	0.00E+00			
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00			
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00			
Lead acetate[2]	301042	0.00E+00			
Lead phosphate[2]	7446277	0.00E+00			
Lead subacetate[2]	1335326	0.00E+00			
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00			
MALEIC ANHYDRIDE	108316	0.00E+00			
MANGANESE AND COMPOUNDS	7439965	0.00E+00			
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00			
Mercuric chloride	7487947	0.00E+00			
METHANOL	67561	0.00E+00			
METHYL BROMIDE (Bromomethane)	74839	0.00E+00			
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00			
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00			
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00			
METHYL ISOCYANATE	624839	0.00E+00			
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00			
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00			
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00			
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00			
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00			
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00			
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00			
N-NITROSODIETHYLAMINE	55185	0.00E+00			
N-NITROSODIMETHYLAMINE	62759	0.00E+00			
N-NITROSODIPHENYLAMINE	86306	0.00E+00			
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00			
N-NITROSOMORPHOLINE	59892	0.00E+00			
N-NITROSOPIPERIDINE	100754	0.00E+00			
N-NITROSOPYRROLIDINE	930552	0.00E+00			
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00			
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00			

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	7.10E-03	9.99E+00	2.68E-03
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA) [2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON [2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	0.00E+00		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	0.00E+00		
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		
		TOTAL UNADJUSTED Risk Values	**9.987** **0.003**	**1.27E-02**

Step 1: Enter Facility Data		Step 3: Estimate Distance	
Plant Name	Project site and onsite MEIR	What is the distance (m) from the facility boundary to the MEI?	35
Plant No.	Future Emergency Generator		
Step 4: Specify Source Type		Step 5: Read Estimates	
Does facility have only diesel backup generators?	yes	Total Cancer Risk	6.4
Is this analysis for a gas station?	no	Total Chronic Hazard	0.00
		Total PM2.5 Concentration	0.01

Step 2: Enter Emissions Data

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		6.75E-03			0.01
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS[3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	0.00E+00			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00			
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00			
CHLOROBENZENE	108907	0.00E+00			
CHLOROFORM[1]	67663	0.00E+00			
Chlorophenols	87865	0.00E+00			
PENTACHLOROPHENOL	87865	0.00E+00			
2,4,6-TRICHLOROPHENOL	88062	0.00E+00			
CHLOROPICRIN	76062	0.00E+00			
p-CHLORO-o-TOLUIDINE	95692	0.00E+00			
CHROMIUM 6+[2]	18540299	0.00E+00			
Barium chromate[2]	10294403	0.00E+00			
Calcium chromate[2]	13765190	0.00E+00			
Lead chromate[2]	7758976	0.00E+00			
Sodium dichromate[2]	10588019	0.00E+00			
Strontium chromate[2]	7789062	0.00E+00			
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00			
COPPER AND COMPOUNDS	7440508	0.00E+00			
p-CRESIDINE	120718	0.00E+00			
CRESOLS	1319773	0.00E+00			
M-CRESOL	108394	0.00E+00			
O-CRESOL	95487	0.00E+00			
P-CRESOL	106445	0.00E+00			
CUPFERRON	135206	0.00E+00			
Cyanide And Compounds (inorganic)	57125	0.00E+00			
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00			
2,4-DIAMINOANISOLE	615054	0.00E+00			
2,4-DIAMINOTOLUENE	95807	0.00E+00			
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00			
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00			
3,3-DICHLOROBENZIDINE	91941	0.00E+00			
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00			
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00			
DIETHANOLAMINE	111422	0.00E+00			
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00			
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00			
2,4-DINITROTOLUENE	121142	0.00E+00			
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00			
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00			
1,2-EPOXYBUTANE	106887	0.00E+00			
ETHYL BENZENE	100414	0.00E+00			
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00			
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00			
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00			
ETHYLENE GLYCOL	107211	0.00E+00			
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00			
ETHYLENE THIOUREA	96457	0.00E+00			
Fluorides	1101	0.00E+00			
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00			
FORMALDEHYDE	50000	0.00E+00			

GLUTARALDEHYDE	111308	0.00E+00			
GLYCOL ETHERS	107211	0.00E+00			
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER – EGEE[1]	110805	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA[1]	111159	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER – EGME[1]	109864	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00			
HEXACHLOROBENZENE	118741	0.00E+00			
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00			
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00			
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00			
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00			
n-HEXANE	110543	0.00E+00			
HYDRAZINE	302012	0.00E+00			
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00			
HYDROGEN SULFIDE	7783064	0.00E+00			
ISOPHORONE	78591	0.00E+00			
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00			
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00			
Lead acetate[2]	301042	0.00E+00			
Lead phosphate[2]	7446277	0.00E+00			
Lead subacetate[2]	1335326	0.00E+00			
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00			
MALEIC ANHYDRIDE	108316	0.00E+00			
MANGANESE AND COMPOUNDS	7439965	0.00E+00			
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00			
Mercuric chloride	7487947	0.00E+00			
METHANOL	67561	0.00E+00			
METHYL BROMIDE (Bromomethane)	74839	0.00E+00			
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00			
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00			
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00			
METHYL ISOCYANATE	624839	0.00E+00			
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00			
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00			
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00			
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00			
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00			
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00			
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00			
N-NITROSODIETHYLAMINE	55185	0.00E+00			
N-NITROSODIMETHYLAMINE	62759	0.00E+00			
N-NITROSODIPHENYLAMINE	86306	0.00E+00			
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00			
N-NITROSOMORPHOLINE	59892	0.00E+00			
N-NITROSOPIPERIDINE	100754	0.00E+00			
N-NITROSOPYRROLIDINE	930552	0.00E+00			
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00			
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00			

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	7.10E-03	9.99E+00	2.68E-03
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA) [2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON [2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	0.00E+00		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	0.00E+00		
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		

TOTAL UNADJUSTED Risk Values	**9.987**	**0.003**	**1.27E-02**

BAY AREA AIR QUALITY MANAGEMENT DISTRICT Printed: MAY 6, 2019
DETAIL POLLUTANTS - ABATED
MOST RECENT P/O APPROVED (2017)

Zappetini, Inc (P# 3235)

S#	SOURCE NAME				
MATERIAL		SOURCE CODE			
THROUGHPUT		DATE	POLLUTANT	CODE	LBS/DAY
1	Paint Spraying Operation				
		SG62A295			
			Mineral spirits	184	0.00E+00
			Trichloroethylene	295	0.00E+00
		SG62B184			
			Mineral spirits	184	7.39E-02
			Organic liquid evap - othe	201	1.08E-01
			Trichloroethylene	295	6.41E-02
		SG700188			
			Naphtha	188	0.00E+00

	Step 1: Enter Facility Data
Plant Name	Steve Zappetini & Son Inc
Plant No.	3235

Step 3: Estimate Distance

What is the distance (m) from the facility boundary to the MEI?	165

Step 4: Specify Source Type

Does facility have only diesel backup generators?	no
Is this analysis for a gas station?	no

Step 5: Read Estimates

Total Cancer Risk	0.2
Total Chronic Hazard	0.00
Total PM2.5 Concentration	0.00

Step 2: Enter Emissions Data

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		0.00E+00			
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS[3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	0.00E+00			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00	
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00	
CHLOROBENZENE	108907	0.00E+00	
CHLOROFORM[1]	67663	0.00E+00	
Chlorophenols	87865	0.00E+00	
PENTACHLOROPHENOL	87865	0.00E+00	
2,4,6-TRICHLOROPHENOL	88062	0.00E+00	
CHLOROPICRIN	76062	0.00E+00	
p-CHLORO-o-TOLUIDINE	95692	0.00E+00	
CHROMIUM 6+[2]	18540299	0.00E+00	
Barium chromate[2]	10294403	0.00E+00	
Calcium chromate[2]	13765190	0.00E+00	
Lead chromate[2]	7758976	0.00E+00	
Sodium dichromate[2]	10588019	0.00E+00	
Strontium chromate[2]	7789062	0.00E+00	
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00	
COPPER AND COMPOUNDS	7440508	0.00E+00	
p-CRESIDINE	120718	0.00E+00	
CRESOLS	1319773	0.00E+00	
M-CRESOL	108394	0.00E+00	
O-CRESOL	95487	0.00E+00	
P-CRESOL	106445	0.00E+00	
CUPFERRON	135206	0.00E+00	
Cyanide And Compounds (inorganic)	57125	0.00E+00	
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00	
2,4-DIAMINOANISOLE	615054	0.00E+00	
2,4-DIAMINOTOLUENE	95807	0.00E+00	
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00	
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00	
3,3-DICHLOROBENZIDINE	91941	0.00E+00	
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00	
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00	
DIETHANOLAMINE	111422	0.00E+00	
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00	
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00	
2,4-DINITROTOLUENE	121142	0.00E+00	
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00	
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00	
1,2-EPOXYBUTANE	106887	0.00E+00	
ETHYL BENZENE	100414	0.00E+00	
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00	
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00	
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00	
ETHYLENE GLYCOL	107211	0.00E+00	
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00	
ETHYLENE THIOUREA	96457	0.00E+00	
Fluorides	1101	0.00E+00	
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00	
FORMALDEHYDE	50000	0.00E+00	

GLUTARALDEHYDE	111308	0.00E+00
GLYCOL ETHERS	107211	0.00E+00
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00
ETHYLENE GLYCOL ETHYL ETHER – EGEE [1]	110805	0.00E+00
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA [1]	111159	0.00E+00
ETHYLENE GLYCOL METHYL ETHER – EGME [1]	109864	0.00E+00
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00
HEXACHLOROBENZENE	118741	0.00E+00
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00
n-HEXANE	110543	0.00E+00
HYDRAZINE	302012	0.00E+00
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00
HYDROGEN SULFIDE	7783064	0.00E+00
ISOPHORONE	78591	0.00E+00
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00
Lead acetate[2]	301042	0.00E+00
Lead phosphate[2]	7446277	0.00E+00
Lead subacetate[2]	1335326	0.00E+00
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00
MALEIC ANHYDRIDE	108316	0.00E+00
MANGANESE AND COMPOUNDS	7439965	0.00E+00
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00
Mercuric chloride	7487947	0.00E+00
METHANOL	67561	0.00E+00
METHYL BROMIDE (Bromomethane)	74839	0.00E+00
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00
METHYL ISOCYANATE	624839	0.00E+00
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00
N-NITROSODIETHYLAMINE	55185	0.00E+00
N-NITROSODIMETHYLAMINE	62759	0.00E+00
N-NITROSODIPHENYLAMINE	86306	0.00E+00
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00
N-NITROSOMORPHOLINE	59892	0.00E+00
N-NITROSOPIPERIDINE	100754	0.00E+00
N-NITROSOPYRROLIDINE	930552	0.00E+00
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00

Nickel acetate[2]	373024	0.00E+00			
Nickel carbonate[2]	3333673	0.00E+00			
Nickel carbonyl[2]	13463393	0.00E+00			
Nickel hydroxide[2]	12054487	0.00E+00			
Nickelocene[2]	1271289	0.00E+00			
NICKEL OXIDE[2]	1313991	0.00E+00			
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00			
Nickel subsulfide[2]	12035722	0.00E+00			
NITRIC ACID	7697372	0.00E+00			
NITROGEN DIOXIDE	10102440	0.00E+00			
p-NITROSODIPHENYLAMINE	156105	0.00E+00			
OZONE	10028156	0.00E+00			
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	0.00E+00			
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00			
PHENOL	108952	0.00E+00			
PHOSGENE	75445	0.00E+00			
PHOSPHINE	7803512	0.00E+00			
PHOSPHORIC ACID	7664382	0.00E+00			
PHTHALIC ANHYDRIDE	85449	0.00E+00			
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00			
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[2,7]	1746016	0.00E+00			
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00			
POLYCYCLIC AROMATIC HYDROCARBON[2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00			
NAPHTHALENE	91203	0.00E+00			
POTASSIUM BROMATE	7758012	0.00E+00			
1,3-PROPANE SULTONE	1120714	0.00E+00			
PROPYLENE (PROPENE)	115071	0.00E+00			
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00			
PROPYLENE OXIDE	75569	0.00E+00			
SELENIUM AND COMPOUNDS	7782492	0.00E+00			
HYDROGEN SELENIDE	7783075	0.00E+00			
Selenium sulfide	7446346	0.00E+00			
SILICA (Crystalline, Respirable)	7631869	0.00E+00			
SODIUM HYDROXIDE	1310732	0.00E+00			
STYRENE	100425	0.00E+00			
SULFATES	9960	0.00E+00			
SULFUR DIOXIDE	7446095	0.00E+00			
SULFURIC ACID	7664939	0.00E+00			
SULFUR TRIOXIDE	7446719	0.00E+00			
OLEUM	8014957	0.00E+00			
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00			
THIOACETAMIDE	62555	0.00E+00			
TOLUENE	108883	0.00E+00			
Toluene diisocyantates	26471625	0.00E+00			
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00			
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00			
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00			

TRICHLOROETHYLENE	79016	6.41E-02	5.74E-01	2.02E-04	
TRIETHYLAMINE	121448	0.00E+00			
URETHANE (Ethyl carbamate)	51796	0.00E+00			
Vanadium Compounds	7440622	0.00E+00			
Vanadium (fume or dust)	7440622	0.00E+00			
VANADIUM PENTOXIDE	1314621	0.00E+00			
VINYL ACETATE	108054	0.00E+00			
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00			
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00			
XYLENES (mixed isomers)	1330207	0.00E+00			
m-XYLENE	108383	0.00E+00			
o-XYLENE	95476	0.00E+00			
p-XYLENE	106423	0.00E+00			
		TOTAL UNADJUSTED Risk Values	**0.574**	**0.000**	**0.00E+00**

BAY AREA AIR QUALITY MANAGEMENT DISTRICT Printed: MAY 6, 2019
DETAIL POLLUTANTS - ABATED
MOST RECENT P/O APPROVED (2018)

Rafael Town Center (P# 13397)

S#	SOURCE NAME / MATERIAL / THROUGHPUT	SOURCE CODE / DATE	POLLUTANT	CODE	LBS/DAY
1	Emergency Generator Natural Gas Engine	C22AF189			
			Benzene	41	1.36E-04
			Formaldehyde	124	1.23E-03
			Organics (other, including	990	1.22E-01
			Particulates (part not spe	1990	8.82E-04
			Nitrous Oxide (N2O)	2030	2.04E-05
			Nitrogen Oxides (part not	2990	3.00E-01
			Sulfur Dioxide (SO2)	3990	5.01E-05
			Carbon Monoxide (CO) pollu	4990	3.79E-02
			Carbon Dioxide, non-biogen	6960	1.08E+01
			Methane (CH4)	6970	1.20E-01

	Step 1: Enter Facility Data
Plant Name	Rafael Town Center
Plant No.	13397

Step 3: Estimate Distance	
What is the distance (m) from the facility boundary to the MEI?	60

Step 4: Specify Source Type	
Does facility have only diesel backup generators?	yes
Is this analysis for a gas station?	no

Step 5: Read Estimates	
Total Cancer Risk	0.5
Total Chronic Hazard	0.00
Total PM2.5 Concentration	0.00

Step 2: Enter Emissions Data

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		8.39E-04			0.00
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS[3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	3.79E-02			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00			
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00			
CHLOROBENZENE	108907	0.00E+00			
CHLOROFORM[1]	67663	0.00E+00			
Chlorophenols	87865	0.00E+00			
PENTACHLOROPHENOL	87865	0.00E+00			
2,4,6-TRICHLOROPHENOL	88062	0.00E+00			
CHLOROPICRIN	76062	0.00E+00			
p-CHLORO-o-TOLUIDINE	95692	0.00E+00			
CHROMIUM 6+[2]	18540299	0.00E+00			
Barium chromate[2]	10294403	0.00E+00			
Calcium chromate[2]	13765190	0.00E+00			
Lead chromate[2]	7758976	0.00E+00			
Sodium dichromate[2]	10588019	0.00E+00			
Strontium chromate[2]	7789062	0.00E+00			
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00			
COPPER AND COMPOUNDS	7440508	0.00E+00			
p-CRESIDINE	120718	0.00E+00			
CRESOLS	1319773	0.00E+00			
M-CRESOL	108394	0.00E+00			
O-CRESOL	95487	0.00E+00			
P-CRESOL	106445	0.00E+00			
CUPFERRON	135206	0.00E+00			
Cyanide And Compounds (inorganic)	57125	0.00E+00			
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00			
2,4-DIAMINOANISOLE	615054	0.00E+00			
2,4-DIAMINOTOLUENE	95807	0.00E+00			
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00			
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00			
3,3-DICHLOROBENZIDINE	91941	0.00E+00			
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00			
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00			
DIETHANOLAMINE	111422	0.00E+00			
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00			
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00			
2,4-DINITROTOLUENE	121142	0.00E+00			
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00			
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00			
1,2-EPOXYBUTANE	106887	0.00E+00			
ETHYL BENZENE	100414	0.00E+00			
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00			
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00			
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00			
ETHYLENE GLYCOL	107211	0.00E+00			
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00			
ETHYLENE THIOUREA	96457	0.00E+00			
Fluorides	1101	0.00E+00			
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00			
FORMALDEHYDE	50000	0.00E+00			

GLUTARALDEHYDE	111308	0.00E+00
GLYCOL ETHERS	107211	0.00E+00
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00
ETHYLENE GLYCOL ETHYL ETHER – EGEE [1]	110805	0.00E+00
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA [1]	111159	0.00E+00
ETHYLENE GLYCOL METHYL ETHER – EGME [1]	109864	0.00E+00
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00
HEXACHLOROBENZENE	118741	0.00E+00
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00
n-HEXANE	110543	0.00E+00
HYDRAZINE	302012	0.00E+00
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00
HYDROGEN SULFIDE	7783064	0.00E+00
ISOPHORONE	78591	0.00E+00
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00
Lead acetate[2]	301042	0.00E+00
Lead phosphate[2]	7446277	0.00E+00
Lead subacetate[2]	1335326	0.00E+00
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00
MALEIC ANHYDRIDE	108316	0.00E+00
MANGANESE AND COMPOUNDS	7439965	0.00E+00
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00
Mercuric chloride	7487947	0.00E+00
METHANOL	67561	0.00E+00
METHYL BROMIDE (Bromomethane)	74839	0.00E+00
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00
METHYL ISOCYANATE	624839	0.00E+00
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00
N-NITROSODIETHYLAMINE	55185	0.00E+00
N-NITROSODIMETHYLAMINE	62759	0.00E+00
N-NITROSODIPHENYLAMINE	86306	0.00E+00
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00
N-NITROSOMORPHOLINE	59892	0.00E+00
N-NITROSOPIPERIDINE	100754	0.00E+00
N-NITROSOPYRROLIDINE	930552	0.00E+00
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	8.82E-04	1.24E+00	3.33E-04
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON[2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	0.00E+00		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	0.00E+00		
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		
TOTAL UNADJUSTED Risk Values		**1.241**	**0.000**	**1.58E-03**

BAY AREA AIR QUALITY MANAGEMENT DISTRICT Printed: MAY 6, 2019
DETAIL POLLUTANTS - ABATED
MOST RECENT P/O APPROVED (2016)

Comcast Cable Corporation (P# 15958)

S#	SOURCE NAME / MATERIAL / THROUGHPUT	SOURCE CODE / DATE	POLLUTANT	CODE	LBS/DAY
1	Diesel Engine, Caterpillar model SR-4B, emergency standby	C22AG098			
			Benzene	41	4.09E-04
			Formaldehyde	124	3.38E-05
			Organics (other, including	990	1.82E-02
			Arsenic (all)	1030	3.56E-07
			Beryllium (all) pollutant	1040	2.09E-07
			Cadmium	1070	8.90E-07
			Chromium (hexavalent)	1095	1.84E-08
			Lead (all) pollutant	1140	7.55E-07
			Manganese	1160	1.18E-06
			Nickel pollutant	1180	1.44E-05
			Mercury (all) pollutant	1190	2.52E-07
			Diesel Engine Exhaust Part	1350	2.79E-03
			PAH's (non-speciated)	1840	1.88E-06
			Nitrous Oxide (N2O)	2030	1.09E-04
			Nitrogen Oxides (part not	2990	1.28E-01
			Sulfur Dioxide (SO2)	3990	1.33E-04
			Carbon Monoxide (CO) pollu	4990	1.58E-01
			Carbon Dioxide, non-biogen	6960	1.37E+01
			Methane (CH4)	6970	5.47E-04

Step 1: **Enter Facility Data**

Plant Name	Comcast of California/Colorado/Texas
Plant No.	15958

Step 3: **Estimate Distance**

What is the distance (m) from the facility boundary to the MEI?	150

Step 4: **Specify Source Type**

Does facility have only diesel backup generators?	yes
Is this analysis for a gas station?	no

Step 5: **Read Estimates**

Total Cancer Risk	0.5
Total Chronic Hazard	0.00
Total PM2.5 Concentration	0.00

Step 2: **Enter Emissions Data**

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		0.00E+00			
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS [3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	1.58E-01			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00
CHLOROBENZENE	108907	0.00E+00
CHLOROFORM[1]	67663	0.00E+00
Chlorophenols	87865	0.00E+00
PENTACHLOROPHENOL	87865	0.00E+00
2,4,6-TRICHLOROPHENOL	88062	0.00E+00
CHLOROPICRIN	76062	0.00E+00
p-CHLORO-o-TOLUIDINE	95692	0.00E+00
CHROMIUM 6+[2]	18540299	0.00E+00
Barium chromate[2]	10294403	0.00E+00
Calcium chromate[2]	13765190	0.00E+00
Lead chromate[2]	7758976	0.00E+00
Sodium dichromate[2]	10588019	0.00E+00
Strontium chromate[2]	7789062	0.00E+00
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00
COPPER AND COMPOUNDS	7440508	0.00E+00
p-CRESIDINE	120718	0.00E+00
CRESOLS	1319773	0.00E+00
M-CRESOL	108394	0.00E+00
O-CRESOL	95487	0.00E+00
P-CRESOL	106445	0.00E+00
CUPFERRON	135206	0.00E+00
Cyanide And Compounds (inorganic)	57125	0.00E+00
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00
2,4-DIAMINOANISOLE	615054	0.00E+00
2,4-DIAMINOTOLUENE	95807	0.00E+00
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00
3,3-DICHLOROBENZIDINE	91941	0.00E+00
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00
DIETHANOLAMINE	111422	0.00E+00
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00
2,4-DINITROTOLUENE	121142	0.00E+00
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00
1,2-EPOXYBUTANE	106887	0.00E+00
ETHYL BENZENE	100414	0.00E+00
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00
ETHYLENE GLYCOL	107211	0.00E+00
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00
ETHYLENE THIOUREA	96457	0.00E+00
Fluorides	1101	0.00E+00
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00
FORMALDEHYDE	50000	0.00E+00

GLUTARALDEHYDE	111308	0.00E+00			
GLYCOL ETHERS	107211	0.00E+00			
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER – EGEE [1]	110805	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA [1]	111159	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER – EGME [1]	109864	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00			
HEXACHLOROBENZENE	118741	0.00E+00			
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00			
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00			
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00			
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00			
n-HEXANE	110543	0.00E+00			
HYDRAZINE	302012	0.00E+00			
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00			
HYDROGEN SULFIDE	7783064	0.00E+00			
ISOPHORONE	78591	0.00E+00			
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00			
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00			
Lead acetate[2]	301042	0.00E+00			
Lead phosphate[2]	7446277	0.00E+00			
Lead subacetate[2]	1335326	0.00E+00			
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00			
MALEIC ANHYDRIDE	108316	0.00E+00			
MANGANESE AND COMPOUNDS	7439965	0.00E+00			
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00			
Mercuric chloride	7487947	0.00E+00			
METHANOL	67561	0.00E+00			
METHYL BROMIDE (Bromomethane)	74839	0.00E+00			
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00			
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00			
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00			
METHYL ISOCYANATE	624839	0.00E+00			
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00			
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00			
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00			
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00			
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00			
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00			
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00			
N-NITROSODIETHYLAMINE	55185	0.00E+00			
N-NITROSODIMETHYLAMINE	62759	0.00E+00			
N-NITROSODIPHENYLAMINE	86306	0.00E+00			
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00			
N-NITROSOMORPHOLINE	59892	0.00E+00			
N-NITROSOPIPERIDINE	100754	0.00E+00			
N-NITROSOPYRROLIDINE	930552	0.00E+00			
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00			
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00			

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	2.79E-03	3.92E+00	1.05E-03
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON[2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	1.33E-04		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	0.00E+00		
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		

TOTAL UNADJUSTED Risk Values	**3.925**	**0.001**	**0.00E+00**

BAY AREA AIR QUALITY MANAGEMENT DISTRICT Printed: MAY 6, 2019
DETAIL POLLUTANTS - ABATED
MOST RECENT P/O APPROVED (2019)

Royal Ground (P# 22498)

S# SOURCE NAME / MATERIAL THROUGHPUT	SOURCE CODE DATE	POLLUTANT	CODE	LBS/DAY
1 Coffee Roaster				
	C1760189			
		Benzene	41	1.03E-08
		Formaldehyde	124	1.21E-07
		Toluene	293	5.47E-09
		Organics (other, including	990	9.21E-06
		Particulates (part not spe	1990	4.83E-07
		Nitrous Oxide (N2O)	2030	3.72E-06
		Nitrogen Oxides (part not	2990	2.25E-03
		Sulfur Dioxide (SO2)	3990	9.15E-06
		Carbon Monoxide (CO) pollu	4990	5.63E-04
		Carbon Dioxide, non-biogen	6960	1.97E+00
		Methane (CH4)	6970	3.06E-06
	G1011078			
		Organics (other, including	990	3.82E-01
		Particulates (part not spe	1990	5.37E-02
		Carbon Monoxide (CO) pollu	4990	2.08E+00
		Carbon Dioxide, non-biogen	6960	9.63E+00
-1 Afterburner with cyclone				
	C8360189			
		Benzene	41	2.57E-07
		Formaldehyde	124	3.02E-06
		Toluene	293	1.37E-07
		Organics (other, including	990	2.30E-04
		Particulates (part not spe	1990	1.21E-04
		Nitrous Oxide (N2O)	2030	9.30E-06
		Nitrogen Oxides (part not	2990	5.64E-03
		Sulfur Dioxide (SO2)	3990	2.29E-05
		Carbon Monoxide (CO) pollu	4990	1.41E-03
		Carbon Dioxide, non-biogen	6960	4.93E+00
		Methane (CH4)	6970	7.65E-05

PLANT TOTAL:

lbs/day	Pollutant
2.67E-07	Benzene (41)
1.65E+01	Carbon Dioxide, non-biogenic CO2 (6960)
2.08E+00	Carbon Monoxide (CO) pollutant (4990)
3.14E-06	Formaldehyde (124)
7.96E-05	Methane (CH4) (6970)
7.89E-03	Nitrogen Oxides (part not spec elsewhere) (2990)
1.30E-05	Nitrous Oxide (N2O) (2030)
3.82E-01	Organics (other, including CH4) (990)
5.38E-02	Particulates (part not spec elsewhere) (1990)
3.20E-05	Sulfur Dioxide (SO2) (3990)
1.42E-07	Toluene (293)

Step 1: **Enter Facility Data**	
Plant Name	**Royal Ground**
Plant No.	**22498**

Step 3: **Estimate Distance**	
What is the distance (m) from the facility boundary to the MEI?	**250**

Step 4: **Specify Source Type**	
Does facility have only diesel backup generators?	**no**
Is this analysis for a gas station?	**no**

Step 5: **Read Estimates**	
Total Cancer Risk	**13.8**
Total Chronic Hazard	**0.00**
Total PM2.5 Concentration	**0.01**

Step 2: **Enter Emissions Data**

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		3.28E-02			0.06
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS[3]	1332214	0.00E+00			
BENZENE[1]	71432	2.67E-07	3.41E-05	1.68E-07	
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	0.00E+00			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00		
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00		
CHLOROBENZENE	108907	0.00E+00		
CHLOROFORM[1]	67663	0.00E+00		
Chlorophenols	87865	0.00E+00		
PENTACHLOROPHENOL	87865	0.00E+00		
2,4,6-TRICHLOROPHENOL	88062	0.00E+00		
CHLOROPICRIN	76062	0.00E+00		
p-CHLORO-o-TOLUIDINE	95692	0.00E+00		
CHROMIUM 6+[2]	18540299	0.00E+00		
Barium chromate[2]	10294403	0.00E+00		
Calcium chromate[2]	13765190	0.00E+00		
Lead chromate[2]	7758976	0.00E+00		
Sodium dichromate[2]	10588019	0.00E+00		
Strontium chromate[2]	7789062	0.00E+00		
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00		
COPPER AND COMPOUNDS	7440508	0.00E+00		
p-CRESIDINE	120718	0.00E+00		
CRESOLS	1319773	0.00E+00		
M-CRESOL	108394	0.00E+00		
O-CRESOL	95487	0.00E+00		
P-CRESOL	106445	0.00E+00		
CUPFERRON	135206	0.00E+00		
Cyanide And Compounds (inorganic)	57125	0.00E+00		
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00		
2,4-DIAMINOANISOLE	615054	0.00E+00		
2,4-DIAMINOTOLUENE	95807	0.00E+00		
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00		
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00		
3,3-DICHLOROBENZIDINE	91941	0.00E+00		
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00		
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00		
DIETHANOLAMINE	111422	0.00E+00		
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00		
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00		
2,4-DINITROTOLUENE	121142	0.00E+00		
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00		
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00		
1,2-EPOXYBUTANE	106887	0.00E+00		
ETHYL BENZENE	100414	0.00E+00		
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00		
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00		
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00		
ETHYLENE GLYCOL	107211	0.00E+00		
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00		
ETHYLENE THIOUREA	96457	0.00E+00		
Fluorides	1101	0.00E+00		
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00		
FORMALDEHYDE	50000	3.14E-06	8.43E-05	6.59E-07

GLUTARALDEHYDE	111308	0.00E+00	
GLYCOL ETHERS	107211	0.00E+00	
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00	
ETHYLENE GLYCOL ETHYL ETHER – EGEE[1]	110805	0.00E+00	
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA[1]	111159	0.00E+00	
ETHYLENE GLYCOL METHYL ETHER – EGME[1]	109864	0.00E+00	
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00	
HEXACHLOROBENZENE	118741	0.00E+00	
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00	
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00	
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00	
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00	
n-HEXANE	110543	0.00E+00	
HYDRAZINE	302012	0.00E+00	
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00	
HYDROGEN SULFIDE	7783064	0.00E+00	
ISOPHORONE	78591	0.00E+00	
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00	
LEAD AND COMPOUNDS[2,4] (inorganic) *values also apply to:*	7439921	0.00E+00	
Lead acetate[2]	301042	0.00E+00	
Lead phosphate[2]	7446277	0.00E+00	
Lead subacetate[2]	1335326	0.00E+00	
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00	
MALEIC ANHYDRIDE	108316	0.00E+00	
MANGANESE AND COMPOUNDS	7439965	0.00E+00	
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00	
Mercuric chloride	7487947	0.00E+00	
METHANOL	67561	0.00E+00	
METHYL BROMIDE (Bromomethane)	74839	0.00E+00	
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00	
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00	
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00	
METHYL ISOCYANATE	624839	0.00E+00	
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00	
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00	
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00	
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00	
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00	
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00	
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00	
N-NITROSODIETHYLAMINE	55185	0.00E+00	
N-NITROSODIMETHYLAMINE	62759	0.00E+00	
N-NITROSODIPHENYLAMINE	86306	0.00E+00	
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00	
N-NITROSOMORPHOLINE	59892	0.00E+00	
N-NITROSOPIPERIDINE	100754	0.00E+00	
N-NITROSOPYRROLIDINE	930552	0.00E+00	
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00	
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00	

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	5.38E-02	7.57E+01	2.03E-02
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA) [2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON [2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	3.20E-05		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	1.42E-07		8.95E-10
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		

TOTAL UNADJUSTED Risk Values	**75.680**	**0.020**	**6.20E-02**

BAY AREA AIR QUALITY MANAGEMENT DISTRICT Printed: MAY 6, 2019
DETAIL POLLUTANTS - ABATED
MOST RECENT P/O APPROVED (2019)

Safeway Inc #653 (P# 22809)

S# SOURCE NAME / MATERIAL / THROUGHPUT	SOURCE CODE / DATE	POLLUTANT	CODE	LBS/DAY
1 Emergency Standby Natural Gas Generator Set	C22AF189			
		Organics (other, including	990	2.01E-03
		Particulates (part not spe	1990	1.55E-04
		Nitrous Oxide (N2O)	2030	5.37E-07
		Nitrogen Oxides (part not	2990	4.46E-03
		Sulfur Dioxide (SO2)	3990	8.81E-06
		Carbon Monoxide (CO) pollu	4990	7.79E-03
		Carbon Dioxide, non-biogen	6960	1.90E+00
		Methane (CH4)	6970	1.06E-02

	Step 1: Enter Facility Data
Plant Name	Safeway Inc #653
Plant No.	22809

Step 3: Estimate Distance	
What is the distance (m) from the facility boundary to the MEI?	240

Step 4: Specify Source Type	
Does facility have only diesel backup generators?	yes
Is this analysis for a gas station?	no

Step 5: Read Estimates	
Total Cancer Risk	0.0
Total Chronic Hazard	0.00
Total PM2.5 Concentration	0.00

Step 2: Enter Emissions Data

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		1.47E-04			0.00
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS [3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	7.79E-03			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00			
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00			
CHLOROBENZENE	108907	0.00E+00			
CHLOROFORM[1]	67663	0.00E+00			
Chlorophenols	87865	0.00E+00			
PENTACHLOROPHENOL	87865	0.00E+00			
2,4,6-TRICHLOROPHENOL	88062	0.00E+00			
CHLOROPICRIN	76062	0.00E+00			
p-CHLORO-o-TOLUIDINE	95692	0.00E+00			
CHROMIUM 6+[2]	18540299	0.00E+00			
Barium chromate[2]	10294403	0.00E+00			
Calcium chromate[2]	13765190	0.00E+00			
Lead chromate[2]	7758976	0.00E+00			
Sodium dichromate[2]	10588019	0.00E+00			
Strontium chromate[2]	7789062	0.00E+00			
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00			
COPPER AND COMPOUNDS	7440508	0.00E+00			
p-CRESIDINE	120718	0.00E+00			
CRESOLS	1319773	0.00E+00			
M-CRESOL	108394	0.00E+00			
O-CRESOL	95487	0.00E+00			
P-CRESOL	106445	0.00E+00			
CUPFERRON	135206	0.00E+00			
Cyanide And Compounds (inorganic)	57125	0.00E+00			
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00			
2,4-DIAMINOANISOLE	615054	0.00E+00			
2,4-DIAMINOTOLUENE	95807	0.00E+00			
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00			
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00			
3,3-DICHLOROBENZIDINE	91941	0.00E+00			
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00			
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00			
DIETHANOLAMINE	111422	0.00E+00			
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00			
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00			
2,4-DINITROTOLUENE	121142	0.00E+00			
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00			
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00			
1,2-EPOXYBUTANE	106887	0.00E+00			
ETHYL BENZENE	100414	0.00E+00			
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00			
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00			
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00			
ETHYLENE GLYCOL	107211	0.00E+00			
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00			
ETHYLENE THIOUREA	96457	0.00E+00			
Fluorides	1101	0.00E+00			
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00			
FORMALDEHYDE	50000	0.00E+00			

GLUTARALDEHYDE	111308	0.00E+00		
GLYCOL ETHERS	107211	0.00E+00		
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00		
ETHYLENE GLYCOL ETHYL ETHER – EGEE [1]	110805	0.00E+00		
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA [1]	111159	0.00E+00		
ETHYLENE GLYCOL METHYL ETHER – EGME [1]	109864	0.00E+00		
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00		
HEXACHLOROBENZENE	118741	0.00E+00		
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00		
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00		
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00		
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00		
n-HEXANE	110543	0.00E+00		
HYDRAZINE	302012	0.00E+00		
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00		
HYDROGEN SULFIDE	7783064	0.00E+00		
ISOPHORONE	78591	0.00E+00		
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00		
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00		
Lead acetate[2]	301042	0.00E+00		
Lead phosphate[2]	7446277	0.00E+00		
Lead subacetate[2]	1335326	0.00E+00		
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00		
MALEIC ANHYDRIDE	108316	0.00E+00		
MANGANESE AND COMPOUNDS	7439965	0.00E+00		
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00		
Mercuric chloride	7487947	0.00E+00		
METHANOL	67561	0.00E+00		
METHYL BROMIDE (Bromomethane)	74839	0.00E+00		
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00		
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00		
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00		
METHYL ISOCYANATE	624839	0.00E+00		
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00		
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00		
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00		
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00		
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00		
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00		
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00		
N-NITROSODIETHYLAMINE	55185	0.00E+00		
N-NITROSODIMETHYLAMINE	62759	0.00E+00		
N-NITROSODIPHENYLAMINE	86306	0.00E+00		
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00		
N-NITROSOMORPHOLINE	59892	0.00E+00		
N-NITROSOPIPERIDINE	100754	0.00E+00		
N-NITROSOPYRROLIDINE	930552	0.00E+00		
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00		
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00		

Nickel acetate[2]	373024	0.00E+00			
Nickel carbonate[2]	3333673	0.00E+00			
Nickel carbonyl[2]	13463393	0.00E+00			
Nickel hydroxide[2]	12054487	0.00E+00			
Nickelocene[2]	1271289	0.00E+00			
NICKEL OXIDE[2]	1313991	0.00E+00			
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00			
Nickel subsulfide[2]	12035722	0.00E+00			
NITRIC ACID	7697372	0.00E+00			
NITROGEN DIOXIDE	10102440	0.00E+00			
p-NITROSODIPHENYLAMINE	156105	0.00E+00			
OZONE	10028156	0.00E+00			
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	1.55E-04	2.18E-01	5.86E-05	
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00			
PHENOL	108952	0.00E+00			
PHOSGENE	75445	0.00E+00			
PHOSPHINE	7803512	0.00E+00			
PHOSPHORIC ACID	7664382	0.00E+00			
PHTHALIC ANHYDRIDE	85449	0.00E+00			
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00			
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[2,7]	1746016	0.00E+00			
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00			
POLYCYCLIC AROMATIC HYDROCARBON[2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00			
NAPHTHALENE	91203	0.00E+00			
POTASSIUM BROMATE	7758012	0.00E+00			
1,3-PROPANE SULTONE	1120714	0.00E+00			
PROPYLENE (PROPENE)	115071	0.00E+00			
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00			
PROPYLENE OXIDE	75569	0.00E+00			
SELENIUM AND COMPOUNDS	7782492	0.00E+00			
HYDROGEN SELENIDE	7783075	0.00E+00			
Selenium sulfide	7446346	0.00E+00			
SILICA (Crystalline, Respirable)	7631869	0.00E+00			
SODIUM HYDROXIDE	1310732	0.00E+00			
STYRENE	100425	0.00E+00			
SULFATES	9960	0.00E+00			
SULFUR DIOXIDE	7446095	8.81E-06			
SULFURIC ACID	7664939	0.00E+00			
SULFUR TRIOXIDE	7446719	0.00E+00			
OLEUM	8014957	0.00E+00			
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00			
THIOACETAMIDE	62555	0.00E+00			
TOLUENE	108883	0.00E+00			
Toluene diisocyantates	26471625	0.00E+00			
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00			
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00			
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00			

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		

TOTAL UNADJUSTED Risk Values	**0.218**	**0.000**	**2.78E-04**

	Step 1: Enter Facility Data
Plant Name	703 - 723 3rd Street
Plant No.	Future Emergency Generator

Step 3: Estimate Distance	
What is the distance (m) from the facility boundary to the MEI?	280

Step 4: Specify Source Type	
Does facility have only diesel backup generators?	yes
Is this analysis for a gas station?	no

Step 5: Read Estimates	
Total Cancer Risk	0.4
Total Chronic Hazard	0.00
Total PM2.5 Concentration	0.00

Step 2: Enter Emissions Data

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (μg/m3)
Fine Particulate Matter (PM2.5)		6.75E-03			0.01
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS [3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	0.00E+00			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00			
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00			
CHLOROBENZENE	108907	0.00E+00			
CHLOROFORM[1]	67663	0.00E+00			
Chlorophenols	87865	0.00E+00			
PENTACHLOROPHENOL	87865	0.00E+00			
2,4,6-TRICHLOROPHENOL	88062	0.00E+00			
CHLOROPICRIN	76062	0.00E+00			
p-CHLORO-o-TOLUIDINE	95692	0.00E+00			
CHROMIUM 6+[2]	18540299	0.00E+00			
Barium chromate[2]	10294403	0.00E+00			
Calcium chromate[2]	13765190	0.00E+00			
Lead chromate[2]	7758976	0.00E+00			
Sodium dichromate[2]	10588019	0.00E+00			
Strontium chromate[2]	7789062	0.00E+00			
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00			
COPPER AND COMPOUNDS	7440508	0.00E+00			
p-CRESIDINE	120718	0.00E+00			
CRESOLS	1319773	0.00E+00			
M-CRESOL	108394	0.00E+00			
O-CRESOL	95487	0.00E+00			
P-CRESOL	106445	0.00E+00			
CUPFERRON	135206	0.00E+00			
Cyanide And Compounds (inorganic)	57125	0.00E+00			
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00			
2,4-DIAMINOANISOLE	615054	0.00E+00			
2,4-DIAMINOTOLUENE	95807	0.00E+00			
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00			
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00			
3,3-DICHLOROBENZIDINE	91941	0.00E+00			
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00			
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00			
DIETHANOLAMINE	111422	0.00E+00			
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00			
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00			
2,4-DINITROTOLUENE	121142	0.00E+00			
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00			
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00			
1,2-EPOXYBUTANE	106887	0.00E+00			
ETHYL BENZENE	100414	0.00E+00			
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00			
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00			
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00			
ETHYLENE GLYCOL	107211	0.00E+00			
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00			
ETHYLENE THIOUREA	96457	0.00E+00			
Fluorides	1101	0.00E+00			
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00			
FORMALDEHYDE	50000	0.00E+00			

GLUTARALDEHYDE	111308	0.00E+00			
GLYCOL ETHERS	107211	0.00E+00			
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER – EGEE [1]	110805	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA [1]	111159	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER – EGME [1]	109864	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00			
HEXACHLOROBENZENE	118741	0.00E+00			
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00			
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00			
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00			
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00			
n-HEXANE	110543	0.00E+00			
HYDRAZINE	302012	0.00E+00			
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00			
HYDROGEN SULFIDE	7783064	0.00E+00			
ISOPHORONE	78591	0.00E+00			
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00			
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00			
Lead acetate[2]	301042	0.00E+00			
Lead phosphate[2]	7446277	0.00E+00			
Lead subacetate[2]	1335326	0.00E+00			
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00			
MALEIC ANHYDRIDE	108316	0.00E+00			
MANGANESE AND COMPOUNDS	7439965	0.00E+00			
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00			
Mercuric chloride	7487947	0.00E+00			
METHANOL	67561	0.00E+00			
METHYL BROMIDE (Bromomethane)	74839	0.00E+00			
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00			
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00			
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00			
METHYL ISOCYANATE	624839	0.00E+00			
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00			
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00			
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00			
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00			
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00			
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00			
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00			
N-NITROSODIETHYLAMINE	55185	0.00E+00			
N-NITROSODIMETHYLAMINE	62759	0.00E+00			
N-NITROSODIPHENYLAMINE	86306	0.00E+00			
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00			
N-NITROSOMORPHOLINE	59892	0.00E+00			
N-NITROSOPIPERIDINE	100754	0.00E+00			
N-NITROSOPYRROLIDINE	930552	0.00E+00			
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00			
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00			

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	7.10E-03	9.99E+00	2.68E-03
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA)[2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON[2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	0.00E+00		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	0.00E+00		
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		

TOTAL UNADJUSTED Risk Values	**9.987**	**0.003**	**1.27E-02**

Step 1: Enter Facility Data	
Plant Name	809 B Street
Plant No.	Future Emergency Generator

Step 3: Estimate Distance	
What is the distance (m) from the facility boundary to the MEI?	240

Step 4: Specify Source Type	
Does facility have only diesel backup generators?	yes
Is this analysis for a gas station?	no

Step 5: Read Estimates	
Total Cancer Risk	0.6
Total Chronic Hazard	0.00
Total PM2.5 Concentration	0.00

Step 2: Enter Emissions Data

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		6.75E-03			0.01
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS[3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	0.00E+00			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00			
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00			
CHLOROBENZENE	108907	0.00E+00			
CHLOROFORM[1]	67663	0.00E+00			
Chlorophenols	87865	0.00E+00			
PENTACHLOROPHENOL	87865	0.00E+00			
2,4,6-TRICHLOROPHENOL	88062	0.00E+00			
CHLOROPICRIN	76062	0.00E+00			
p-CHLORO-o-TOLUIDINE	95692	0.00E+00			
CHROMIUM 6+[2]	18540299	0.00E+00			
Barium chromate[2]	10294403	0.00E+00			
Calcium chromate[2]	13765190	0.00E+00			
Lead chromate[2]	7758976	0.00E+00			
Sodium dichromate[2]	10588019	0.00E+00			
Strontium chromate[2]	7789062	0.00E+00			
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00			
COPPER AND COMPOUNDS	7440508	0.00E+00			
p-CRESIDINE	120718	0.00E+00			
CRESOLS	1319773	0.00E+00			
M-CRESOL	108394	0.00E+00			
O-CRESOL	95487	0.00E+00			
P-CRESOL	106445	0.00E+00			
CUPFERRON	135206	0.00E+00			
Cyanide And Compounds (inorganic)	57125	0.00E+00			
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00			
2,4-DIAMINOANISOLE	615054	0.00E+00			
2,4-DIAMINOTOLUENE	95807	0.00E+00			
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00			
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00			
3,3-DICHLOROBENZIDINE	91941	0.00E+00			
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00			
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00			
DIETHANOLAMINE	111422	0.00E+00			
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00			
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00			
2,4-DINITROTOLUENE	121142	0.00E+00			
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00			
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00			
1,2-EPOXYBUTANE	106887	0.00E+00			
ETHYL BENZENE	100414	0.00E+00			
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00			
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00			
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00			
ETHYLENE GLYCOL	107211	0.00E+00			
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00			
ETHYLENE THIOUREA	96457	0.00E+00			
Fluorides	1101	0.00E+00			
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00			
FORMALDEHYDE	50000	0.00E+00			

GLUTARALDEHYDE	111308	0.00E+00			
GLYCOL ETHERS	107211	0.00E+00			
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER – EGEE[1]	110805	0.00E+00			
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA[1]	111159	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER – EGME[1]	109864	0.00E+00			
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00			
HEXACHLOROBENZENE	118741	0.00E+00			
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00			
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00			
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00			
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00			
n-HEXANE	110543	0.00E+00			
HYDRAZINE	302012	0.00E+00			
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00			
HYDROGEN SULFIDE	7783064	0.00E+00			
ISOPHORONE	78591	0.00E+00			
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00			
LEAD AND COMPOUNDS [2,4] (inorganic) *values also apply to:*	7439921	0.00E+00			
Lead acetate[2]	301042	0.00E+00			
Lead phosphate[2]	7446277	0.00E+00			
Lead subacetate[2]	1335326	0.00E+00			
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00			
MALEIC ANHYDRIDE	108316	0.00E+00			
MANGANESE AND COMPOUNDS	7439965	0.00E+00			
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00			
Mercuric chloride	7487947	0.00E+00			
METHANOL	67561	0.00E+00			
METHYL BROMIDE (Bromomethane)	74839	0.00E+00			
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00			
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00			
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00			
METHYL ISOCYANATE	624839	0.00E+00			
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00			
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00			
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00			
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00			
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00			
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00			
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00			
N-NITROSODIETHYLAMINE	55185	0.00E+00			
N-NITROSODIMETHYLAMINE	62759	0.00E+00			
N-NITROSODIPHENYLAMINE	86306	0.00E+00			
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00			
N-NITROSOMORPHOLINE	59892	0.00E+00			
N-NITROSOPIPERIDINE	100754	0.00E+00			
N-NITROSOPYRROLIDINE	930552	0.00E+00			
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00			
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00			

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	7.10E-03	9.99E+00	2.68E-03
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA) [2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON [2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	0.00E+00		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	0.00E+00		
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		

TOTAL UNADJUSTED Risk Values	**9.987**	**0.003**	**1.27E-02**

	Step 1: Enter Facility Data
Plant Name	San Rafael Corporate Center - Lindaro Street
Plant No.	Future Emergency Generator

Step 3: Estimate Distance	
What is the distance (m) from the facility boundary to the MEI?	200

Step 4: Specify Source Type	
Does facility have only diesel backup generators?	yes
Is this analysis for a gas station?	no

Step 5: Read Estimates	
Total Cancer Risk	0.8
Total Chronic Hazard	0.00
Total PM2.5 Concentration	0.00

Step 2: Enter Emissions Data

Chemical Name	CAS No. (dashes removed)	Emission Rate (lb/day)	Cancer Risk (# / 1,000,000)	Chronic Hazard (index)	PM2.5 Concentration (µg/m3)
Fine Particulate Matter (PM2.5)		6.75E-03			0.01
ACETALDEHYDE	75070	0.00E+00			
ACETAMIDE	60355	0.00E+00			
ACROLEIN	107028	0.00E+00			
ACRYLAMIDE	79061	0.00E+00			
ACRYLIC ACID	79107	0.00E+00			
ACRYLONITRILE	107131	0.00E+00			
ALLYL CHLORIDE	107051	0.00E+00			
2-AMINOANTHRAQUINONE	117793	0.00E+00			
AMMONIA	7664417	0.00E+00			
ANILINE	62533	0.00E+00			
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]	7440382	0.00E+00			
ARSINE	7784421	0.00E+00			
ASBESTOS[3]	1332214	0.00E+00			
BENZENE[1]	71432	0.00E+00			
BENZIDINE (AND ITS SALTS) values also apply to:	92875	0.00E+00			
Benzidine based dyes	92875	0.00E+00			
Direct Black 38	1937377	0.00E+00			
Direct Blue 6	2602462	0.00E+00			
Direct Brown 95 (technical grade)	16071866	0.00E+00			
BENZYL CHLORIDE	100447	0.00E+00			
BERYLLIUM AND COMPOUNDS[2]	7440417	0.00E+00			
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111444	0.00E+00			
BIS(CHLOROMETHYL)ETHER	542881	0.00E+00			
BROMINE AND COMPOUNDS see Potassium Bromate	7758012	0.00E+00			
1,3-BUTADIENE	106990	0.00E+00			
CADMIUM AND COMPOUNDS[2]	7440439	0.00E+00			
CAPROLACTAM	105602	0.00E+00			
CARBON DISULFIDE[1]	75150	0.00E+00			
CARBON MONOXIDE	630080	0.00E+00			
CARBON TETRACHLORIDE[1] (Tetrachloromethane)	56235	0.00E+00			
CHLORINATED PARAFFINS	108171262	0.00E+00			
CHLORINE	7782505	0.00E+00			

CHLORINE DIOXIDE	10049044	0.00E+00		
4-CHLORO-O-PHENYLENEDIAMINE	95830	0.00E+00		
CHLOROBENZENE	108907	0.00E+00		
CHLOROFORM[1]	67663	0.00E+00		
Chlorophenols	87865	0.00E+00		
PENTACHLOROPHENOL	87865	0.00E+00		
2,4,6-TRICHLOROPHENOL	88062	0.00E+00		
CHLOROPICRIN	76062	0.00E+00		
p-CHLORO-o-TOLUIDINE	95692	0.00E+00		
CHROMIUM 6+[2]	18540299	0.00E+00		
Barium chromate[2]	10294403	0.00E+00		
Calcium chromate[2]	13765190	0.00E+00		
Lead chromate[2]	7758976	0.00E+00		
Sodium dichromate[2]	10588019	0.00E+00		
Strontium chromate[2]	7789062	0.00E+00		
CHROMIC TRIOXIDE (as chromic acid mist)	1333820	0.00E+00		
COPPER AND COMPOUNDS	7440508	0.00E+00		
p-CRESIDINE	120718	0.00E+00		
CRESOLS	1319773	0.00E+00		
M-CRESOL	108394	0.00E+00		
O-CRESOL	95487	0.00E+00		
P-CRESOL	106445	0.00E+00		
CUPFERRON	135206	0.00E+00		
Cyanide And Compounds (inorganic)	57125	0.00E+00		
HYDROGEN CYANIDE (Hydrocyanic acid)	74908	0.00E+00		
2,4-DIAMINOANISOLE	615054	0.00E+00		
2,4-DIAMINOTOLUENE	95807	0.00E+00		
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96128	0.00E+00		
1,4-DICHLOROBENZENE (p-Dichlorobenzene)	106467	0.00E+00		
3,3-DICHLOROBENZIDINE	91941	0.00E+00		
1,1,-DICHLOROETHANE (Ethylidene dichloride)	75343	0.00E+00		
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	117817	0.00E+00		
DIETHANOLAMINE	111422	0.00E+00		
p-DIMETHYLAMINOAZOBENZENE	60117	0.00E+00		
N,N-DIMETHYL FORMAMIDE	68122	0.00E+00		
2,4-DINITROTOLUENE	121142	0.00E+00		
1,4-DIOXANE (1,4-Diethylene dioxide)	123911	0.00E+00		
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)	106898	0.00E+00		
1,2-EPOXYBUTANE	106887	0.00E+00		
ETHYL BENZENE	100414	0.00E+00		
ETHYL CHLORIDE (Chloroethane)	75003	0.00E+00		
ETHYLENE DIBROMIDE (1,2-Dibromoethane)	106934	0.00E+00		
ETHYLENE DICHLORIDE (1,2-Dichloroethane)	107062	0.00E+00		
ETHYLENE GLYCOL	107211	0.00E+00		
ETHYLENE OXIDE (1,2-Epoxyethane)	75218	0.00E+00		
ETHYLENE THIOUREA	96457	0.00E+00		
Fluorides	1101	0.00E+00		
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664393	0.00E+00		
FORMALDEHYDE	50000	0.00E+00		

GLUTARALDEHYDE	111308	0.00E+00
GLYCOL ETHERS	107211	0.00E+00
ETHYLENE GLYCOL BUTYL ETHER – EGBE	111762	0.00E+00
ETHYLENE GLYCOL ETHYL ETHER – EGEE[1]	110805	0.00E+00
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA[1]	111159	0.00E+00
ETHYLENE GLYCOL METHYL ETHER – EGME[1]	109864	0.00E+00
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA	110496	0.00E+00
HEXACHLOROBENZENE	118741	0.00E+00
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608731	0.00E+00
alpha-HEXACHLOROCYCLOHEXANE	319846	0.00E+00
beta- HEXACHLOROCYCLOHEXANE	319857	0.00E+00
gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58899	0.00E+00
n-HEXANE	110543	0.00E+00
HYDRAZINE	302012	0.00E+00
HYDROCHLORIC ACID (Hydrogen chloride)	7647010	0.00E+00
HYDROGEN SULFIDE	7783064	0.00E+00
ISOPHORONE	78591	0.00E+00
ISOPROPYL ALCOHOL (Isopropanol)	67630	0.00E+00
LEAD AND COMPOUNDS[2,4] (inorganic) *values also apply to:*	7439921	0.00E+00
Lead acetate[2]	301042	0.00E+00
Lead phosphate[2]	7446277	0.00E+00
Lead subacetate[2]	1335326	0.00E+00
LINDANE [see gamma-Hexachlorocyclohexanes]	58899	0.00E+00
MALEIC ANHYDRIDE	108316	0.00E+00
MANGANESE AND COMPOUNDS	7439965	0.00E+00
MERCURY AND COMPOUNDS (INORGANIC)	7439976	0.00E+00
Mercuric chloride	7487947	0.00E+00
METHANOL	67561	0.00E+00
METHYL BROMIDE (Bromomethane)	74839	0.00E+00
METHYL tertiary-BUTYL ETHER	1634044	0.00E+00
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71556	0.00E+00
METHYL ETHYL KETONE (2-Butanone)	78933	0.00E+00
METHYL ISOCYANATE	624839	0.00E+00
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101144	0.00E+00
METHYLENE CHLORIDE (Dichloromethane)	75092	0.00E+00
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101779	0.00E+00
METHYLENE DIPHENYL ISOCYANATE	101688	0.00E+00
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90948	0.00E+00
N-NITROSODI-n-BUTYLAMINE	924163	0.00E+00
N-NITROSODI-n-PROPYLAMINE	621647	0.00E+00
N-NITROSODIETHYLAMINE	55185	0.00E+00
N-NITROSODIMETHYLAMINE	62759	0.00E+00
N-NITROSODIPHENYLAMINE	86306	0.00E+00
N-NITROSO-N-METHYLETHYLAMINE	10595956	0.00E+00
N-NITROSOMORPHOLINE	59892	0.00E+00
N-NITROSOPIPERIDINE	100754	0.00E+00
N-NITROSOPYRROLIDINE	930552	0.00E+00
NAPTHALENE [see Polycylcic aromatic hydrocarbons]	91203	0.00E+00
NICKEL AND COMPOUNDS[2] *(values also apply to:)*	7440020	0.00E+00

Nickel acetate[2]	373024	0.00E+00		
Nickel carbonate[2]	3333673	0.00E+00		
Nickel carbonyl[2]	13463393	0.00E+00		
Nickel hydroxide[2]	12054487	0.00E+00		
Nickelocene[2]	1271289	0.00E+00		
NICKEL OXIDE[2]	1313991	0.00E+00		
Nickel refinery dust from the pyrometallurgical process[2]	1146	0.00E+00		
Nickel subsulfide[2]	12035722	0.00E+00		
NITRIC ACID	7697372	0.00E+00		
NITROGEN DIOXIDE	10102440	0.00E+00		
p-NITROSODIPHENYLAMINE	156105	0.00E+00		
OZONE	10028156	0.00E+00		
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	85105	7.10E-03	9.99E+00	2.68E-03
PERCHLOROETHYLENE (Tetrachloroethylene)	127184	0.00E+00		
PHENOL	108952	0.00E+00		
PHOSGENE	75445	0.00E+00		
PHOSPHINE	7803512	0.00E+00		
PHOSPHORIC ACID	7664382	0.00E+00		
PHTHALIC ANHYDRIDE	85449	0.00E+00		
PCB (POLYCHLORINATED BIPHENYLS)	1336363	0.00E+00		
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD) (Treated as 2,3,7,8-TCDD for HRA) [2,7]	1746016	0.00E+00		
POLYCHLORINATED DIBENZOFURANS (PCDF) (Treated as 2,3,7,8-TCDD for HRA) 2,7	1746016	0.00E+00		
POLYCYCLIC AROMATIC HYDROCARBON [2] (PAH) (AS B(a)P-EQUIV)[5]	50328	0.00E+00		
NAPHTHALENE	91203	0.00E+00		
POTASSIUM BROMATE	7758012	0.00E+00		
1,3-PROPANE SULTONE	1120714	0.00E+00		
PROPYLENE (PROPENE)	115071	0.00E+00		
PROPYLENE GLYCOL MONOMETHYL ETHER	107982	0.00E+00		
PROPYLENE OXIDE	75569	0.00E+00		
SELENIUM AND COMPOUNDS	7782492	0.00E+00		
HYDROGEN SELENIDE	7783075	0.00E+00		
Selenium sulfide	7446346	0.00E+00		
SILICA (Crystalline, Respirable)	7631869	0.00E+00		
SODIUM HYDROXIDE	1310732	0.00E+00		
STYRENE	100425	0.00E+00		
SULFATES	9960	0.00E+00		
SULFUR DIOXIDE	7446095	0.00E+00		
SULFURIC ACID	7664939	0.00E+00		
SULFUR TRIOXIDE	7446719	0.00E+00		
OLEUM	8014957	0.00E+00		
1,1,2,2-TETRACHLOROETHANE	79345	0.00E+00		
THIOACETAMIDE	62555	0.00E+00		
TOLUENE	108883	0.00E+00		
Toluene diisocyantates	26471625	0.00E+00		
TOLUENE-2,4-DIISOCYANATE	584849	0.00E+00		
TOLUENE-2,6-DIISOCYANATE	91087	0.00E+00		
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79005	0.00E+00		

TRICHLOROETHYLENE	79016	0.00E+00		
TRIETHYLAMINE	121448	0.00E+00		
URETHANE (Ethyl carbamate)	51796	0.00E+00		
Vanadium Compounds	7440622	0.00E+00		
Vanadium (fume or dust)	7440622	0.00E+00		
VANADIUM PENTOXIDE	1314621	0.00E+00		
VINYL ACETATE	108054	0.00E+00		
VINYL CHLORIDE (Chloroethylene)	75014	0.00E+00		
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75354	0.00E+00		
XYLENES (mixed isomers)	1330207	0.00E+00		
m-XYLENE	108383	0.00E+00		
o-XYLENE	95476	0.00E+00		
p-XYLENE	106423	0.00E+00		
TOTAL UNADJUSTED Risk Values		**9.987**	**0.003**	**1.27E-02**

Bay Area Air Quality Management District

Roadway Screening Analysis Calculator
2nd Street

Search Parameters

County	Marin	
Roadway Direction	East-West	
Side of the Roadway	North	
Distance from Roadway	185	feet
Annual Average Daily Traffic (ADT)	22,285	

Results

Marin County

EAST-WEST DIRECTIONAL ROADWAY

PM2.5 annual average

0.050 (µg/m^3)

Cancer Risk

3.22 (per million)

Data for Marin County based on meteorological data collected from Mt. Tamalpias in 2005

Notes and References:

1. Emissions were developed using EMFAC2011 for fleet mix in 2014 assuming 10,000 AADT and includes impacts from diesel and gasoline vehicle exhaust, brake and tire wear, and resuspended dust.
2. Roadways were modeled using CALINE4 air dispersion model assuming a source length of one kilometer. Meteorological data used to estimate the screening values are noted at the bottom of the “Results” box.
3. Cancer risks were estimated for 70 year lifetime exposure starting in 2014 that includes sensitivity values for early life exposures and OEHHA toxicity values adopted in 2013.

APPENDIX C
NOISE BACKGROUND DATA

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St north of 3rd Street Baseline AM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	10.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 39.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St south of 3rd Street Baseline PM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	48.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	2.0
Average heavy truck speed (mph):	25.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	50.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St north of 3rd Street Baseline PM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	15.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	41.6

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St south of 3rd St Baseline AM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	48.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	2.0
Average heavy truck speed (mph):	25.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	50.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St south of 3rd St Baseline+P AM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	70.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	2.0
Average heavy truck speed (mph):	25.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	51.5

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St south of 3rd Street C AM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	48.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	2.0
Average heavy truck speed (mph):	25.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	50.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St north of 3rd Street C AM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	20.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	42.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St north of 3rd Street C PM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	30.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 44.6

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St north of 3rd Street C+P AM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	20.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 42.8

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St north of 3rd Street C+P PM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	30.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	44.6

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Brooks St south of 3rd Street C+P AM

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	70.0
Average automobile speed (mph):	25.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	2.0
Average heavy truck speed (mph):	25.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	51.5

APPENDIX D
TRANSPORTATION BACKGROUND DATA

Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion

REVISED

Prepared for:
City of San Rafael

April 5, 2019

RS16-3456

FEHR PEERS

Table of Contents

Appendices

List of Figures

List of Tables

Executive Summary

This study analyzes the transportation impacts associated with the proposed BioMarin San Rafael campus expansion project at 999 3rd Street in San Rafael. The proposed project will expand the current BioMarin campus by adding 110,000 gross square feet (GSF) of office and 97,000 GSF of laboratory space for research and development (R&D). Additionally, BioMarin is dedicating the northwest corner of the site for development of a senior center (18,000 GSF) and affordable housing (67 units) for low income seniors.

The CEQA transportation impact assessment consists of:

- Traffic operations at 36 intersections
- Traffic operations on five arterials
- Freeway operations on US 101 from north of the Mission Avenue ramps to south of the 2nd Street ramps
- Bicycle, pedestrian, and transit conditions at these locations and adjacent to the project site

The transportation assessment identifies significant and unavoidable impacts at two intersections, on one arterial, and on one freeway segment.

- 3rd Street and Tamalpais Avenue West intersection during the AM and PM peak hours (Cumulative conditions)
- 3rd Street arterial during the AM peak hour (Baseline conditions and Cumulative conditions)
- US 101 southbound Mission Avenue off-ramp diverge segment during the AM peak hour (Cumulative conditions)

Pedestrian safety concerns and the limited roadway and freeway width available to add lanes result in impacts being significant but unavoidable. Additional recommendations are provided to reduce vehicle delay on intersections operating unacceptably.

This study also provides a forecast of vehicle miles traveled for the project. Employee home-work VMT are estimated to be higher than City and regional averages.

This report additionally includes a review of the project site plan. Improvements are suggested to enhance vehicle and pedestrian access and safety. Crossing treatment and intersection control option to improve pedestrian connectivity and safety at the four intersections adjacent to the project site are also evaluated.

The report includes additional analysis requested by the City of San Rafael, including:

- Addition of a westbound left-turn pocket at the intersection of 3rd Street and Brooks Street
- Addition of a turnout at the 3rd Street driveway
- Removal of the future reconfiguration of the intersection of 3rd Street and Hetherton Street
- Analysis of improvements at 3rd Street and Brooks Street to provide a pedestrian crossing of 3rd Street
- Analysis of improvements at 2nd Street and Brooks Street to resolve visibility concerns for southbound left-turning vehicles
- Analysis of improvements at 3rd Street and Lindaro Street to provide a more direct pedestrian connection to downtown
- Analysis of pedestrian crossings at 2nd Street and Brooks Street
- Discussion of bike parking

Introduction

This report documents the existing, baseline, and cumulative conditions for the proposed BioMarin San Rafael campus expansion project at 999 3rd Street in San Rafael. The report then analyzes the impacts of the proposed project on baseline and cumulative conditions.

Project Description

The proposed project will expand the current BioMarin campus by adding 110,000 gross square feet (GSF) of office and 97,000 GSF of laboratory space for research and development (R&D). BioMarin proposes to leverage its campus parking model, with visitor, ADA, and service parking on site. Most (non-ADA) BioMarin employees working at the project site will park at the existing BioMarin garage and surface parking south of 2nd Street, where there is a large parking surplus. Additionally, BioMarin is dedicating the northwest corner of the site for development of a senior center (18,000 GSF) and affordable housing (67 units) for low income seniors. The senior center will include classrooms, meeting spaces, and other senior services. The senior center will have parking located on the ground floor of the building. No parking will be provided for senior residents.

Project Location

The project site occupies approximately three acres, bounded by 3rd Street to the north, 2nd Street to the south, Brooks Street to the west, and Lindaro Street to the east as shown in Figure 1. This site is currently vacant and was formerly occupied by PG&E.

The project site is located in downtown San Rafael, an area of mixed office, retail, dining, and other uses. The site has good walking and transit access including to the C. Paul Bettini Transit Center and the Sonoma-Marin Area Rail Transit (SMART) San Rafael downtown train station approximately two blocks to the east. The US 101/2nd Street interchange is approximately three blocks to the east. The site is also adjacent to the existing BioMarin San Rafael campus located south of 2nd Street.

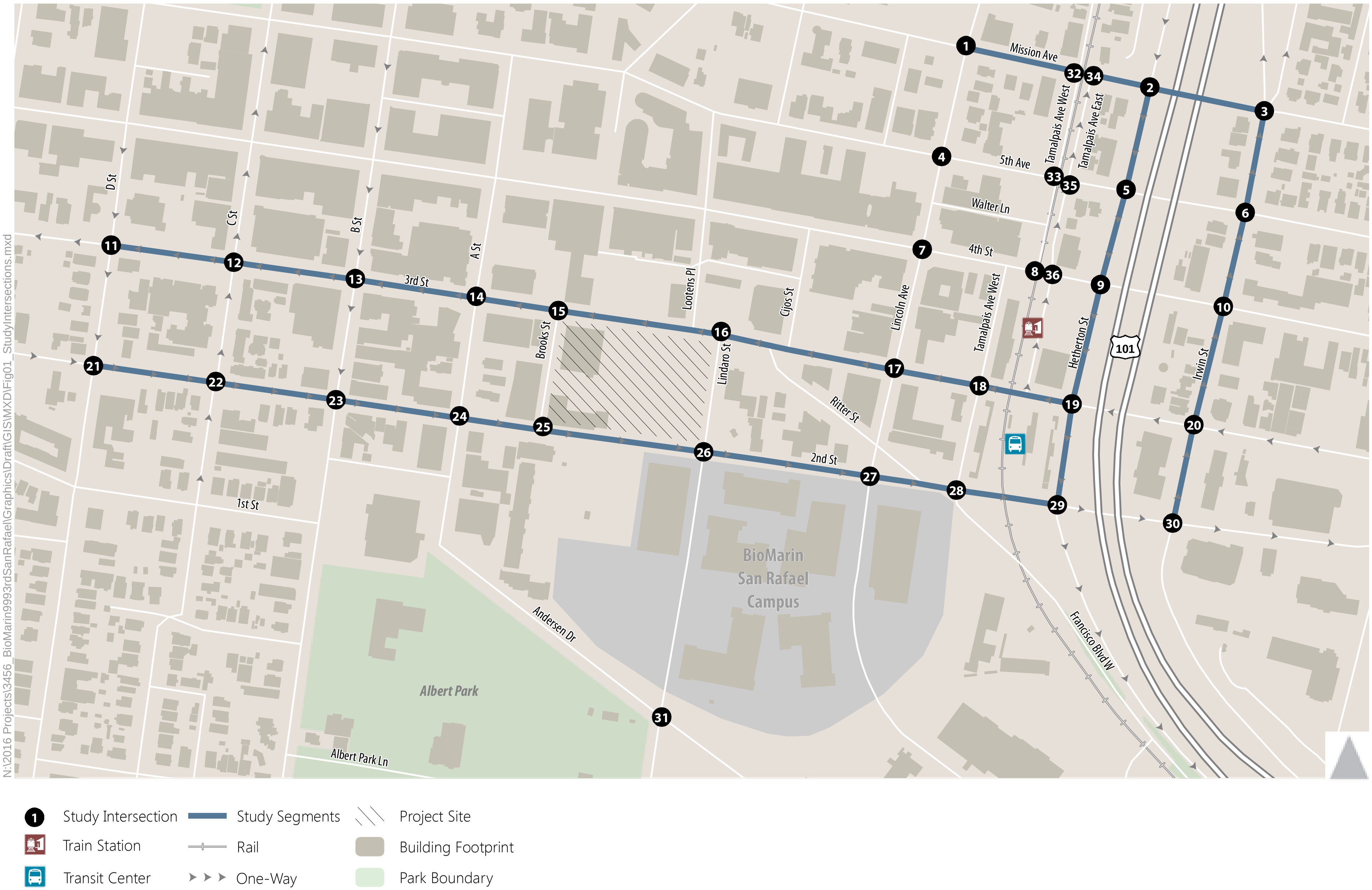


Figure 1

Project Location

Study Area

Intersections are generally the critical nodes of urban roadway networks that control system capacity and driver experience. Therefore, the operations of critical intersections surrounding the project site are used as indicators of the adequacy of the vehicular circulation system. During the scoping of the transportation impact analysis, the City requested analysis of 36 intersections, five arterial segments, and a section of US 101 (Figure 1) based on the project trip generation and distribution. These analysis locations are:

Study Intersections

1. Mission Avenue and Lincoln Avenue
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street
4. 5th Avenue and Lincoln Avenue
5. 5th Avenue and Hetherton Street
6. 5th Avenue and Irwin Street
7. 4th Street and Lincoln Avenue
8. 4th Street and Tamalpais Avenue West
9. 4th Street and Hetherton Street
10. 4th Street and Irwin Street
11. 3rd Street and D Street
12. 3rd Street and C Street
13. 3rd Street and B Street
14. 3rd Street and A Street
15. 3rd Street and Brooks Street
16. 3rd Street and Lindaro Street
17. 3rd Street and Lincoln Avenue
18. 3rd Street and Tamalpais Avenue West
19. 3rd Street and Hetherton Street
20. 3rd Street and Irwin Street
21. 2nd Street and D Street
22. 2nd Street and C Street
23. 2nd Street and B Street
24. 2nd Street and A Street
25. 2nd Street and Brooks Street
26. 2nd Street and Lindaro Street
27. 2nd Street and Lincoln Avenue
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp
30. 2nd Street and Irwin Street/US 101 Northbound Ramp
31. Andersen Drive and Lindaro Street
32. Tamalpais Avenue West and Mission Avenue
33. Tamalpais Avenue West and 5th Avenue
34. Tamalpais Avenue East and Mission Avenue
35. Tamalpais Avenue East and 5th Avenue
36. Tamalpais Avenue East and 4th Street

Arterial Study Segments

1. Mission Avenue from Lincoln Avenue to US 101 Northbound Ramp/Irwin Street
2. 3rd Street from Hetherton Street to D Street
3. 2nd Street from D Street to Hetherton Street/US 101 Southbound Ramp
4. Hetherton Street from Mission Avenue to 2nd Street
5. Irwin Street from 2nd Street to Mission Avenue

Freeway Study Segments

- US 101 segments from north of Mission Avenue ramps to south of 2nd Street ramps

Analysis Scenarios

The analysis includes an evaluation of transportation conditions during a typical weekday AM peak hour, occurring between 7:00 and 9:00 AM, and PM peak hour, occurring between 4:00 and 6:00 PM, when the combination of traffic on the surrounding roadway network and traffic generated by the project would peak.

This report presents the analysis of the following scenarios:

- Existing Conditions – Existing volumes based on recent traffic counts and the Synchro model provided by the City.
- Baseline Conditions – Existing volumes plus traffic volume estimates for approved, but not yet constructed, development; traffic increases due to regional growth expected prior to the proposed project opening (estimated 2023); and approved/funded transportation system improvements expected to be in place when the project opens. These projects are:
    - Seagate apartments, 703 3rd Street
    - Senior assisted housing, 1203 Lincoln Avenue
    - Addition of a leading pedestrian interval to the intersection of 3rd Street and Tamalpais Avenue West
    - SMART train extension to Larkspur
- Baseline Plus Project Conditions (R&D Only) – Baseline conditions plus project trip generation for the new R&D buildings only, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.
- Baseline Plus Project Conditions (R&D & Senior Services and Housing) – Baseline conditions plus project trip generation developed for both the BioMarin and Senior Services and Housing buildings, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.
- Cumulative Conditions – This scenario includes market-level population and employment growth and expected transportation improvements for year 2040. This scenario includes the Baseline Conditions scenario and adds the following:
    - Background growth, derived from the Metropolitan Transportation Commission Travel Demand Model
    - Conversion of C Street and D Street between 4th Street and 5th Street from one-way to two-way
    - Conversion of Tamalpais Avenue West between Mission Avenue and 4th Street from two-way to one-way southbound

- Conversion of Tamalpais Avenue West between 4th Street and 3rd Street from two-way to one-way northbound
- Employing signal optimization technology

- Cumulative Plus Project Conditions (R&D Only) – Cumulative conditions plus project trip generation for the new R&D buildings only, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.
- Cumulative Plus Project Conditions (R&D & Senior Services and Housing) – Baseline conditions plus project trip generation developed for both the BioMarin and Senior Services and Housing buildings, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.

Study Methodology

This chapter presents the analysis methodology and significance criteria applied in this study.

Analysis Methods

This study analyzes traffic operations using level of service (LOS) as the primary measure of performance. Automobile LOS is a qualitative description of traffic flow from the perspective of motorists. The *Highway Capacity Manual* (HCM) defines six levels of service from LOS A representing the least congested traffic conditions to LOS F representing the most congested traffic conditions. These grades represent the perspective of drivers and are an indication of the comfort and convenience associated with driving, as well as speed, travel time, traffic interruptions, and freedom to maneuver.

Roadway Operations

Traffic operations at all study intersections and arterial segments were analyzed for weekday AM and PM peak hour conditions using procedures and methodologies contained in the *Highway Capacity Manual* (Transportation Research Board, 2010) (HCM 2010) for calculating delay at intersections and on arterials. These methodologies were applied using the Synchro software program. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for such intersections are based on HCM 2000 methodology. Additionally, the four intersections adjacent to the project site were analyzed using the SimTraffic software program. Existing conditions data were provided in Synchro network and data files by the City of San Rafael and then updated with traffic count data provided by the City, collected by Fehr & Peers in 2016, and new counts collected by Fehr & Peers on October 24, November 7, and December 13, 2017, February 27, 2018, and March 21, 2019. Updates were made to the Synchro networks to reflect current observed conditions.

Signalized and Unsignalized Intersections

Table 1 displays the average delay ranges associated with each LOS category for intersections.

TABLE 1: INTERSECTION LEVEL OF SERVICE DEFINITIONS		
Level of Service	Average Control Delay (seconds/vehicle)[1]	
	Signalized	Unsignalized
A	0 – 10.0	0 – 10.0
B	10.1 – 20.0	10.1 – 15.0
C	20.1 – 35.0	15.1 – 25.0
D	35.1 – 55.0	25.1 – 35.0
E	55.1 – 80.0	35.1 – 50.0
F	> 80.0	> 50.0

Notes:

1. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and acceleration delay based on Highway Capacity Manual (Transportation Research Board, 2010).

For signalized intersections, the LOS is based on the average delay experienced by all vehicles passing through the intersection. For side-street stop controlled intersections, the delay and LOS for the worst movement is reported along with the average delay for the entire intersection.

Arterials

Table 2 displays the average travel speed ranges associated with each LOS category for arterials. Thresholds are from the San Rafael 2020 General Plan.

TABLE 2: ARTERIAL LEVEL OF SERVICE DEFINITIONS	
Level of Service	Speed (mph)
A	≥ 25.1
B	19.1 - 25.0
C	13.1 – 19.0
D	9.1 – 13.0
E	7.1 – 9.0
F	≤ 7.0

Source: San Rafael 2020 General Plan.

As discussed in the following significance criteria section, arterial LOS for TAM Congestion Management Plan (CMP) segments are determined based on volume-to-capacity ratio (V/C). The San Rafael 2020 General Plan EIR used model results to estimate this number. The Metropolitan Transportation Commission Travel Demand Model is the current available model for downtown San Rafael. This model indicates a capacity of 950 vehicles/hour/lane on 2nd Street and 3rd Street. Because this is generally higher than expected for a downtown arterial, a capacity of 800 vehicles/hour/lane is applied for those CMP segments.

Freeway Segments

Freeway operations on basic, merge, and diverge segments were analyzed for weekday AM and PM peak hour conditions using procedures and methodologies contained in the Highway Capacity Manual, Sixth Edition (Transportation Research Board, 2017). Weave segments were analyzed using the Leisch methodology, based on the Highway Design Manual (California Department of Transportation, 2014). Similar to intersections, the operating characteristics of freeway segments are evaluated using the concept of LOS. Freeway basic, merge, and diverge segment LOS is based on vehicle density (passenger cars per lane per mile). Table 3 shows the correlation of density and LOS. Inputs to calculate freeway segment densities were obtained from Caltrans Performance Measurement System (PeMS) data and from the traffic counts discussed earlier.

TABLE 3: FREEWAY LEVEL OF SERVICE DEFINITIONS

Level of Service	Density (passenger cars per mile per lane)
A	≤ 11.0
B	11.1 - 18.0
C	18.1 – 26.0
D	26.1 – 35.0
E	35.1 – 45.0
F	≥ 45.1

Source: Highway Capacity Manual 2010.

The purpose of the freeway analysis is to determine the project's contribution to the available capacity on the freeway; therefore, the Highway Capacity Software (HCS) was used to complete the analysis of basic, merge, and diverge segments. HCS is an appropriate analysis tool because it applies the freeway methodologies in the HCM by accounting for the volume demand and available capacity by segment. The HCS tool is a static model, which does not account for downstream queues. However, since the purpose of this analysis is to determine the project's contribution to the regional network, the static model approach was the most appropriate to account for the project's contribution.

For information purposes only, changes in freeway ramp queue lengths were estimated. The HCM methodology used in the Synchro software program does not adequately account for queue spillover or short turn pockets. Therefore, the differences between the Synchro estimated 95th percentile queue lengths under plus-project and no-project conditions are reported.

Traffic Forecasting

The Metropolitan Transportation Commission Travel Demand Model was used to estimate traffic growth in the study area. Although this model is the best available forecasting tool for San Rafael, it does not have a network and traffic analysis zone structure sufficient to forecast traffic volume by segment in the study area. Thus, the model was used to determine expected annual traffic volume growth in the study area. This growth was determined to be 0.4% annually and applied to the existing condition volumes to derive forecasts for baseline and cumulative year conditions.

Significance Criteria

The following thresholds of significance have been used to determine whether implementing the proposed project would result in a significant transportation impact. The San Rafael General Plan 2020, the San Rafael General Plan 2020 EIR, and the Marin County Congestion Management Plan were all used to develop these criteria and thresholds.

Signalized Intersections

The citywide LOS standard from the San Rafael General Plan 2020 is LOS D except as noted below:

- LOS E
    a. Downtown
    b. Irwin Street and Grand Avenue between 2nd Street and Mission Avenue
    c. 3rd Street and Union Street (maximum of 70 seconds of delay during peak hours)
    d. Andersen Drive and West Francisco Boulevard
    e. Andersen Drive and Bellam Boulevard
    f. Freitas Parkway and Civic Center Drive/Redwood Highway
    g. Merrydale Road and Civic Center Drive
    h. Merrydale Road and Las Gallinas
- LOS F
    a. Mission Avenue and Irwin Street
- Signalized intersections at Highway 101 and I-580 on-ramps and off-ramps are exempt from LOS standards because delay at these intersections is affected by regional traffic and not significantly impacted by local measures.

The San Rafael General Plan 2020 EIR defines the following as significant impacts:

- If a signalized intersection with baseline traffic volumes is operating at an acceptable LOS and deteriorates to an unacceptable operation with the addition of project traffic; or

- If a signalized intersection with baseline traffic volumes is at an unacceptable LOS and project traffic causes an increase in the delay of five seconds or more.

Unsignalized Intersections

Consistent with the San Rafael General Plan 2020 EIR, a significant impact at an unsignalized intersection is identified based on the following:

- If an unsignalized intersection with baseline traffic volumes is operating at an acceptable LOS and deteriorates to an unacceptable operation with the addition of project traffic; or

- If an unsignalized intersection with baseline traffic volumes is already operating at an unacceptable LOS and project traffic causes an increase in the delay of five seconds or more.

Arterials

The citywide LOS standard for arterials, as defined in San Rafael General Plan 2020, is LOS D except as noted below (Congestion Management Segments are west of US 101):

a. Downtown except as noted below	E
o Congestion Management Segments (2nd, 3rd, and 4th Streets)	D
b. Arterials operating at LOS E outside Downtown, and F[1]	F

For the arterials in this analysis, the applied standard is LOS D for 2nd Street and 3rd Street, LOS E for eastbound Mission Avenue, and LOS F for all other arterials.

For the purposes of this analysis, a significant impact on an arterial is identified based on the following, consistent with the San Rafael General Plan 2020 EIR and the 2015 Marin County Congestion Management Plan Update:

- If an arterial with baseline traffic volumes is operating at an acceptable LOS and deteriorates to an unacceptable operation with the addition of project traffic.

- If an arterial with baseline traffic volumes is already at an unacceptable LOS and project impact causes a decrease in the calculated average travel speed of five miles per hour or more (City

[1] Arterials operating at LOS E outside Downtown, and F as of the date of adoption of General Plan 2020, are listed in Appendix C of the San Rafael General Plan 2020.

arterials) or 0.05 volume to capacity (V/C) or more (congestion management arterials), this impact is significant.

Freeway

The Marin County Congestion Management Plan establishes LOS E as the threshold for US 101 through San Rafael. The San Rafael General Plan 2020 EIR defines the following as significant impacts:

- If a freeway segment with baseline traffic volumes is operating at an acceptable LOS (LOS A, B, C, D, or E) and deteriorates to an unacceptable operation (LOS F).
- If a freeway segment with baseline traffic volumes is already at operating at LOS F and there is an increase in the V/C of 0.01 or more.

Bicycle/Pedestrian

The San Rafael General Plan 2020 includes the following goals for pedestrian and bicycle conditions:

Goal 16: Bikeways. It is the goal of San Rafael to have safe, convenient and attractive bikeways and amenities.

Goal 17: Pedestrian Paths. It is the goal of San Rafael to have safe, convenient and pleasurable pedestrian amenities.

Consistent with these goals, bicycle/pedestrian impacts would be significant if the project:

- Caused a substantial inconvenience or substantial reduction in quality of service for users of existing bicycle or pedestrian travel facilities
- Substantially reduced bicycle or pedestrian access
- Substantially reduced safety for bicyclists or pedestrians

Transit

The San Rafael General Plan 2020 includes the following goal related to the transit network:

C-14 Transit Network. Encourage the continued development of a safe, efficient, and reliable regional and local transit network to provide convenient alternatives to driving.

Consistent with this goal, transit impacts would be significant if the project:

- Induced substantial growth or concentration of population beyond the capacity of existing or planned public transit facilities.

- Increased demand for public transit service to such a degree that accepted service standards are not maintained.
- Reduced availability of public transit to users, or interfered with existing transit users.

Existing Conditions

This chapter describes the existing transportation system and traffic conditions within the study area. This includes the existing roadway network, as well as transit, bicycle, and pedestrian facilities within the vicinity of the project site. This scenario is informative and establishes present-day traffic conditions at the study intersections, arterials, and freeway segments.

The quantitative assessment of existing traffic conditions is based on an evaluation of current traffic counts. The City of San Rafael maintains a database of existing traffic volumes and provided Synchro files for use in this traffic study. These data were augmented with traffic counts collected by Fehr & Peers in 2016. Additional traffic counts were collected at study intersections on Tuesday, October 24; Tuesday, November 7, on Wednesday, December 13, 2017, and on Tuesday, February 27, 2018, during the AM (7-9 AM) and PM (4-6 PM) peak periods. Schools were in session at the time of the counts, weather conditions were dry, and no unusual traffic conditions were observed.

Roadway Network

The local circulation system near the project is shown in Figure 1. The project site is located in downtown San Rafael and west of US 101. The following roadways provide local access to the proposed project site. All of these local streets have sidewalks along both sides unless otherwise noted.

3rd Street – 3rd Street is primarily a three-lane one-way street that serves westbound traffic. 3rd Street widens from two lanes to three lanes at Grand Avenue and then continues under the freeway into downtown. At E Street, 3rd Street reduces to two lanes and then merges with 2nd Street just west of Hayes Street. On-street parking is prohibited along the north side of 3rd Street and the south side east of Lindaro Street.

2nd Street – 2nd Street is primarily a three-lane one-way street that serves eastbound traffic. 2nd Street separates from 3rd Street and widens to three lanes just east of Miramar Avenue and continues through downtown. At Grand Avenue, 2nd Street reduces to two lanes and then merges with 3rd Street just west of Union Street. On-street parking is prohibited along 2nd Street. There are no sidewalks on the north side of 2nd Street between Lincoln Avenue and Ritter Street and the south side of 2nd Street between Francisco Boulevard West and Irwin Street.

Brooks Street – Brooks Street is a one-block long two-way street, with one travel lane in each direction that runs north-south between 2nd Street and 3rd Street. On-street parking is prohibited except for three spaces along the east curb just south of 3rd Street.

Lindaro Street – Lindaro Street is a two-way street, with one travel lane in each direction, which runs north-south from 3rd Street to Woodland Avenue. The crosswalk on the west leg of the intersection with 3rd Street is unmarked. Lindaro Street passes through the existing BioMarin San Rafael campus between 2nd Street and Andersen Drive.

Figure 2 and Figure 3 display the existing peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively. Peak hours observed were 7:30-8:30 AM and 4:30-5:30 PM.

This page intentionally left blank.

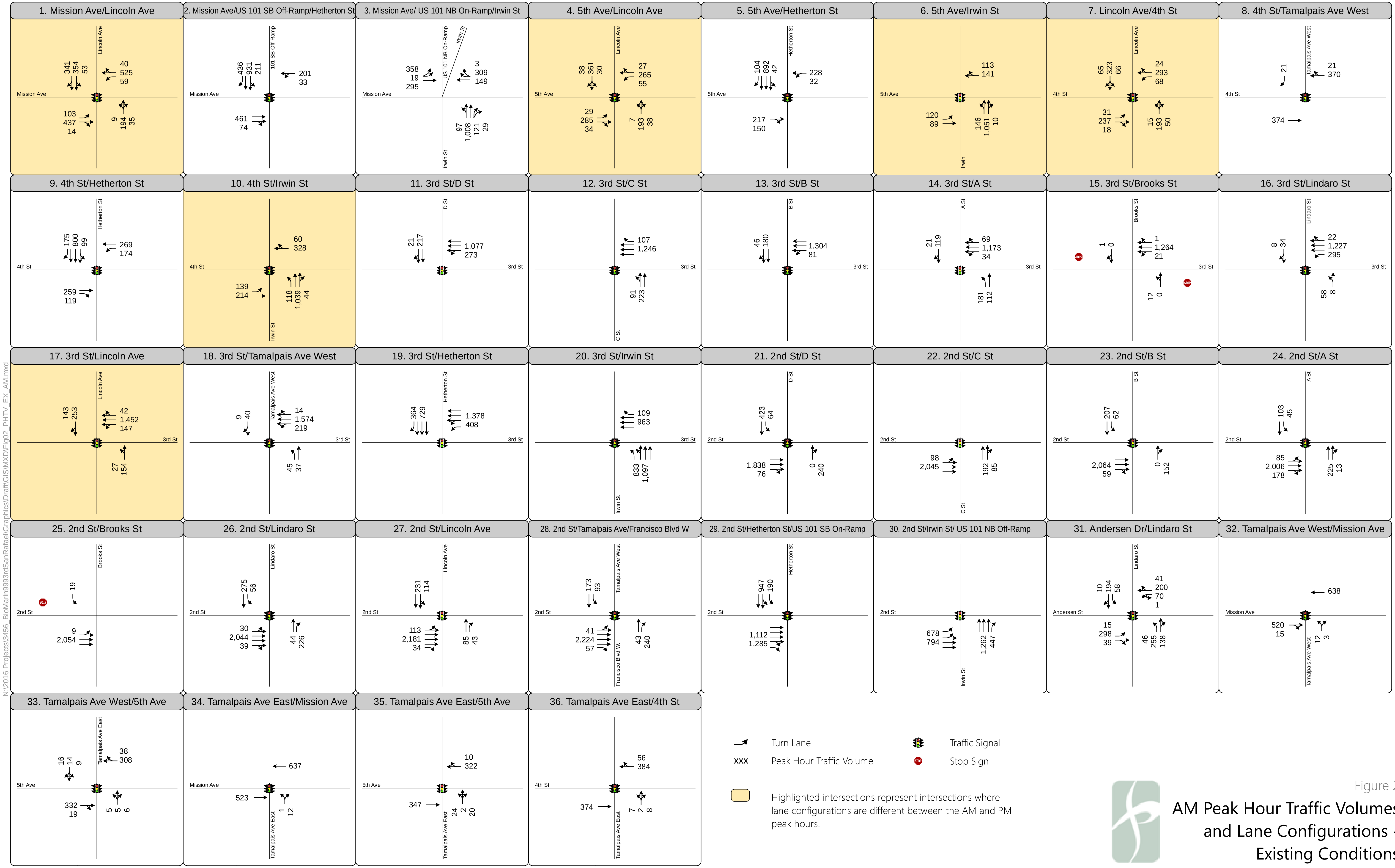


Figure 2

AM Peak Hour Traffic Volumes and Lane Configurations - Existing Conditions

N:\2016 Projects\3456_BioMarin\993rdSanRafael\Graphics\Draft\GIS\MXD\Fig02_PHTV_EX_AM.mxd

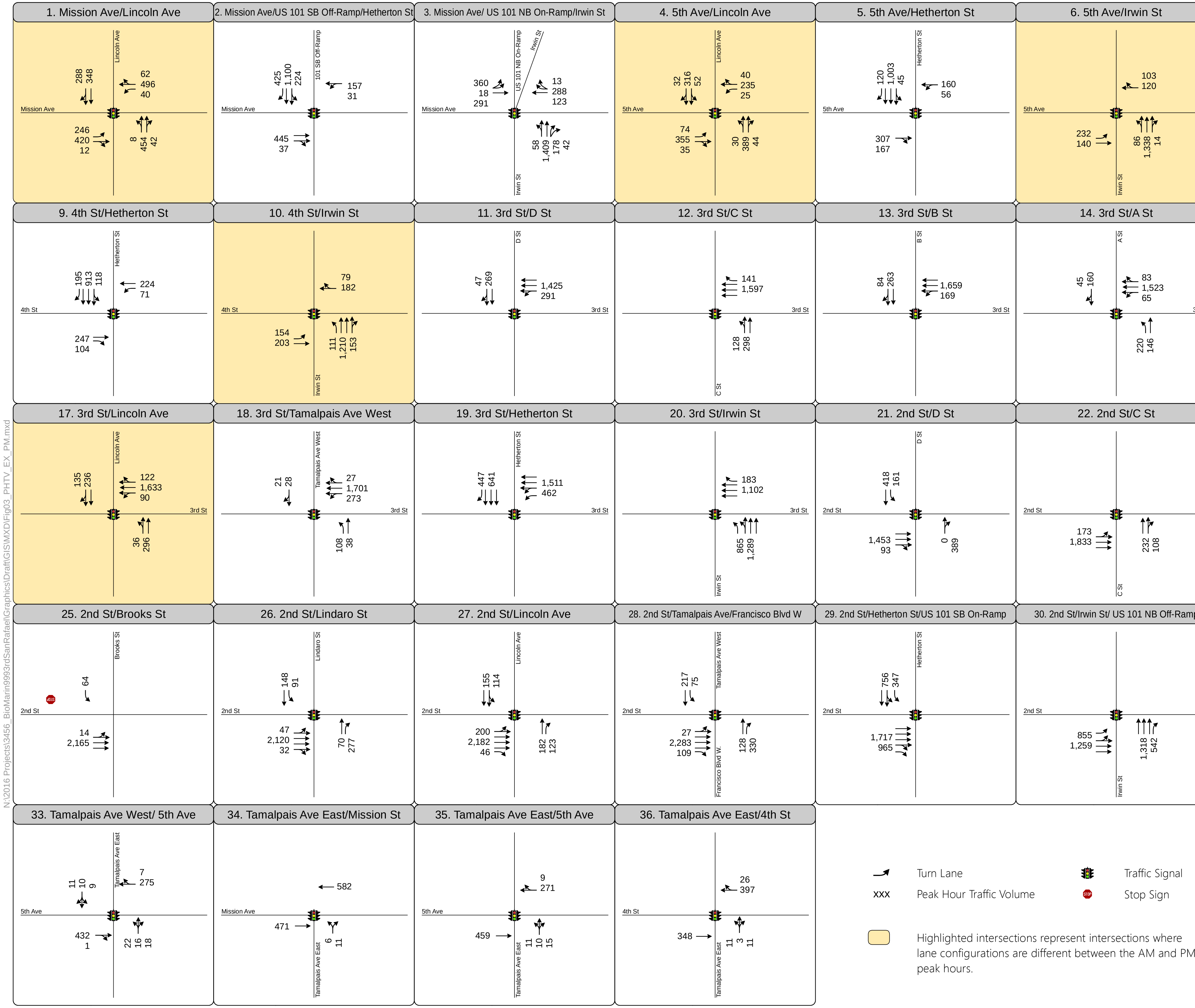


Figure 3

PM Peak Hour Traffic Volumes and Lane Configurations - Existing Conditions

N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig03_PHTV_EX_PM.mxd

Intersection Operations

Table 4 summarizes the existing levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix A presents all LOS calculations.

TABLE 4: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – EXISTING CONDITIONS

Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 20.8	D / 39.0
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 35.1	C / 22.9
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 23.5	C / 22.2
4. 5th Avenue and Lincoln Avenue	Signal	B / 15.3	A / 9.1
5. 5th Avenue and Hetherton Street[3]	Signal	A / 6.8	A / 8.1
6. 5th Avenue and Irwin Street	Signal	D / 36.3	C / 28.9
7. 4th Street and Lincoln Avenue	Signal	B / 18.3	B / 19.8
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 5.9	A / 3.9
9. 4th Street and Hetherton Street[3]	Signal	A / 8.9	A / 9.1
10. 4th Street and Irwin Street	Signal	C / 32.4	C / 28.4
11. 3rd Street and D Street	Signal	C / 26.3	C / 29.5
12. 3rd Street and C Street	Signal	C / 24.7	C / 28.8
13. 3rd Street and B Street	Signal	C / 25.5	C / 32.6
14. 3rd Street and A Street	Signal	C / 26.1	C / 29.8
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.7 (13.3)	A (A) / 1.6 (9.0)
16. 3rd Street and Lindaro Street	Signal	A / 5.7	A / 9.8
17. 3rd Street and Lincoln Avenue	Signal	D / 42.5	C / 30.3
18. 3rd Street and Tamalpais Avenue West	Signal	C / 30.4	C / 32.2
19. 3rd Street and Hetherton Street	Signal	C / 31.8	D / 44.1
20. 3rd Street and Irwin Street	Signal	C / 27.5	C / 30.7
21. 2nd Street and D Street	Signal	A / 3.2	A / 3.3
22. 2nd Street and C Street	Signal	D / 37.5	D / 36.2
23. 2nd Street and B Street	Signal	A / 2.2	A / 2.9
24. 2nd Street and A Street	Signal	D / 37.6	D / 35.1
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.5 (15.6)	A (D) / 2.9 (26.0)
26. 2nd Street and Lindaro Street	Signal	B / 13.6	B / 13.4

TABLE 4: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – EXISTING CONDITIONS			
Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
27. 2nd Street and Lincoln Avenue	Signal	D / 42.7	D / 37.3
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 44.4	D / 37.1
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	D / 48.4	C / 32.6
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 28.0	D / 44.9
31. Andersen Drive and Lindaro Street	Signal	C / 22.3	C / 21.0
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 20.4	B / 10.3
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 5.5	A / 6.5
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 49.9	B / 19.6
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 5.6	A / 3.9
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 12.0	A / 9.8

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 5 summarizes the existing levels of service on the arterials in the analysis area. All operate acceptably except for 2nd Street which operates unacceptably during the AM and PM peak hours. Appendix A includes arterial LOS calculations.

TABLE 5: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – EXISTING CONDITIONS

Arterial	Standard	LOS / Average Speed [1]	
		AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 8	D / 10
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 4	F / 6
3. 3rd Street WB from Hetherton Street to D Street	D	D / 11	D / 12
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**E / 7**	**E / 9**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 7	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	D / 9	D / 10

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 4 presents existing conditions freeway volumes, and Table 6 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix A. As shown, all segments operate at acceptable levels during the AM and PM peak hours with the exception of the southbound weave segment between the 2nd Street on-ramp and the I-580 EB off-ramp during the AM peak hour.

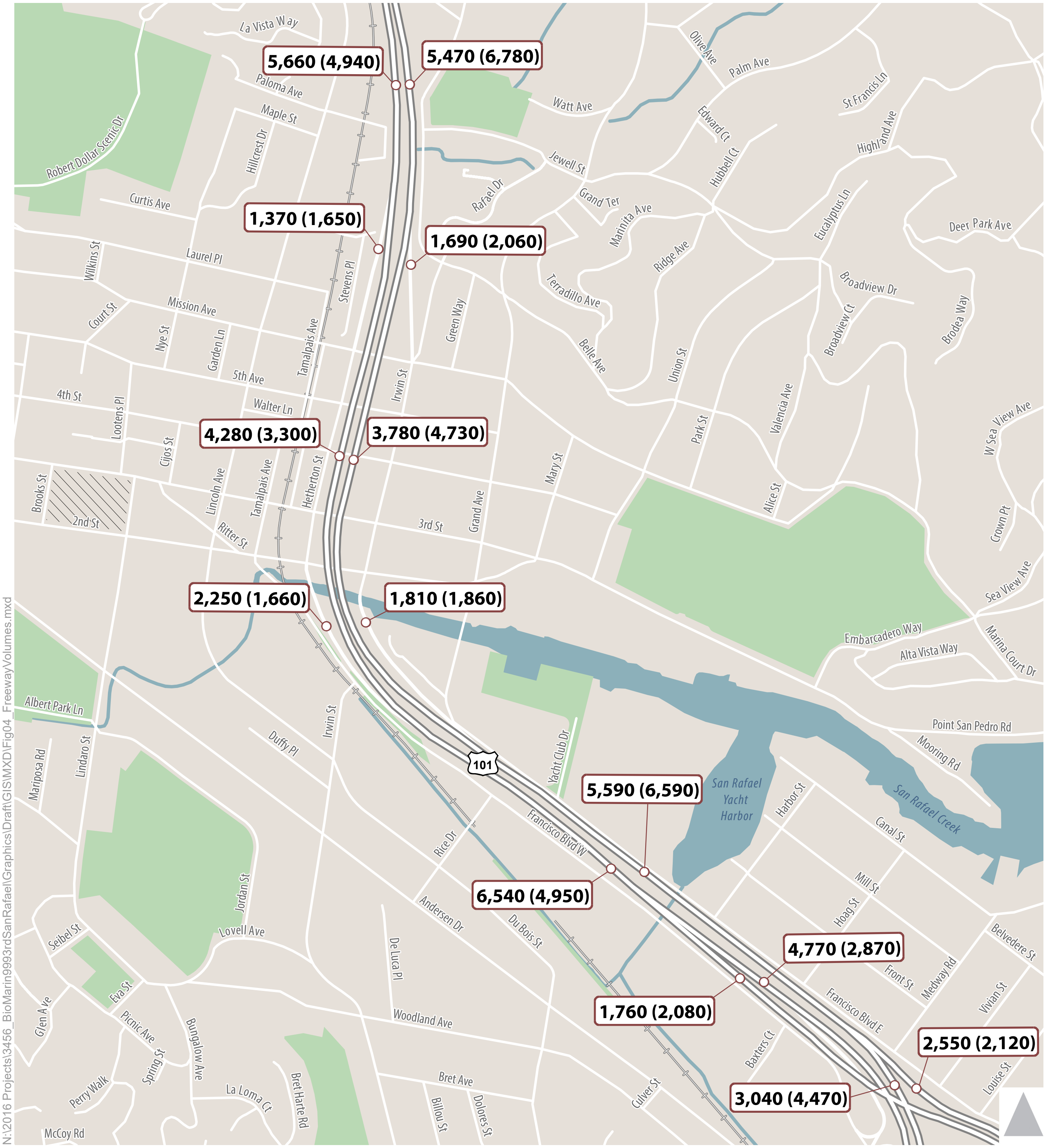
TABLE 6: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – EXISTING CONDITIONS				
Segment	**Segment Type**	**Standard**	**LOS / Density (pc/mi/ln[1])**	
			AM	**PM**
Northbound				
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	C / 26	D / 34
Southbound				
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 36	D / 30
Mission Avenue Off-Ramp	Diverge	E	E / 37	D / 32
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Ramp queues were also observed at the northbound 2nd Street and southbound Mission Avenue off-ramps. Maximum peak period queues were observed extending onto the freeway mainline at both off-ramps during the PM peak hour. Table 7 and Figure 5 summarize these observations.

TABLE 7: WEEKDAY PEAK HOUR OFF-RAMP QUEUES – EXISTING CONDITIONS			
Off-Ramp	**Ramp Storage Length (feet)**	**Maximum Queue (feet)[1]**	
		AM	**PM**
US 101 NB to 2nd Street	1,070	859	**2,952**
US 101 SB to Mission Avenue	940	584	**940+[2]**

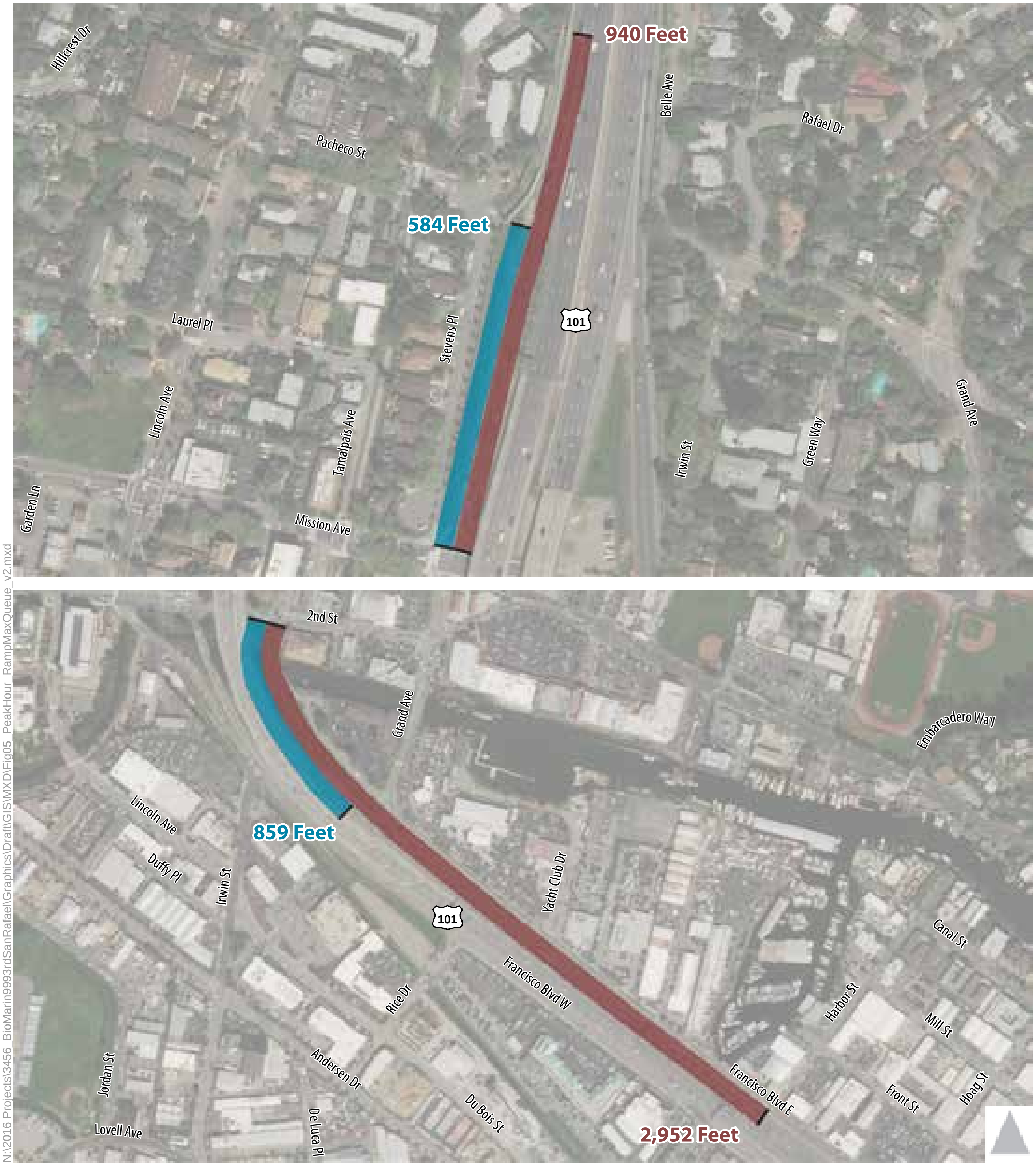
Notes:
1. **Bold** indicates unacceptable operations.
2. End of queue could not be observed.
Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 4

Weekday Peak Hour Freeway Volumes - Existing Conditions



N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig05_PeakHour_RampMaxQueue_v2.mxd

AM Maximum Queue Length

PM Maximum Queue Length

Figure 5

Weekday Peak Hour Off-Ramp Queues - Existing Conditions

Bicycle and Pedestrian Network

Bicycle Facilities

The existing bicycle network is limited within the study area:

- 4th Street is classified as a Class III bikeway (bike route) between 2nd Street and Tamalpais Avenue East and between Irwin Street and Union Street; sections of this bikeway have sharrow markings.
- Lincoln Avenue is classified as a Class III bikeway from 2nd Street to Irwin Street.
- Andersen Drive has westbound Class II bike lanes between A Street and Lindaro Street and is a Class III bikeway with sharrow markings eastbound.
- The Puerto Suello Hill Pathway (Class I bike path) passes through the study area.

The Marin County Bicycle Coalition (MCBC) map identifies Mission Avenue as the primary east-west on-street bikeway route through the study area. Lincoln Avenue, Andersen Drive, Irwin Street, and D Street are identified as primary north-south on-street bikeway routes on the MCBC map.

The 2018 San Rafael Bicycle & Pedestrian Master Plan proposes a feasibility study for an east-west bikeway through downtown along 4th Street. New north-south bicycle connections are proposed along D Street and C Street (Class IV protected bikeway couplet or Class III bicycle boulevard) and Tamalpais Avenue West (Class IV separated bikeway). The plan also proposes US 101 undercrossing improvements at 3rd Street, 4th Street, 5th Avenue, and Mission Avenue that would benefit bicyclists and pedestrians.

Pedestrian Network

Sidewalks are present along both sides of all roadways near the project site except for the following:

- South side of Ritter Street between Lincoln Avenue and 2nd Street
- North side of 2nd Street between Lincoln Avenue and Ritter Street
- South side of 2nd Street between Francisco Boulevard West and Irwin Street
- Sections of Tamalpais Avenue adjacent to the railroad tracks between Mission Avenue and 3rd Street

Adjacent to the project site, crosswalks are available as follows:

- **3rd Street and Brooks Street**: No crosswalks are marked on any of the three legs of the intersection. Pedestrian crossing of 3rd Street is prohibited on both the west and east legs. The nearest available marked crossings of 3rd Street are at A Street 220 feet to the west and Lindaro Street 450 feet to the east. An unmarked crosswalk is also at Lootens Place 370 feet to the east.

- **3rd Street and Lootens Place**: A crosswalk is marked on the north leg only; the west and east legs are unmarked. The nearest available marked crosswalks across 3rd Street are at Lindaro Street 90 feet to the east and A Street 590 feet to the west.
- **3rd Street and Lindaro Street**: Crosswalks are marked on the south and east legs only; the west leg is unmarked.
- **2nd Street and Brooks Street**: A crosswalk is marked on the north leg only; the west and east legs of the intersection, which span 2nd Street, are unmarked. The nearest available marked crosswalks across 2nd Street are at A Street 220 feet to the west and Lindaro Street 450 feet to the east.
- **2nd Street and Lindaro Street**: Crosswalks are marked on all four legs.

Pedestrian volumes were measured at four intersections adjacent to the project site in June 2016 and October/November 2017 as shown in Table 8. Pedestrian volumes crossing 2nd Street and 3rd Street at these intersections during the weekday AM and PM peak hours are relatively light under existing conditions, with the highest pedestrian counts occurring at the east leg of the 3rd Street and Lindaro Street intersection where 38 pedestrians crossed 3rd Street during the AM peak hour and 37 pedestrians crossed during the PM peak hour.

TABLE 8: INTERSECTION PEDESTRIAN VOLUMES – EXISTING CONDITIONS

Leg	Existing Weekday Pedestrian Counts	
	AM Peak Hour	PM Peak Hour
15. 3rd Street and Brooks Street		
West[1]	1	3
East[1]	2	4
North	38	37
South	36	51
16. 3rd Street and Lindaro Street		
East	38	37
North	26	51
South	22	30
25. 2nd Street and Brooks Street		
West	1	1
East	1	3
North	16	15
26. 2nd Street and Lindaro Street		
West	1	8
East	24	14
North	19	15
South	34	36

Note: [1]Pedestrian crossing currently prohibited but observed.
Source: Fehr & Peers, 2018.

Transit Network

Existing transit service within the study area is provided by bus at the San Rafael C. Paul Bettini Transit Center on Tamalpais Avenue approximately two blocks or 800 feet east of the project site. A total of 13 Marin Transit routes, eight Golden Gate Transit routes, and one Sonoma County Transit route currently serve the transit center. Greyhound also serves the center, as do airport bus companies and taxis. The transit center is well equipped with shelters and benches. Plans are being developed to build a new transit center that will be better able to accommodate buses and trains.

The Sonoma-Marin Area Rail Transit (SMART) San Rafael downtown station is also located approximately two blocks (950 feet) east of the project site. The train provides service to cities to the north, including to Novato, Petaluma, Santa Rosa, and the Sonoma County Airport. SMART operates 34 daily weekday trains and 10 daily trains on weekends and holidays. Weekday trains operate every 30 minutes in each direction from about 5:30-10:00 AM and 3:30-9:30 PM, with limited midday service. Construction work is underway on the SMART Larkspur extension.

Collision History

Collision history at the study intersections was reviewed for the years 2015 to 2017. Table 9 presents the results of this review. Of the intersections adjacent to the project site, the intersection of 2nd Street and Lindaro Street had four collisions, with most common collision types of rear end and broadside and primary collision factor of unsafe speed. The intersection of 3rd Street and Hetherton Street had the most collisions over the three-year period: a total of 12 collisions, 5 of which involved pedestrians or cyclists, and 1 of which involved a pedestrian fatality.

TABLE 9: COLLISION HISTORY AT STUDY INTERSECTIONS

Intersection	Number of Collisions					Most Common Collision Type	Most Common Primary Collision Factor (PCF)[2]	Collision Rate[3]
	3-Year Total[1]	Average Per Year	Total Injury Collisions	Total Fatal Collisions	Total Involving Peds or Bicyclists			
1. Mission Avenue and Lincoln Avenue	11	3.67	11		3	Head-On, Other	Traffic Signals and Signs	0.39
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street	3	1.00	3			Broadside	Traffic Signals and Signs	0.11
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street	10	3.33	10			Broadside	Traffic Signals and Signs	0.31
4. 5th Avenue and Lincoln Avenue	9	3.00	9		2	Various	Automobile Right of Way	0.47
5. 5th Avenue and Hetherton Street	5	1.67	5		1	Broadside	Traffic Signals and Signs	0.23
6. 5th Avenue and Irwin Street	3	1.00	3		1	Broadside	Various	0.13
7. 4th Street and Lincoln Avenue	6	2.00	6		2	Head-On, Rear End	Unsafe Speed, Pedestrian Right of Way	0.33
8. 4th Street and Tamalpais Avenue West	2	0.67	2		2	Vehicle/ Pedestrian, Other	Improper Turning, Pedestrian Right of Way	0.21
9. 4th Street and Hetherton Street	6	2.00	6		2	Head-On, Vehicle/ Pedestrian	Traffic Signals and Signs, Pedestrian Right of Way	0.27

TABLE 9: COLLISION HISTORY AT STUDY INTERSECTIONS

Intersection	Number of Collisions					Most Common Collision Type	Most Common Primary Collision Factor (PCF)[2]	Collision Rate[3]
	3-Year Total[1]	Average Per Year	Total Injury Collisions	Total Fatal Collisions	Total Involving Peds or Bicyclists			
10. 4th Street and Irwin Street	7	2.33	7		5	Vehicle/ Pedestrian	Pedestrian Right of Way	0.29
11. 3rd Street and D Street	0	0.00	0			-	-	-
12. 3rd Street and C Street	2	0.67	2			Broadside	Traffic Signals and Signs	0.08
13. 3rd Street and B Street	7	2.33	7		4	Vehicle/ Pedestrian, Broad-side	Automobile Right of Way	0.28
14. 3rd Street and A Street	3	1.00	3			Rear End	Unsafe Speed	0.12
15. 3rd Street and Brooks Street	1	0.33	1			Rear End	Unsafe Speed	0.05
16. 3rd Street and Lindaro Street	1	0.33	1		1	Vehicle/ Pedestrian	Pedestrian Right of Way	0.04
17. 3rd Street and Lincoln Avenue	11	3.67	11		5	Vehicle/ Pedestrian, Broad-side	Improper Turning, Pedestrian Right of Way	0.37
18. 3rd Street and Tamalpais Avenue West	8	2.67	8		5	Vehicle/ Pedestrian	Pedestrian Right of Way	0.32
19. 3rd Street and Hetherton Street	12	4.00	11	1	5	Vehicle/ Pedestrian, Broad-side	Traffic Signals and Signs	0.34
20. 3rd Street and Irwin Street	1	0.33	1			Head-On	Unsafe Speed	0.03
21. 2nd Street and D Street	6	2.00	6		2	Broadside	Traffic Signals and Signs, Unsafe Speed	0.21
22. 2nd Street and C Street	3	1.00	3			Various	Traffic Signals and Signs, Unsafe Speed	0.11
23. 2nd Street and B Street	1	0.33	1		1	Vehicle/ Pedestrian	Pedestrian Violation	0.03
24. 2nd Street and A Street	8	2.67	8		4	Broadside	Traffic Signals and Signs	0.25
25. 2nd Street and Brooks Street	1	0.33	1			Rear End	Unsafe Speed	0.04
26. 2nd Street and Lindaro Street	4	1.33	4			Rear End, Broadside	Unsafe Speed	0.12

TABLE 9: COLLISION HISTORY AT STUDY INTERSECTIONS								
Intersection	**Number of Collisions**					**Most Common Collision Type**	**Most Common Primary Collision Factor (PCF)²**	**Collision Rate³**
	3-Year Total¹	**Average Per Year**	**Total Injury Collisions**	**Total Fatal Collisions**	**Total Involving Peds or Bicyclists**			
27. 2nd Street and Lincoln Avenue	11	3.67	11		1	Broadside	Traffic Signals and Signs	0.32
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	6	2.00	5	1	1	Other	Improper Turning, Traffic Signals and Signs	0.16
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	5	1.67	5		1	Sideswipe	Traffic Signals and Signs	0.12
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	12	4.00	12		7	Vehicle/ Pedestrian	Pedestrian Right of Way	0.26
31. Andersen Drive and Lindaro Street	2	0.67	2		1	Vehicle/ Pedestrian, Side-swipe	Pedestrian Right of Way	0.13
32. Tamalpais Avenue West and Mission Avenue	0	0.00				-	Pedestrian Right of Way, Automobile Right of Way	-
33. Tamalpais Avenue West and 5th Avenue	2	0.67	2		1	Vehicle/ Pedestrian, Broad-side	-	0.21
34. Tamalpais Avenue East and Mission Avenue	1	0.33	1		1	Vehicle/ Pedestrian	Pedestrian Right of Way	0.08
35. Tamalpais Avenue East and 5th Avenue	0	0.00				-	-	-
36. Tamalpais Avenue East and 4th Stree³	2	0.67	2		2	Vehicle/ Pedestrian, Other	Improper Turning, Pedestrian Right of Way	0.21

Notes:

1. Total number of collisions from January 1, 2015 through December 31, 2017.
2. "Pedestrian Right of Way" indicates failure to yield to pedestrian, "Automobile Right of Way" indicates failure to yield to vehicle.
3. The collision rate is expressed as accidents per million vehicles entering the intersection.

Source: Table produced by Fehr & Peers (2018), data from Statewide Integrated Traffic Records System (SWITRS) through Transportation Injury Mapping System

Baseline Conditions

The Baseline scenario includes plus traffic volume estimates for approved, but not yet constructed, developments; traffic increases due to regional growth expected prior to the proposed project opening; and approved/funded transportation system improvements expected to be in place when the project opens.

The projects included in this scenario are:

- Seagate apartments, 703 3rd Street
- Senior assisted housing, 1203 Lincoln Avenue
- Addition of a leading pedestrian interval to the intersection of 3rd Street and Tamalpais Avenue West
- SMART train extension to Larkspur

Figure 6 and Figure 7 display the existing peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

This page intentionally left blank.

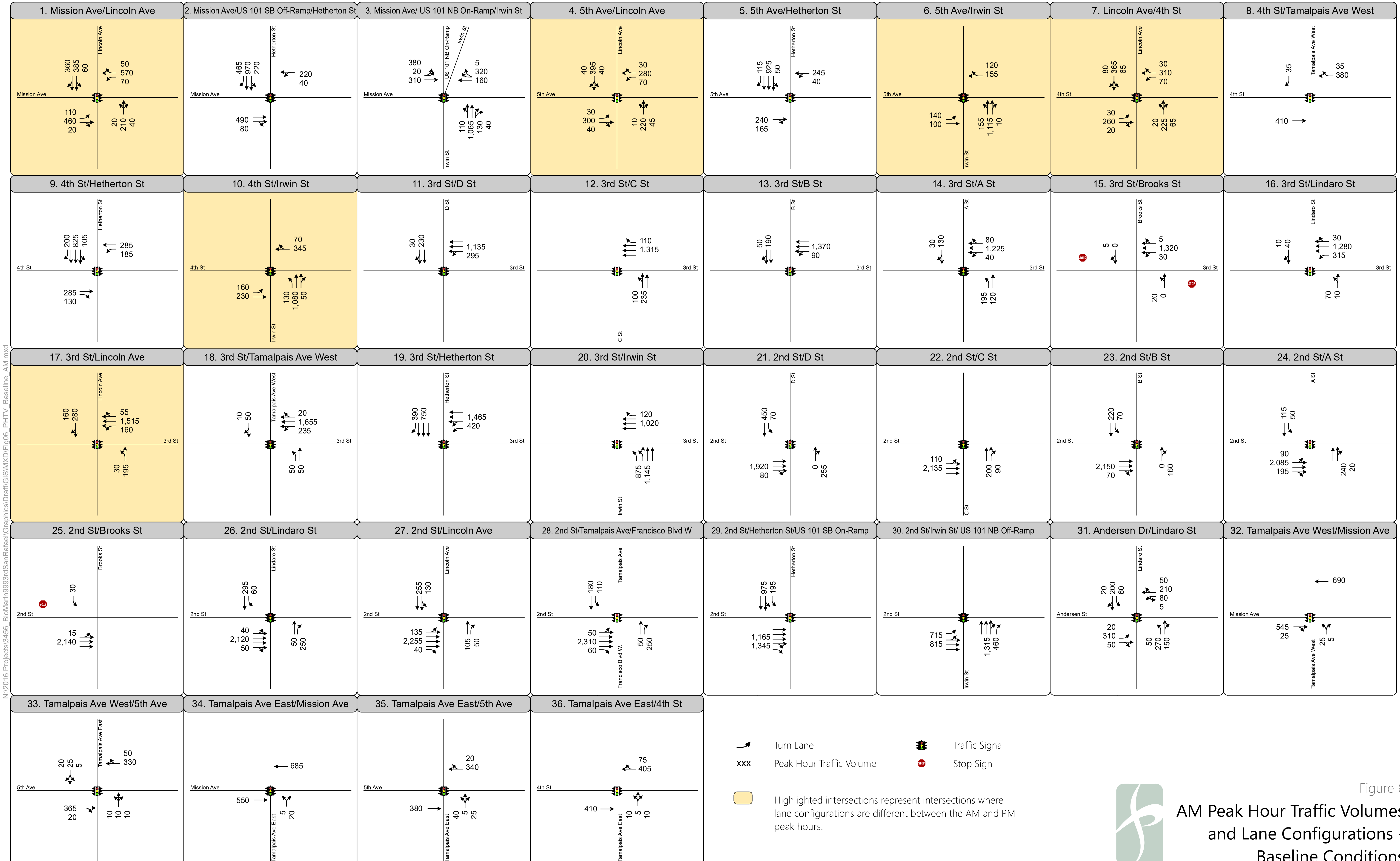


Figure 6

AM Peak Hour Traffic Volumes and Lane Configurations - Baseline Conditions

N:\2016 Projects\3456_BioMarin993rdSanRafael\Graphics\Draft\GIS\MXD\Fig06_PHTV_Baseline_AM.mxd

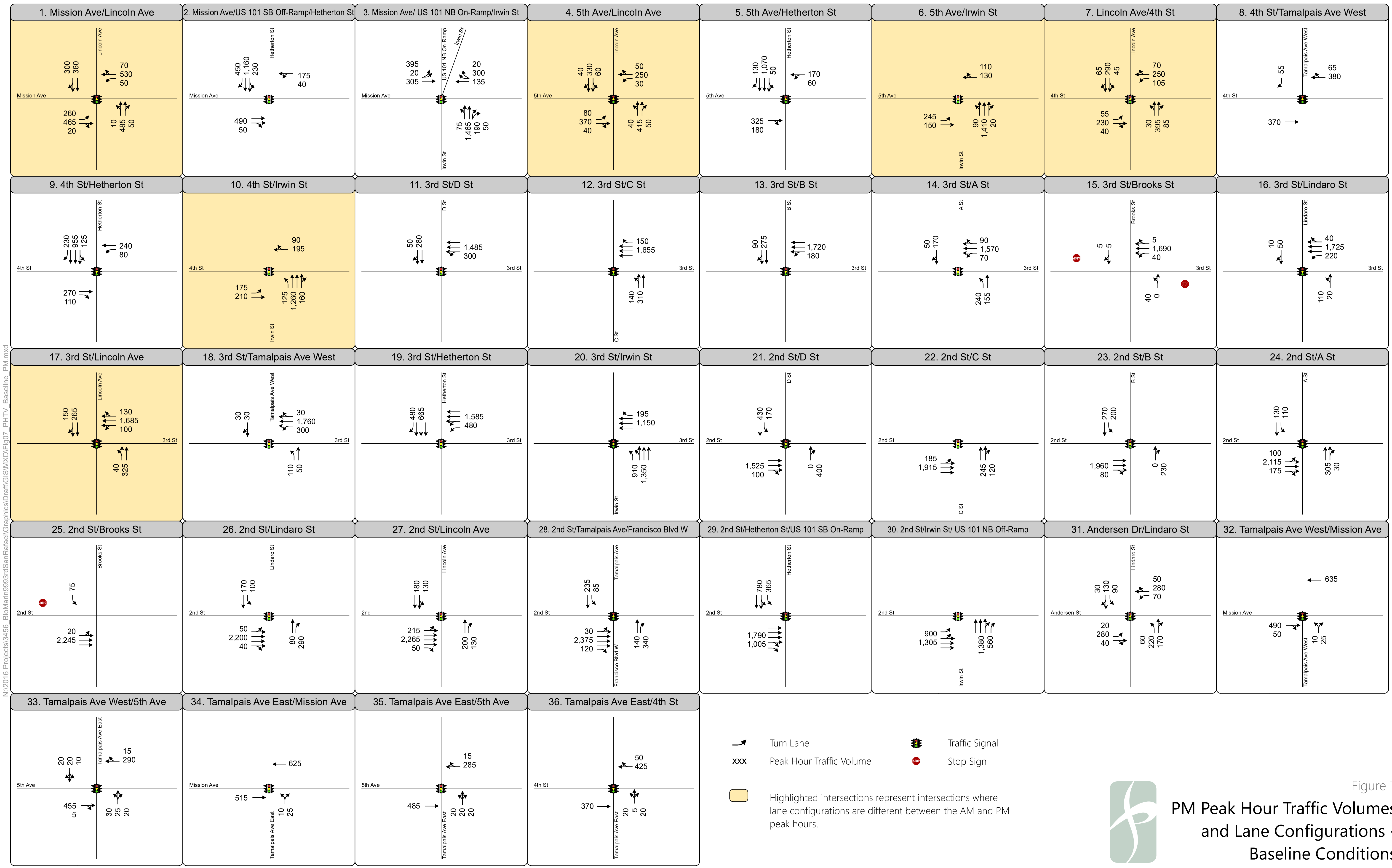


Figure 7
PM Peak Hour Traffic Volumes and Lane Configurations - Baseline Conditions

N:\2016 Projects\3456_BioMarin999\3rdSanRafael\Graphics\Draft\GIS\MXD\Fig07_PHTV_Baseline_PM.mxd

Intersection Operations

Table 10 summarizes the existing levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix B presents all LOS calculations.

TABLE 10: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE CONDITIONS

Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 25.8	D / 43.3
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 42.7	C / 26.9
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 25.6	C / 26.1
4. 5th Avenue and Lincoln Avenue	Signal	B / 16.0	A / 9.4
5. 5th Avenue and Hetherton Street[3]	Signal	A / 7.5	A / 8.9
6. 5th Avenue and Irwin Street	Signal	D / 41.0	C / 30.7
7. 4th Street and Lincoln Avenue	Signal	B / 19.2	C / 20.5
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 6.7	A / 4.5
9. 4th Street and Hetherton Street[3]	Signal	A / 9.7	A / 9.7
10. 4th Street and Irwin Street	Signal	D / 39.9	C / 30.0
11. 3rd Street and D Street	Signal	C / 27.5	C / 30.7
12. 3rd Street and C Street	Signal	C / 25.4	C / 29.6
13. 3rd Street and B Street	Signal	C / 26.7	C / 34.4
14. 3rd Street and A Street	Signal	C / 27.1	C / 31.5
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.9 (14.4)	A (B) / 2.0 (11.4)
16. 3rd Street and Lindaro Street	Signal	A / 5.9	B / 10.6
17. 3rd Street and Lincoln Avenue	Signal	D / 54.3	C / 31.7
18. 3rd Street and Tamalpais Avenue West[3]	Signal	C / 33.6	D / 47.8
19. 3rd Street and Hetherton Street	Signal	C / 32.5	D / 38.3
20. 3rd Street and Irwin Street	Signal	C / 28.9	C / 32.5
21. 2nd Street and D Street	Signal	A / 3.4	A / 3.4
22. 2nd Street and C Street	Signal	D / 42.9	D / 39.6
23. 2nd Street and B Street	Signal	A / 2.3	A / 3.0
24. 2nd Street and A Street	Signal	D / 41.6	D / 37.5
25. 2nd Street and Brooks Street	SSSC	A (B) / 2.8 (12.9)	A (D) / 3.4 (26.0)

TABLE 10: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE CONDITIONS			
Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
26. 2nd Street and Lindaro Street	Signal	B / 13.9	B / 15.7
27. 2nd Street and Lincoln Avenue	Signal	D / 48.3	D / 41.0
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	C / 29.2	C / 32.0
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	E / 73.6	C / 32.3
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 26.2	D / 37.7
31. Andersen Drive and Lindaro Street	Signal	C / 24.5	C / 22.7
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 25.2	B / 13.4
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.8	A / 7.6
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	E / 65.8	C / 26.3
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 6.5	A / 4.9
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 14.1	B / 11.8

Notes:

1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 18, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2019

Arterial Operations

Table 11 summarizes the baseline levels of service on the arterials in the analysis area. All operate acceptably except for 3rd Street and 2nd Street which both operate unacceptably during the AM and PM peak hours. Appendix B includes arterial LOS calculations.

TABLE 11: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – BASELINE CONDITIONS			
Arterial	Standard	LOS / Average Speed [1]	
		AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 7	E / 9
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 5
3. 3rd Street WB from Hetherton Street to D Street	D	**E / 9**	**E / 8**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 7**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 6	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 9	E / 8

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 8 presents baseline conditions freeway volumes, and Table 12 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix B. As shown, all segments operate at acceptable levels during the AM and PM peak hours with the exception of the southbound weave segment between the 2nd Street on-ramp and the I-580 EB off-ramp during the AM peak hour.

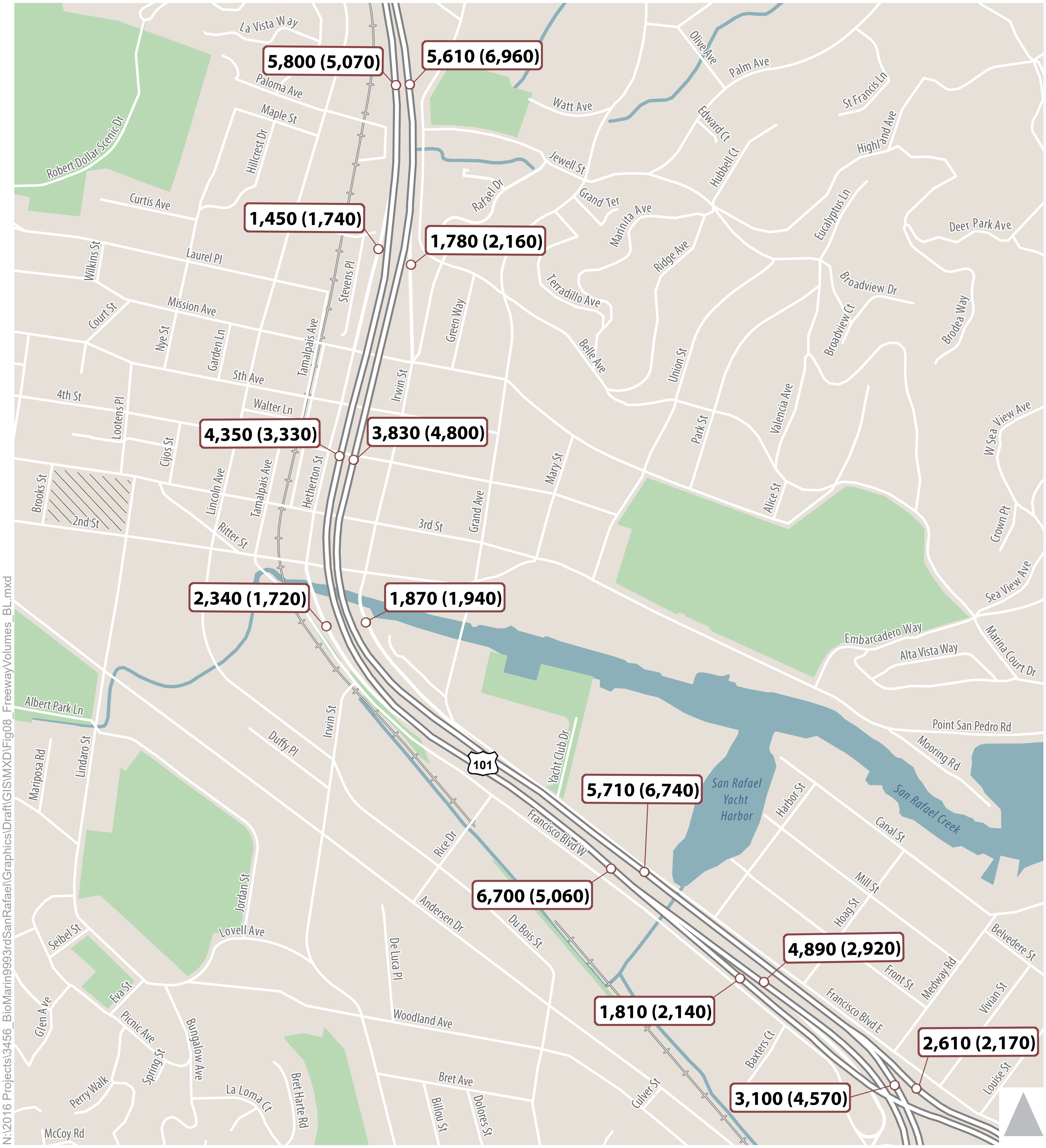
TABLE 12: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – BASELINE CONDITIONS				
Segment	Segment Type	Standard	LOS / Density (pc/mi/ln[1])	
			AM	PM
Northbound				
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	D / 35
Southbound				
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 38	D / 31
Mission Avenue Off-Ramp	Diverge	E	E / 38	E / 33
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to existing conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 13 summarizes these results.

TABLE 13: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – BASELINE CONDITIONS		
Off-Ramp	Increased Queue Length (feet)[1]	
	AM	PM
US 101 NB to 2nd Street	150	25
US 101 SB to Mission Avenue	50	50

Notes:
1. Compared to existing conditions
Source: Fehr & Peers, 2018



N:\2016 Projects\3456_BioMarin\9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig08_FreewayVolumes_BL.mxd

AM (PM) Freeway Volume

Figure 8

Weekday Peak Hour Freeway Volumes - Baseline Conditions

Project Conditions

This chapter discusses trip generation and trip distribution of the proposed project.

Trip Generation

BioMarin R&D Facility

Current accepted trip generation methodologies, such as applying trip rates from the Institute of Transportation Engineers' (ITE) Trip Generation, are based on data collected at suburban, single-use, freestanding sites where virtually all of the trips are made by auto. These defining suburban characteristics limit the trip rate applicability to mixed-use projects and/or projects located in walkable districts with high levels of transit service that would have travel characteristics that are different from single-use suburban developments. The project site is both located in a walkable downtown district and proximate to transit, requiring an adjustment to ITE trip rates to reflect the level of transit use, walking, and bicycling that would occur to the project site. ITE recommends that local travel data is preferred if available to account for the unique context of project sites. For this trip generation assessment, trip generation forecasts are shown both based on trip count data at the existing BioMarin San Rafael campus (assuming similar employee composition as the existing BioMarin San Rafael campus) and based on unadjusted ITE trip rates.

Table 14 provides trip generation forecasts based on peak hour driveway count data at the current BioMarin San Rafael campus parking facilities and the number of employees currently working at the campus. Count data was collected on Tuesday, October 24 and Tuesday, November 7, 2018. Schools were in session at the time of the counts, weather conditions were dry, and no unusual traffic conditions were observed. Using the number of employees working at the existing San Rafael campus buildings, peak hour trip rates per employee were calculated.

TABLE 14: TRIP GENERATION RATES FOR PROPOSED BIOMARIN FACILITY (BASED ON BIOMARIN SAN RAFAEL CAMPUS OBSERVATIONS)

Land Use	Units (employees)	Trip Rate			Trips		
		Daily	Peak Hour		Daily	Peak Hour	
			AM	PM		AM	PM
Research and Development Center	550	NA	0.37	0.35	NA	203	191

Note: NA = not available
Source: Fehr & Peers, 2018.

The trip rate calculated based on San Rafael campus driveway counts is lower than that estimated using unadjusted ITE trip rates (Table 15), which is discussed further below.

TABLE 15: TRIP GENERATION RATES FOR PROPOSED BIOMARIN FACILITY (BASED ON ITE)

Land Use	ITE Code	Units (employees)	Trip Rate			Trips		
			Daily	Peak Hour		Daily	Peak Hour	
				AM	PM		AM	PM
Research and Development Center	760	550	3.39	0.44	0.40	1,863	242	219

Source: Fehr & Peers, 2018.

An employee travel survey conducted at the BioMarin San Rafael Campus in March and April 2018 indicates that on a typical day 16 percent of BioMarin employees use modes other than drive alone, including transit, bicycle, telecommute, and walking. These survey results explain why the BioMarin trip rates are lower than unadjusted ITE trip rates.

- In the survey, driving alone represented 84 percent of mode split
- 8 percent of commute trips were made by public transportation
- 4 percent of workers telecommuted on a typical day
- The remainder of commute trips were by carpooling, biking, walking, or drop-off
- Many BioMarin employees have flexible work schedules and can commute outside of peak hours

The trip generation for the new building was calculated based on the number of new employees. The resulting trip generation is summarized below in Table 16. (Because full-day counts were not available, ITE rates were used to calculate daily trips.)

TABLE 16: TRIP GENERATION ESTIMATE FOR BIOMARIN R&D FACILITY																
Land Use	ITE Code	Units (employees)	Trip Rate							Trips						
			Daily	AM Peak Hour			PM Peak Hour			Daily	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out		Total	In	Out	Total	In	Out
Research and Development Center	760	550	3.39	0.37	91%	9%	0.35	9%	91%	1,863	203	185	18	191	17	174
Source: Fehr & Peers, 2018																

Senior Services and Housing

The northwest corner of the project site is proposed for development of a senior center (18,000 GSF) and affordable housing (67 units) for low income seniors. The senior center will include classrooms, meeting spaces, and other senior services. Sixty-six of the apartments will be leased to residents who do not own vehicles, with the restriction made as a requirement of the lease. One apartment will be occupied by the center manager. The senior center will have 12 parking spaces.

Trip generation levels were determined using the ITE *Trip Generation Manual, 10th Edition* based on the land use for the senior center and housing, then applied trip reduction percentages based on characteristics of the project and surrounding area. The results of this analysis are summarized in Table 17 and explained below.

TABLE 17: TRIP GENERATION ESTIMATE FOR SENIOR CENTER AND HOUSING																
Land Use	ITE Code	Qty[1]	Trip Rate							Trips						
			Daily	AM Peak Hour			PM Peak Hour			Daily	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out		Total	In	Out	Total	In	Out
Recreational Community Center	495	18 KSF	28.82	1.76	66%	34%	2.31	47%	53%	519	32	21	11	42	20	22
Senior Adult Housing – Attached	252	66 DU	3.64	0.20	35%	65%	0.27	55%	45%	240	13	5	8	18	10	8
Apartment	220	1 DU	6.95	0.49	23%	77%	0.62	63%	37%	7	0	0	0	1	1	0
Total Trips (before reduction)										766	45	26	19	61	31	30
Reduction			-23%	-26%			-26%			-176	-12	-7	-5	-16	-8	-8
Total Net External Vehicle Trips (after reduction)										590	33	19	14	32	16	16

Notes:
[1]KSF = thousand square feet, DU = dwelling units
Source: Fehr & Peers, 2018

MXD Trip Reduction Methodology

The MXD trip reduction methodology was used to estimate the reduction in trips from standard ITE rates. The MXD model was developed through collaboration between consultants, the U.S. EPA, and an academic research team. Travel survey data was gathered from 239 mixed-use developments (MXDs) in six major metropolitan regions and correlated with characteristics of the sites and their surroundings. The findings indicate that the amount of external traffic generated is affected by a wide variety of factors including the mix of employment and residents, the overall size and density of the development, the internal connectivity for walking or driving among land uses, the availability of transit service, and the surrounding trip destinations within the immediate area outside the project site. These characteristics were related statistically to trip behavior observed at the study development sites using statistical techniques. These statistical relationships produced equations, known as the EPA MXD model that allows predicting external vehicle trip reduction as a function of the MXD characteristics. Applying external vehicle trip reduction percentage to “raw trips,” as predicted by ITE, produces an estimate for the number of vehicle trips traveling in or out of the site.

The MXD model adjusts trip generation rates to account for the influence of built environment variables such as

- the size of the mixed-use analysis area,
- the number of intersections within the mixed-use analysis area,
- the distance to transit,
- employment within a 30-minute transit trip,
- employment within one mile,
- average household size near the site, and
- average number of vehicles per household near the site.

A variety of research studies have demonstrated that these variables influence vehicle trip generation.

MXD+, Fehr & Peers’ implementation of the MXD methodology, was applied to determine the reduction in automobile trips from the proposed senior center and senior housing facility because of its location in a downtown, mixed-use environment. The MXD+ analysis incorporates data from the EPA Smart Location database, the US Census American Community Survey, and the Metropolitan Transportation Commission travel model to estimate the number of trips to and from destinations outside of the analysis area via walking, biking, and transit.

To avoid underestimating vehicle trips, the estimated share of walking, biking, and transit trips forecast by MXD were reduced by 30%, resulting in a higher number of vehicle trips than forecasted by MXD. Two primary factors support this reduction: the income of senior center staff is not likely to match that needed for nearby housing, which may necessitate increased driving for affordable housing; and potentially reduced mobility of senior center residents may also reduce walking and biking trips. These results are summarized in Table 18, and supported further following the table.

TABLE 18: MXD TRIP REDUCTION SUMMARY		
Category	**Daily**	**Peak Hour**
Walking, biking, and transit	33%	37%
Additional project factors	-10%	-11%
Total trip reduction	**23%**	**26%**
Source: Fehr & Peers, 2018.		

These conclusions are also supported by an analysis done for an earlier version of this project. The senior center and senior housing project is an updated version of the Whistlestop project evaluated in 2014, which was also located in downtown San Rafael. W-Trans letter "Focused Traffic Analysis for the Whistlestop Project," dated July 8, 2014, identified several factors likely to reduce overall vehicle trips for the senior center and senior housing:

- The "Focused Traffic Analysis" documented existing mode shares for the current Whistlestop Senior Center located at 930 Tamalpais Avenue, adjacent to the Bettini Transit Center (Table 6 of that document). Forty percent of visitors arrived by walking, biking, or transit. Some residents of the on-site senior housing will also use the senior center. However, the 2014 analysis did not account for the trips generated by senior center staff. Additionally, the current project location is farther from Bettini Transit Center than the 2014 location, which was next to the transit center. Thus, the reductions shown in Table 19 are appropriate for this project.

TABLE 19: MODE SHARE FOR SENIOR CENTER VISITORS	
Mode	**Share**
Transit	24%
Paratransit	10%
Walking	6%
Private vehicle	60%
Total vehicle trip reduction	**40%**
Source: W-Trans, 2014.	

- The "Focused Traffic Analysis" estimated trip reduction considering that the housing will be occupied by low-income seniors and automobile ownership will be prohibited by lease requirements. However, some amount of traffic associated with visitors including family, friends, aides, and deliveries is still expected. The reductions shown in Table 17 are reasonable for these conditions.

Trip Generation Summary

Table 20 summarizes the total vehicle trip generation for the project, including both the BioMarin facility and the senior center and housing.

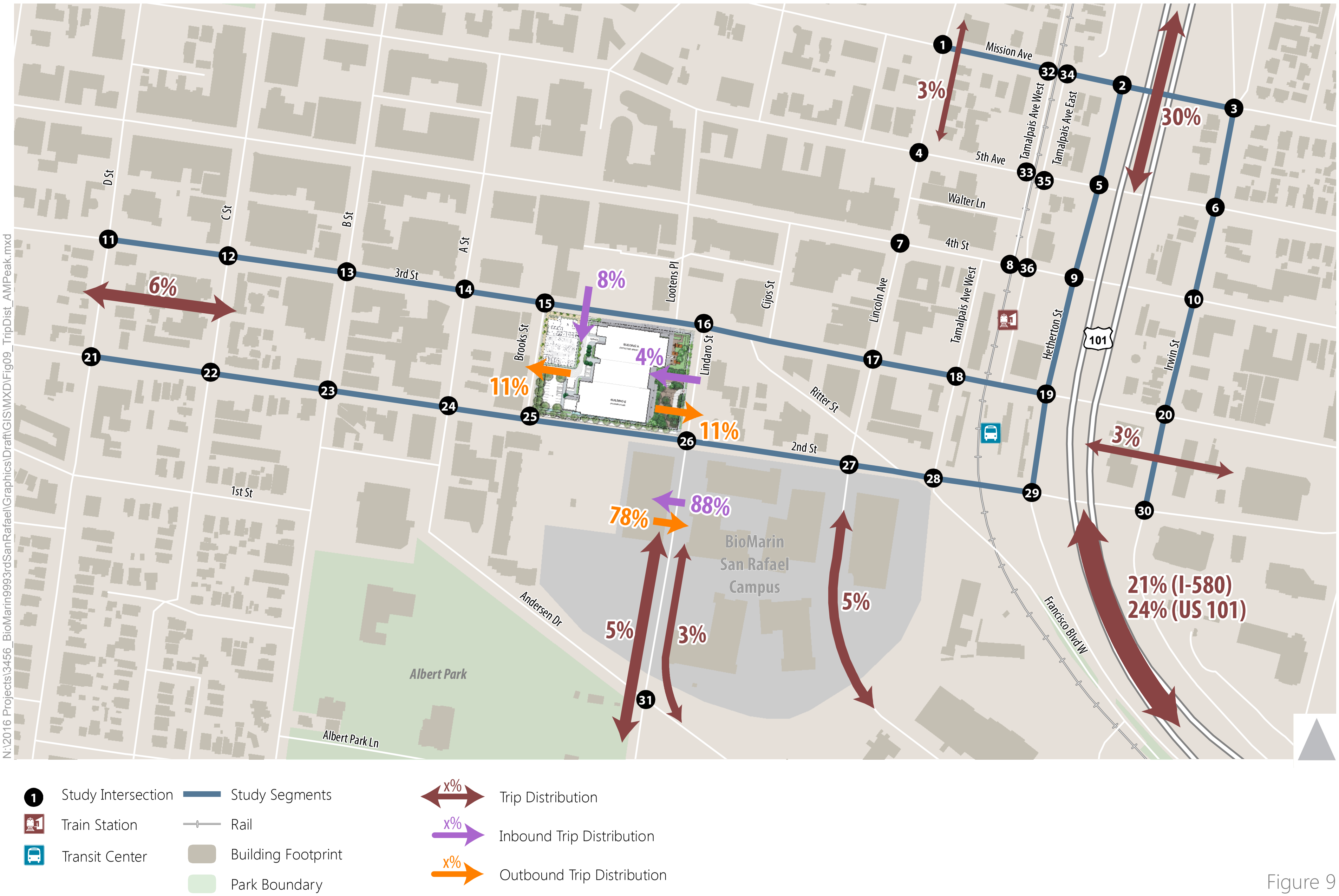
TABLE 20: TOTAL VEHICLE TRIP GENERATION SUMMARY

	Daily	AM Peak Hour			PM Peak Hour		
		Total	Enter	Exit	Total	Enter	Exit
BioMarin facility (daily from Table 15, peak hour from Table 16)	1,863	203	185	18	191	17	174
Senior center and housing (from Table 17)	590	33	19	14	45	23	22
Total	2,453	236	204	32	236	40	196

Source: Fehr & Peers, 2018

Trip Distribution

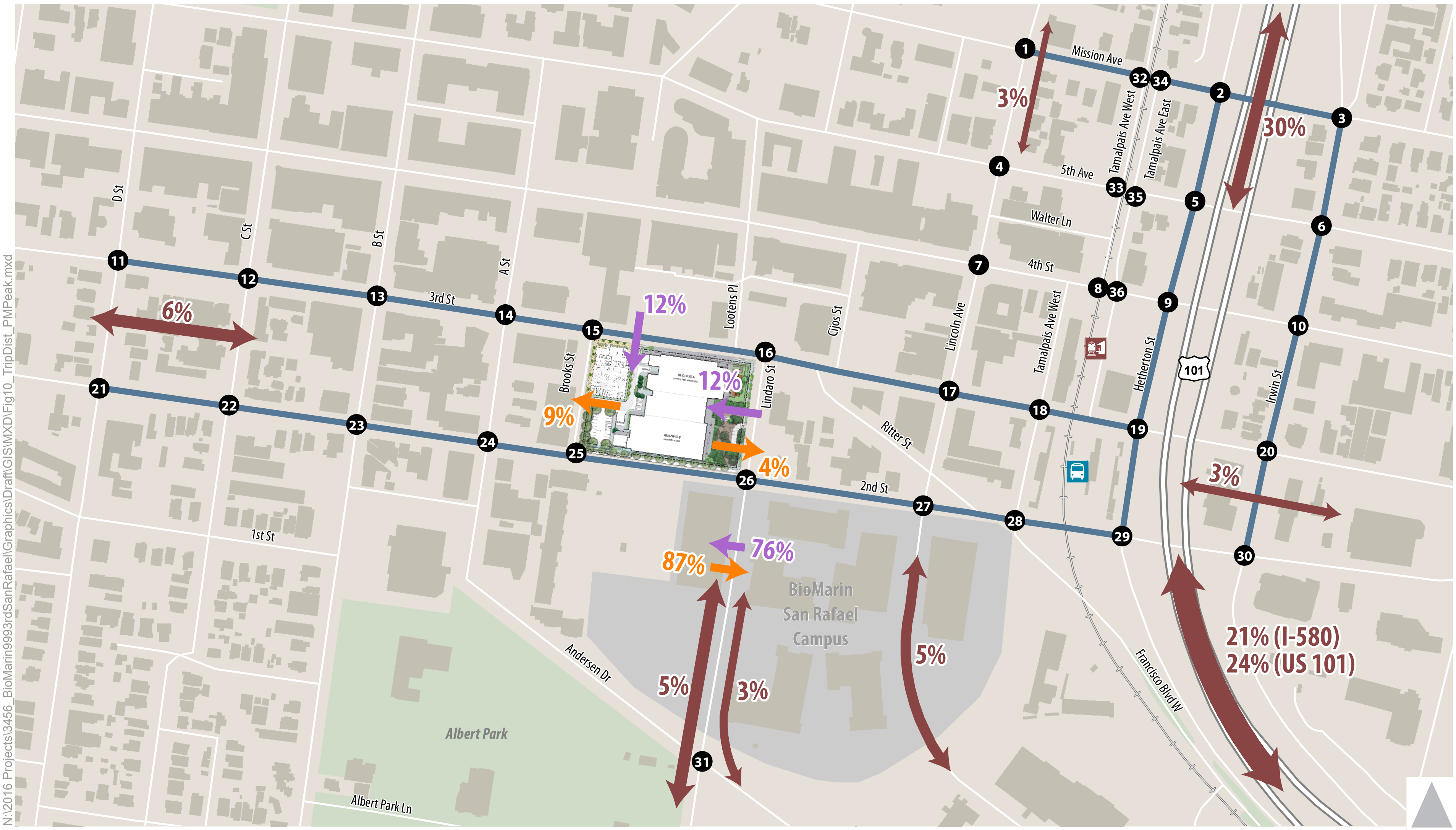
The project trip distribution shown below is based on zip codes of current BioMarin San Rafael campus employees. Vehicle trips from the proposed project were assigned through the study intersections to study area gateways as shown in Figure 9 and Figure 10. Because parking at the project site is limited (29 spaces), most BioMarin employees will use the BioMarin garage at 775 Lindaro Street. All Senior Center visitors and employees will use the Brooks Street driveways, as shown in Figure 11.



N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig09_TripDist_AMPeak.mxd

Figure 9

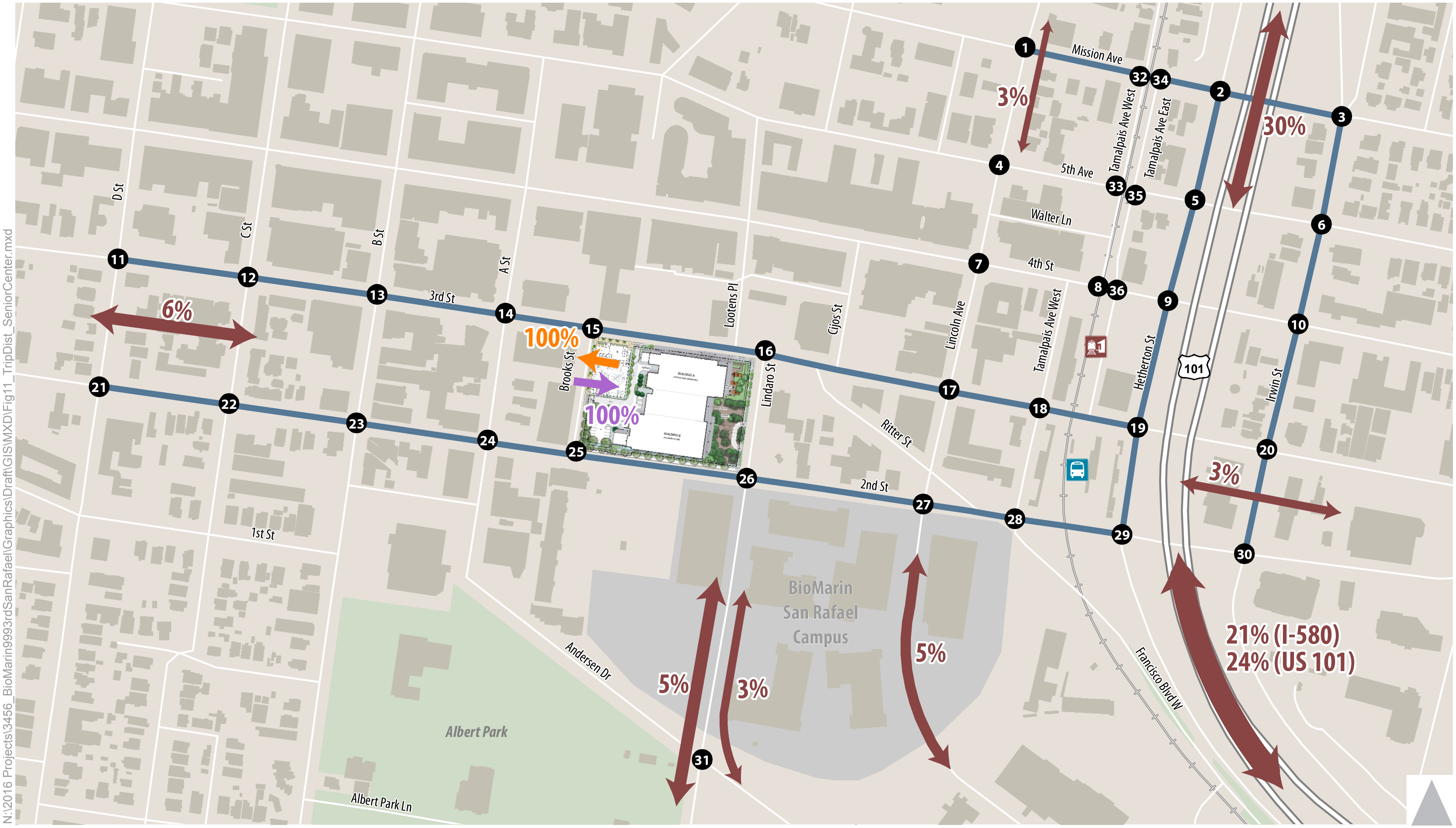
Trip Distribution (R & D Only) - AM Peak Hour



Study Intersection
Train Station
Transit Center
Study Segments
Rail
Building Footprint
Park Boundary
x% Trip Distribution
x% Inbound Trip Distribution
x% Outbound Trip Distribution

Figure 10

Trip Distribution (R & D Only) -
PM Peak Hour



N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig11_TripDist_SeniorCenter.mxd

Figure 11

Trip Distribution (Senior Center and Housing)

Project Pedestrian Crossings

The BioMarin R&D facility and senior services and housing would generate a total of 215 new pedestrian trips during the AM peak hour and 213 new pedestrian trips during the PM peak hour. These trips would be most concentrated at intersections adjacent to the project site. The following factors were considered in assigning pedestrian trips to existing pedestrian crossings at intersections:

- Trips between the R&D facility and the Lindaro Street garage
- Trips between the R&D facility and the existing BioMarin San Rafael campus buildings
- Trips between the R&D facility and the San Rafael SMART station and transit center
- Trips between the R&D facility and other destinations (including residences and downtown)
- Trips between the senior service and housing and the San Rafael SMART station and transit center
- Trips between the senior service and housing and other destinations (including residences, shopping, and downtown)

These added project pedestrian crossings are summarized in Table 21. Most peak hour pedestrian trips generated by the project are employees that would travel to and from the Lindaro Street Garage. The most direct path for these pedestrians would involve using the crosswalk on the west side of the 2nd Street/Lindaro Street intersection. Some peak hour pedestrian trips would cross 3rd Street to travel to and from the existing parking garage on the north side of 3rd Street as well as businesses along 4th Street. Crossing 3rd Street at Brooks Street is currently prohibited. New project crossings in Table 21 are based on retention of this crossing restriction at 3rd Street and Brooks Street. If the existing barriers and signage were removed and a crosswalk were added on the east leg of the 3rd Street/Brooks Street intersection, most of the 4 crossings in the AM peak hour, 5 crossings in the PM peak hour, and 53 total daily crossings generated by the project would shift to this crosswalk from the south leg crosswalk.

TABLE 21: AM AND PM PEAK HOUR NEW PEDESTRIAN CROSSINGS		
Leg	**New Weekday Project Pedestrian Crossings**	
	AM Peak Hour	**PM Peak Hour**
15. 3rd Street and Brooks Street		
North		
South	4	5
16. 3rd Street and Lindaro Street		
East	5	5
North	5	5
South	23	26
25. 2nd Street and Brooks Street		
West		
East		
North	2	2
26. 2nd Street and Lindaro Street		
West	181	168
East	4	3
North	9	8
South	5	3
Source: Fehr & Peers, 2018.		

The BioMarin R&D facility and senior services and housing would generate a total of 146 new pedestrian trips to destinations north of 3rd Street during the lunchtime peak hour. 130 trips from the BioMarin buildings were estimated based on pedestrian count data at the existing BioMarin San Rafael campus (assuming similar employee composition as the existing BioMarin San Rafael campus). Although meals will be served at the senior services center, likely decreasing lunchtime pedestrian trips, 16 pedestrian trips, comparable to PM peak hour, were assumed. The following factors were considered in assigning pedestrian trips to existing pedestrian crossings at intersections:

- Many lunchtime trips are expected to be to restaurants. The destination for these pedestrian trips was considered to be north of 3rd Street.
- Considering these likely destinations, most new pedestrians trips going north of 3rd Street are expected to cross 3rd Street at Lindaro Street. Some (10 percent) were estimated to cross 3rd Street at A Street.
- Some new pedestrian trips are likely to occur between the new BioMarin facility and the existing BioMarin campus. This number was conservatively estimated to be comparable to the number of pedestrians walking to destinations north of 3rd Street.

- Fewer trips are expected to destinations west of 2nd Street and Brooks Street, due to the fewer number of likely destinations.

These added project pedestrian crossings are summarized in Table 22.

TABLE 22: LUNCHTIME PEAK HOUR NEW PEDESTRIAN CROSSINGS

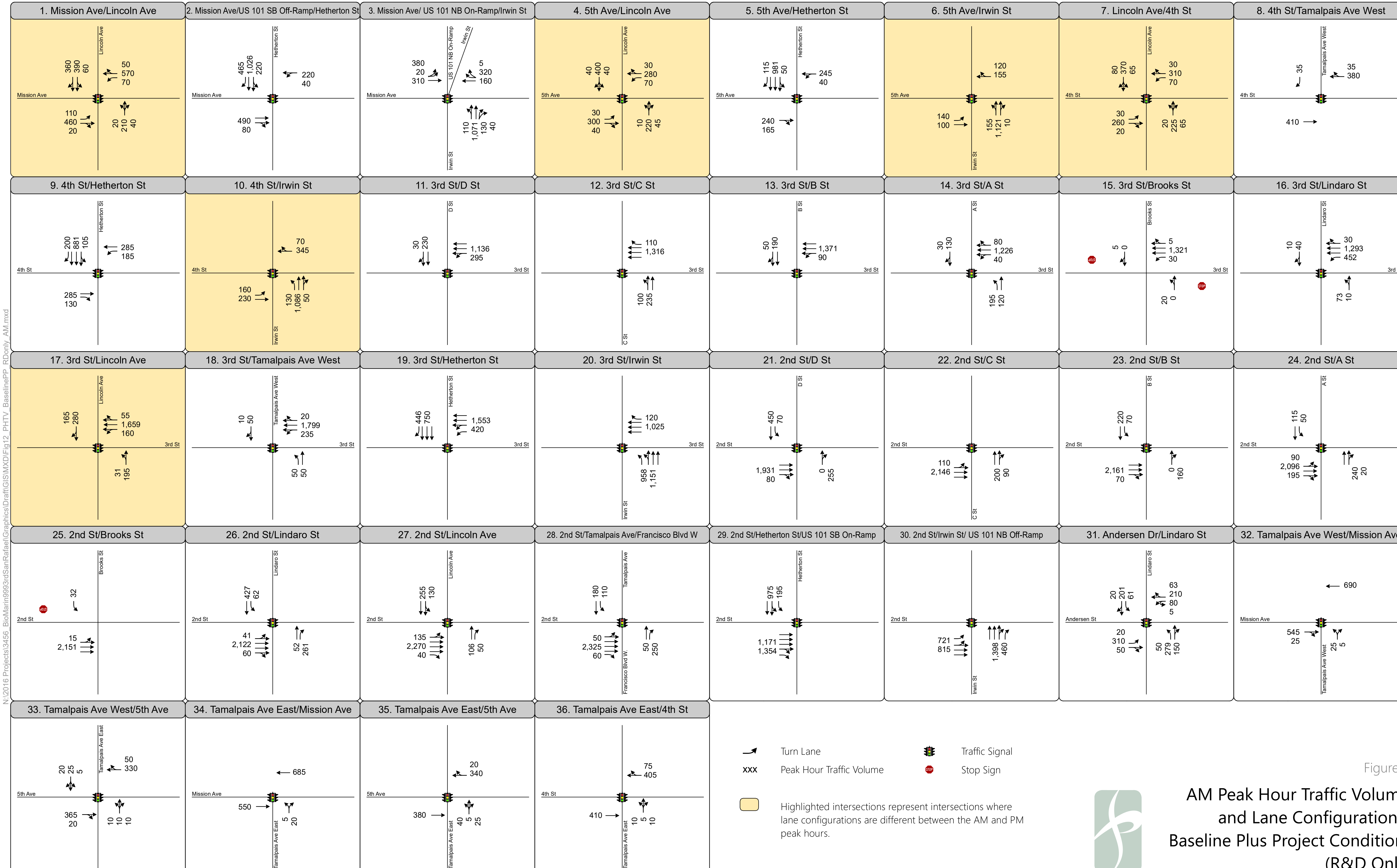
Leg	New Pedestrian Crossings
15. 3rd Street and Brooks Street	
North	
South	15
16. 3rd Street and Lindaro Street	
East	131
North	66
South	131
25. 2nd Street and Brooks Street	
West	
East	
North	5
26. 2nd Street and Lindaro Street	
West	66
East	65
North	65
South	66

Source: Fehr & Peers, 2019.

Baseline Plus Project Conditions (R&D Only)

The Baseline Plus Project (R&D Only) scenario includes baseline transportation conditions plus trips generated from the new R&D buildings. It does not include trips generated by the senior services and housing building.

Figure 12 and Figure 13 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.



Turn Lane

xxx Peak Hour Traffic Volume

Traffic Signal

Stop Sign

Highlighted intersections represent intersections where lane configurations are different between the AM and PM peak hours.

Figure 12

AM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D Only)

N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig12_PHTV_BaselinePP_RDonly_AM.mxd

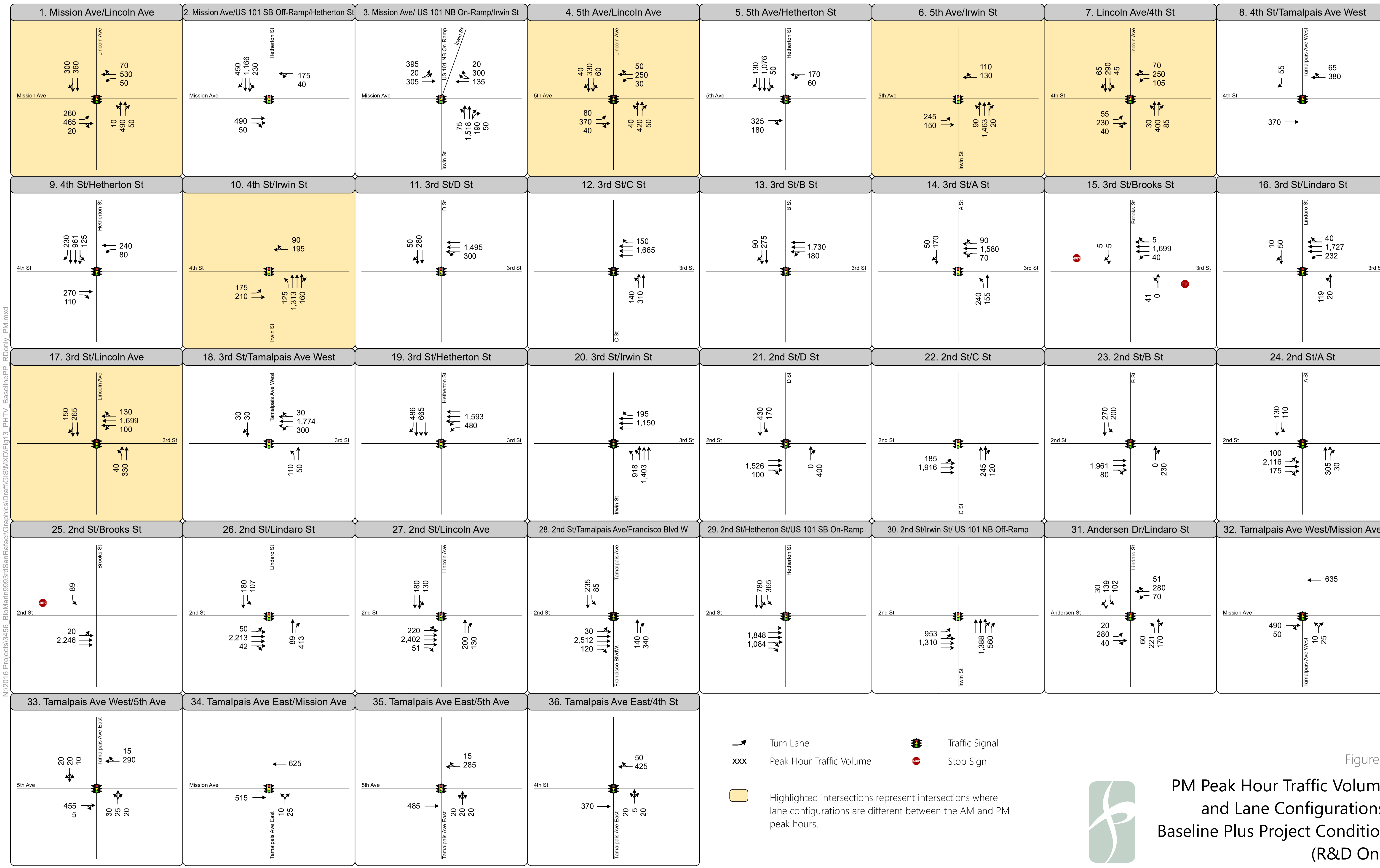


Figure 13

PM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D Only)

N:\2016 Projects\3456_BioMarin993rdSanRafael\Graphics\Draft\GIS\MXD\Fig13_PHTV_BaselinePP_RDonly_PM.mxd

Intersection Operations

Table 23 summarizes baseline plus project (R& D only) levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix C presents all LOS calculations.

TABLE 23: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Intersection	Control Type	Baseline LOS / Average Delay [1, 2]		Baseline Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 25.8	D / 43.3	C / 25.8	D / 43.2
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 42.7	C / 26.9	D / 48.2	C / 27.4
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 25.6	C / 26.1	C / 25.5	C / 26.6
4. 5th Avenue and Lincoln Avenue	Signal	B / 16.0	A / 9.4	B / 16.0	A / 9.5
5. 5th Avenue and Hetherton Street[3]	Signal	A / 7.5	A / 8.9	A / 7.3	A / 8.9
6. 5th Avenue and Irwin Street	Signal	D / 41.0	C / 30.7	D / 41.3	C / 31.7
7. 4th Street and Lincoln Avenue	Signal	B / 19.2	C / 20.5	B / 19.1	C / 20.6
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 6.7	A / 4.5	A / 6.7	A / 4.5
9. 4th Street and Hetherton Street[3]	Signal	A / 9.7	A / 9.7	A / 9.6	A / 9.7
10. 4th Street and Irwin Street	Signal	D / 39.9	C / 30.0	D / 39.7	C / 30.2
11. 3rd Street and D Street	Signal	C / 27.5	C / 30.7	C / 27.5	C / 30.8
12. 3rd Street and C Street	Signal	C / 25.4	C / 29.6	C / 25.4	C / 29.7
13. 3rd Street and B Street	Signal	C / 26.7	C / 34.4	C / 26.7	C / 34.6
14. 3rd Street and A Street	Signal	C / 27.1	C / 31.5	C / 27.1	C / 31.6
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.9 (14.4)	A (B) / 2.0 (11.4)	A (B) / 2.7 (14.5)	A (B) / 2.6 (12.4)
16. 3rd Street and Lindaro Street	Signal	A / 5.9	B / 10.6	B / 13.3	B / 11.2
17. 3rd Street and Lincoln Avenue	Signal	D / 54.3	C / 31.7	E / 57.8	C / 31.9
18. 3rd Street and Tamalpais Avenue West [3]	Signal	C / 33.6	D / 47.8	D / 51.2	D / 49.9
19. 3rd Street and Hetherton Street	Signal	C / 32.5	D / 38.3	D /38.3	D / 38.9
20. 3rd Street and Irwin Street	Signal	C / 28.9	C / 32.5	C / 29.6	C / 33.5
21. 2nd Street and D Street	Signal	A / 3.4	A / 3.4	A / 3.4	A / 3.4
22. 2nd Street and C Street	Signal	D / 42.9	D / 39.6	D / 43.6	D / 39.6
23. 2nd Street and B Street	Signal	A / 2.3	A / 3.0	A / 2.3	A / 3.0

TABLE 23: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)					
Intersection	Control Type	Baseline LOS / Average Delay 1, 2		Baseline Plus Project LOS / Average Delay 1, 2	
		AM	PM	AM	PM
24. 2nd Street and A Street	Signal	D / 41.6	D / 37.5	D / 42.1	D / 37.6
25. 2nd Street and Brooks Street	SSSC	A (B) / 2.8 (12.9)	A (D) / 3.4 (26.0)	A (C) / 2.8 (15.6)	A (D) / 4.0 (31.7)
26. 2nd Street and Lindaro Street	Signal	B / 13.9	B / 15.7	B / 16.4	B / 17.9
27. 2nd Street and Lincoln Avenue	Signal	D / 48.3	D / 41.0	D / 49.3	D / 48.9
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	C / 29.2	C / 32.0	C / 29.4	D / 36.4
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	E / 73.6	C / 32.3	E / 75.1	C / 32.6
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 26.2	D / 37.7	C / 26.6	D / 39.4
31. Andersen Drive and Lindaro Street	Signal	C / 24.5	C / 22.7	C / 24.9	C / 23.0
32. Tamalpais Avenue West and Mission Avenue3	Signal	C / 25.2	B / 13.4	C / 25.2	B / 13.4
33. Tamalpais Avenue West and 5th Avenue3	Signal	A / 6.8	A / 7.6	A / 6.8	A / 7.5
34. Tamalpais Avenue East and Mission Avenue3	Signal	E / 65.8	C / 26.3	E / 65.8	C / 26.3
35. Tamalpais Avenue East and 5th Avenue3	Signal	A / 6.5	A / 4.9	A / 6.5	A / 4.9
36. Tamalpais Avenue East and 4th Street3	Signal	B / 14.1	B / 11.8	B / 14.0	B / 11.8

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 18, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2019

Arterial Operations

Table 24 summarizes the baseline levels with project (R& D only) levels of service on the arterials in the analysis area. Appendix C includes arterial LOS calculations.

TABLE 24: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Arterial	Standard	Baseline LOS / Average Speed [1]		Baseline Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 7	E / 9	E / 7	E / 9
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 5	F / 3	F / 5
3. 3rd Street WB from Hetherton Street to D Street	D	**E / 9**	**E / 8**	**E / 8**	**E / 8**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 7**	**F / 6**	**F / 6**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 6	E / 8	F / 6	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 9	E / 8	E / 8	E / 8

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 25. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 25: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Segment	Baseline		Baseline Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.773	0.860	0.833	0.866	**0.060**	0.006
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.784	0.873	0.789	0.916	0.005	0.043

Notes:
1. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Freeway Operations

Figure 14 presents baseline plus project (R&D only) conditions freeway volumes, and Table 26 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix C. Addition of project traffic does not create any additional unacceptable operations.

TABLE 26: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)						
Segment	**Segment Type**	**Standard**	**Baseline LOS / Density (pc/mi/ln[1])**		**Baseline Plus Project LOS / Density (pc/mi/ln[1])**	
			AM	**PM**	**AM**	**PM**
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29	C / 23	D / 30
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	D / 35	D / 27	E / 35
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 38	D / 31	E / 39	D / 31
Mission Avenue Off-Ramp	Diverge	E	E / 38	E / 33	E / 38	E / 33
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21	D / 27	C / 21
2nd Street On-Ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology.

Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segment with unacceptable operations, as shown in Table 27. Increases due to the project were acceptable (less than 0.01).

TABLE 27: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)						
Segment	**Baseline**		**Baseline Plus Project**		**Increase**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Southbound						
2nd Street On-Ramp to I-580 EB Off-Ramp	1.183	NA[1]	1.185	NA[1]	0.002	NA[1]

Notes:
1. NA, acceptable operations. **Bold** indicates unacceptable increase.

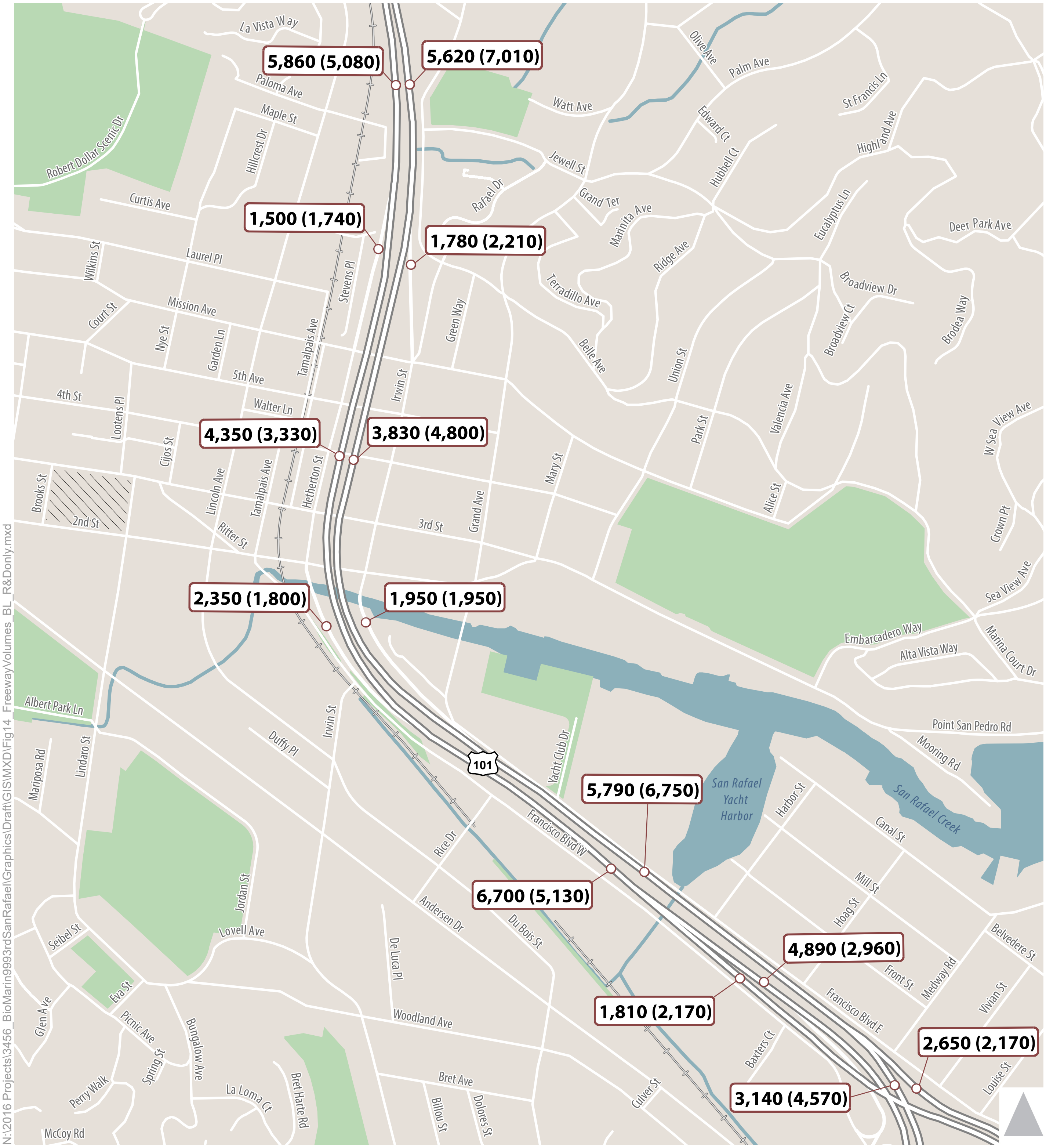
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to baseline conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 28 summarizes these results.

TABLE 28: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)		
Off-Ramp	**Increased Queue Length (feet)[1]**	
	AM	**PM**
US 101 NB to 2nd Street	0	0
US 101 SB to Mission Avenue	25	0

Notes:
1. Compared to baseline conditions

Source: Fehr & Peers, 2018



N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig14_FreewayVolumes_BL_R&Donly.mxd

AM (PM) Freeway Volume

Figure 14

Weekday Peak Hour Freeway Volumes - Baseline Plus Project Conditions (R&D Only)

Baseline Plus Project Conditions (R&D and Senior Services and Housing)

The Baseline Plus Project (R&D and Senior Services and Housing) scenario includes baseline transportation conditions plus trips generated from the new R&D buildings and the senior services and housing building.

Figure 15 and Figure 16 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

This page intentionally left blank.

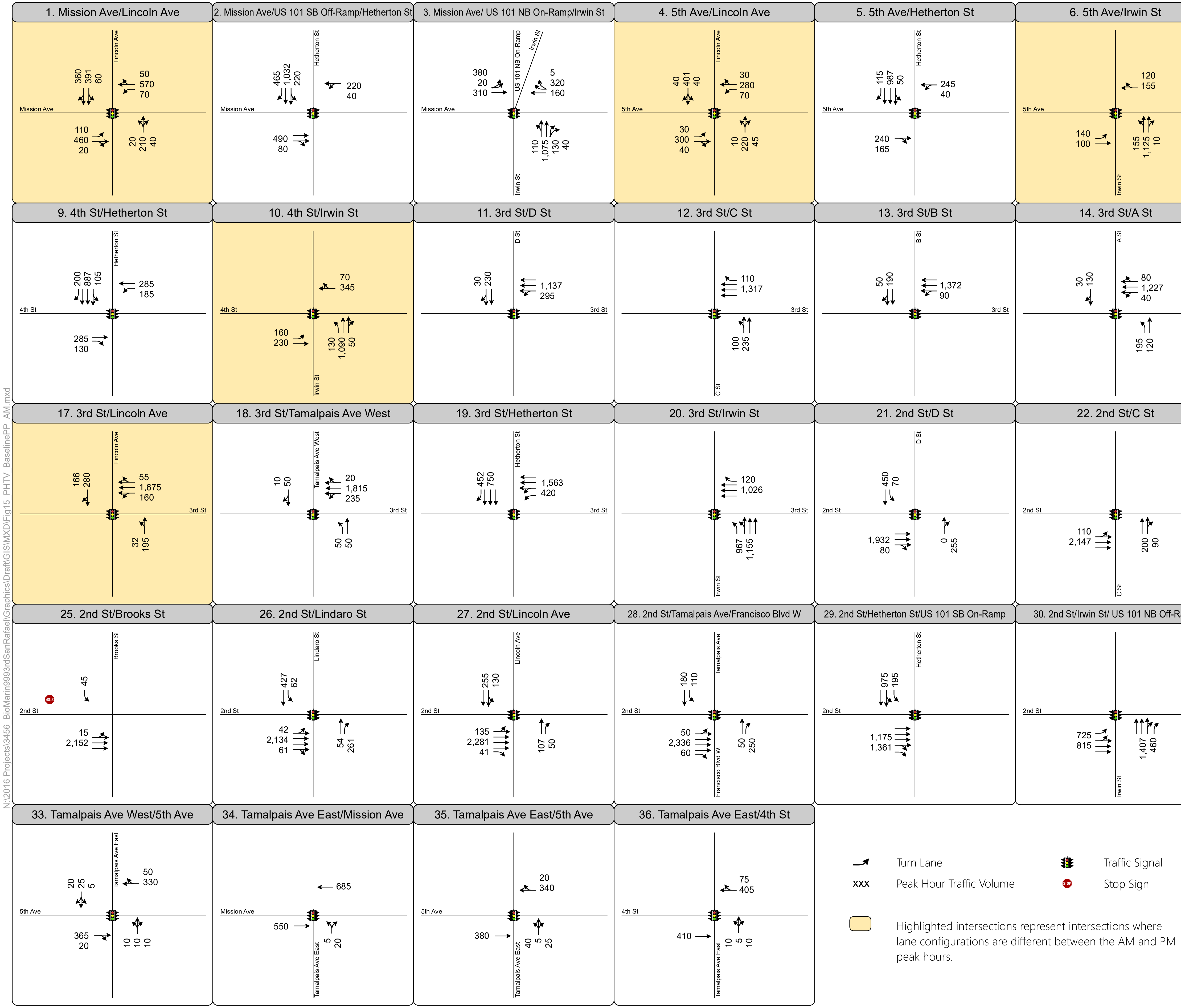


Figure 15

AM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D and Senior Services and Housing)

N:\2016 Projects\3456_BioMarin999\3rdSanRafael\Graphics\Draft\GIS\MXD\Fig15_PHTV_BaselinePP_AM.mxd

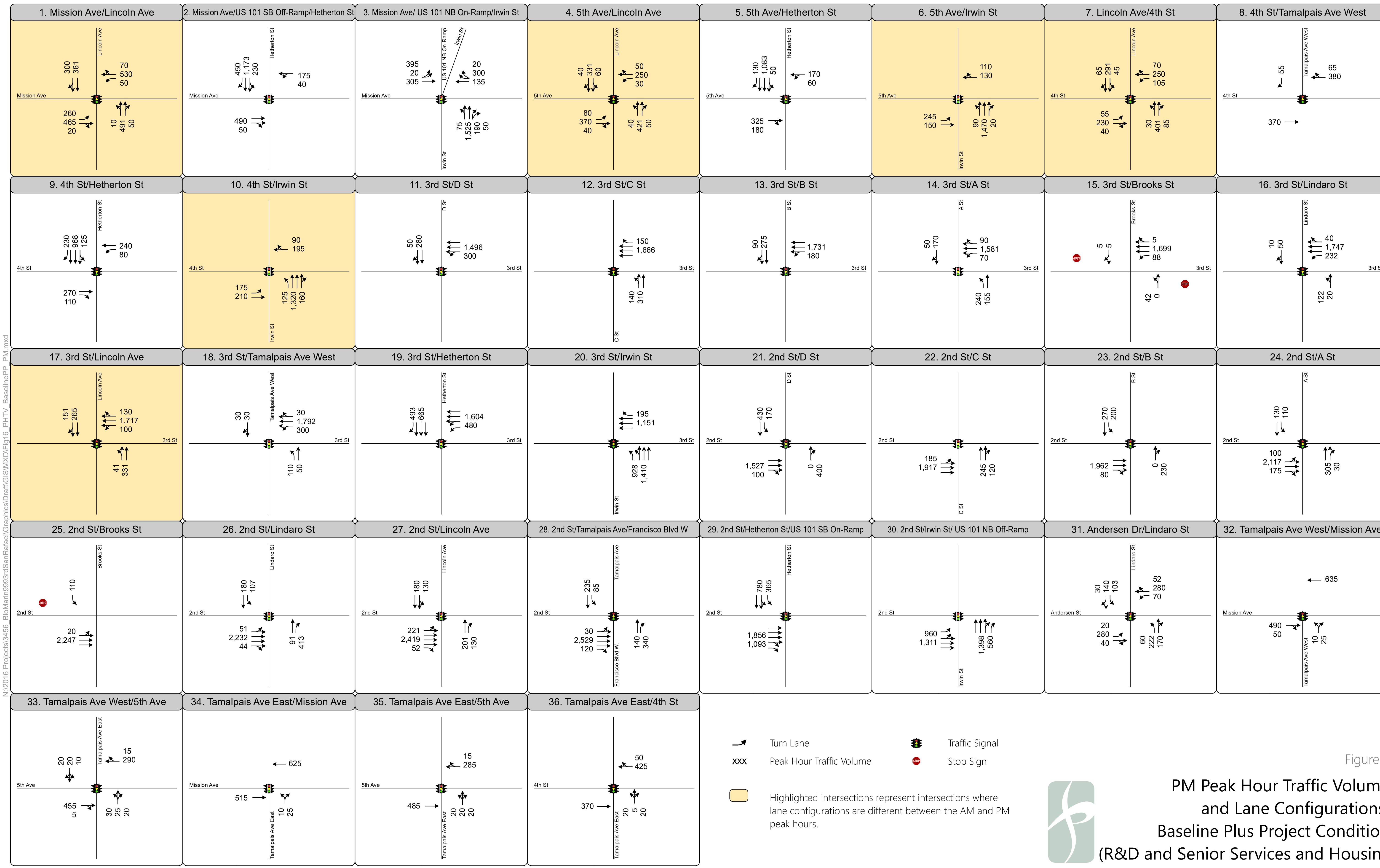


Figure 16

PM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D and Senior Services and Housing)

N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig16_PHTV_BaselinePP_PM.mxd

Intersection Operations

Table 29 summarizes baseline plus project (R& D and Senior Services and Housing) levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix D presents all LOS calculations.

TABLE 29: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Intersection	Control Type	Baseline LOS / Average Delay [1, 2]		Baseline Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 25.8	D / 43.3	C / 25.8	D / 43.2
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 42.7	C / 26.9	D / 49.0	C / 27.8
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 25.6	C / 26.1	C / 25.6	C / 26.7
4. 5th Avenue and Lincoln Avenue	Signal	B / 16.0	A / 9.4	B / 16.0	A / 9.5
5. 5th Avenue and Hetherton Street[3]	Signal	A / 7.5	A / 8.9	A / 7.3	A / 8.9
6. 5th Avenue and Irwin Street	Signal	D / 41.0	C / 30.7	D / 41.6	C / 31.8
7. 4th Street and Lincoln Avenue	Signal	B / 19.2	C / 20.5	B / 19.1	C / 20.6
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 6.7	A / 4.5	A / 6.7	A / 4.5
9. 4th Street and Hetherton Street[3]	Signal	A / 9.7	A / 9.7	A / 9.5	A / 9.7
10. 4th Street and Irwin Street	Signal	D / 39.9	C / 30.0	D / 39.7	C / 30.2
11. 3rd Street and D Street	Signal	C / 27.5	C / 30.7	C / 27.6	C / 30.9
12. 3rd Street and C Street	Signal	C / 25.4	C / 29.6	C / 25.5	C / 29.7
13. 3rd Street and B Street	Signal	C / 26.7	C / 34.4	C / 26.7	C / 34.6
14. 3rd Street and A Street	Signal	C / 27.1	C / 31.5	C / 27.1	C / 31.6
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.9 (14.4)	A (B) / 2.0 (11.4)	A (B) / 2.8 (13.0)	A (B) / 2.9 (13.3)
16. 3rd Street and Lindaro Street	Signal	A / 5.9	B / 10.6	B / 11.1	B / 12.2
17. 3rd Street and Lincoln Avenue	Signal	D / 54.3	C / 31.7	E / 59.1	C / 32.2
18. 3rd Street and Tamalpais Avenue West[3]	Signal	C / 33.6	D / 47.8	D / 53.9	D / 52.5
19. 3rd Street and Hetherton Street	Signal	C / 32.5	D / 38.3	D / 37.9	D / 39.7
20. 3rd Street and Irwin Street	Signal	C / 28.9	C / 32.5	C / 29.7	C / 33.9
21. 2nd Street and D Street	Signal	A / 3.4	A / 3.4	A / 3.4	A / 3.4
22. 2nd Street and C Street	Signal	D / 42.9	D / 39.6	D / 43.7	D / 39.7
23. 2nd Street and B Street	Signal	A / 2.3	A / 3.0	A / 2.3	A / 3.0

TABLE 29: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Intersection	Control Type	Baseline LOS / Average Delay [1, 2]		Baseline Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
24. 2nd Street and A Street	Signal	D / 41.6	D / 37.5	D / 42.1	D / 37.6
25. 2nd Street and Brooks Street	SSSC	A (B) / 2.8 (12.9)	A (D) / 3.4 (26.0)	A (C) / 3.0 (19.9)	A (D) / 3.9 (27.8)
26. 2nd Street and Lindaro Street	Signal	B / 13.9	B / 15.7	B / 16.3	B / 19.8
27. 2nd Street and Lincoln Avenue	Signal	D / 48.3	D / 41.0	D / 50.1	D / 50.2
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	C / 29.2	C / 32.0	C / 29.5	D / 37.1
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	E / 73.6	C / 32.3	E / 76.1	C / 32.7
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 26.2	D / 37.7	C / 26.7	D / 39.8
31. Andersen Drive and Lindaro Street	Signal	C / 24.5	C / 22.7	C / 25.0	C / 23.1
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 25.2	B / 13.4	C / 25.2	B / 13.4
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.8	A / 7.6	A / 6.8	A / 7.6
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	E / 65.8	C / 26.3	E / 65.8	C / 26.3
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 6.5	A / 4.9	A / 6.5	A / 4.9
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 14.1	B / 11.8	B / 14.0	B / 11.8

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 18, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 30 summarizes the baseline levels with project (R&D and Senior Services and Housing) levels of service on the arterials in the analysis area. 3rd Street LOS would decrease to an unacceptable level during the AM peak hour. Appendix D includes arterial LOS calculations.

TABLE 30: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Arterial	Standard	Baseline LOS / Average Speed [1]		Baseline Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 7	E / 9	E / 7	E / 9
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 5	F / 3	F / 5
3. 3rd Street WB from Hetherton Street to D Street	D	**E / 9**	**E / 8**	**E / 7**	**E / 8**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 7**	**F / 6**	**F / 5**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 6	E / 8	F / 6	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 9	E / 8	E / 8	E / 8

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 31. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 31: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Baseline		Baseline Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.773	0.860	0.840	0.874	**0.067**	0.013
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.784	0.873	0.793	0.922	0.008	0.048

Notes:
1. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Freeway Operations

Figure 17 presents baseline plus project (R&D and Senior Services and Housing) conditions freeway volumes, and Table 32 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix D. Addition of project traffic does not create any additional unacceptable operations.

TABLE 32: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Segment Type	Standard	Baseline LOS / Density (pc/mi/ln[1])		Baseline Plus Project LOS / Density (pc/mi/ln[1])	
			AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29	C / 23	D / 30
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	D / 35	D / 27	E / 35
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 38	D / 31	E / 39	D / 31
Mission Avenue Off-Ramp	Diverge	E	E / 38	E / 33	E / 38	E / 33
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21	D / 27	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
2. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
3. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segment with unacceptable operations, as shown in Table 33. Increases due to the project were acceptable (less than 0.01).

TABLE 33: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY AND SENIOR SERVICES AND HOUSING)

Segment	Baseline		Baseline Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
Southbound						
2nd Street On-Ramp to I-580 EB Off-Ramp	1.183	NA[1]	1.187	NA[1]	0.004	NA[1]

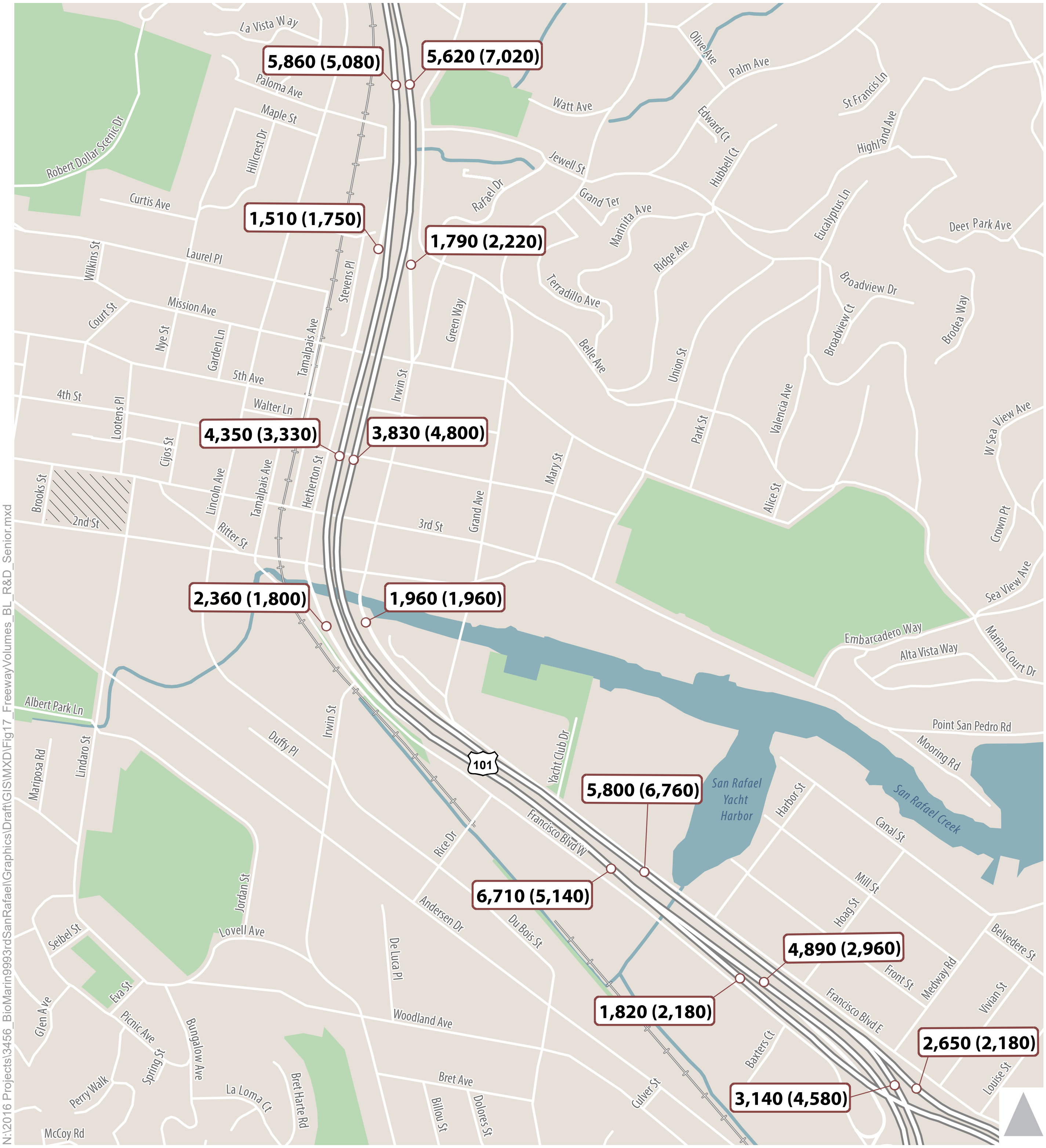
Notes:
1. NA, acceptable operations. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to baseline conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 34 summarizes these results.

TABLE 34: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)		
Off-Ramp	**Increased Queue Length (feet)[1]**	
	AM	**PM**
US 101 NB to 2nd Street	0	0
US 101 SB to Mission Avenue	25	0

Notes:
1. Compared to baseline conditions

Source: Fehr & Peers, 2018



N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig17_FreewayVolumes_BL_R&D_Senior.mxd

AM (PM) Freeway Volume

Figure 17

Weekday Peak Hour Freeway Volumes - Baseline Plus Project Conditions (R&D and Senior Services and Housing)

Cumulative Conditions

The Cumulative scenario includes market-level population and employment growth and expected transportation improvements for year 2040.

Figure 18 and Figure 19 display the Cumulative peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

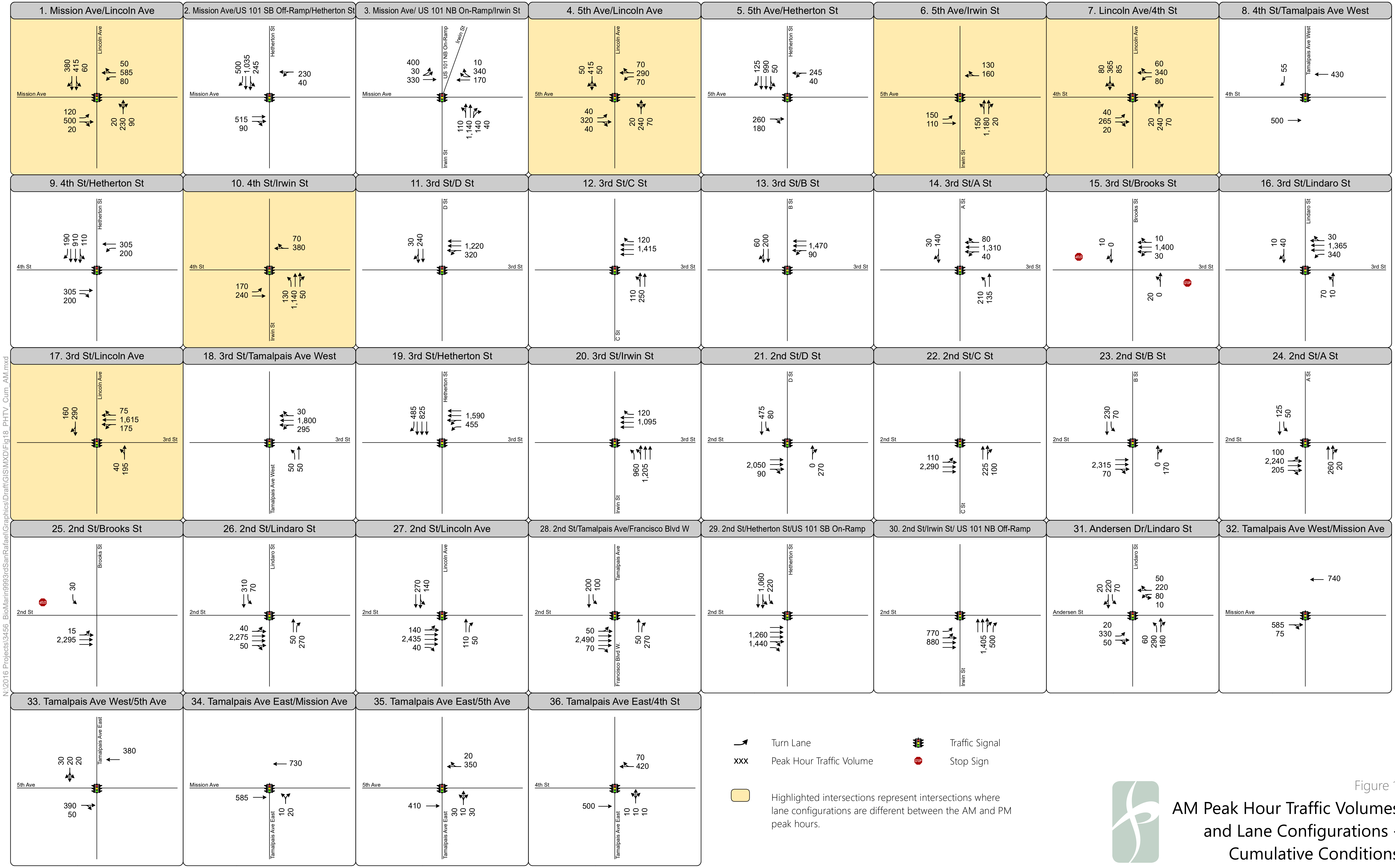


Figure 18

AM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Conditions

N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig18_PHTV_Cum_AM.mxd

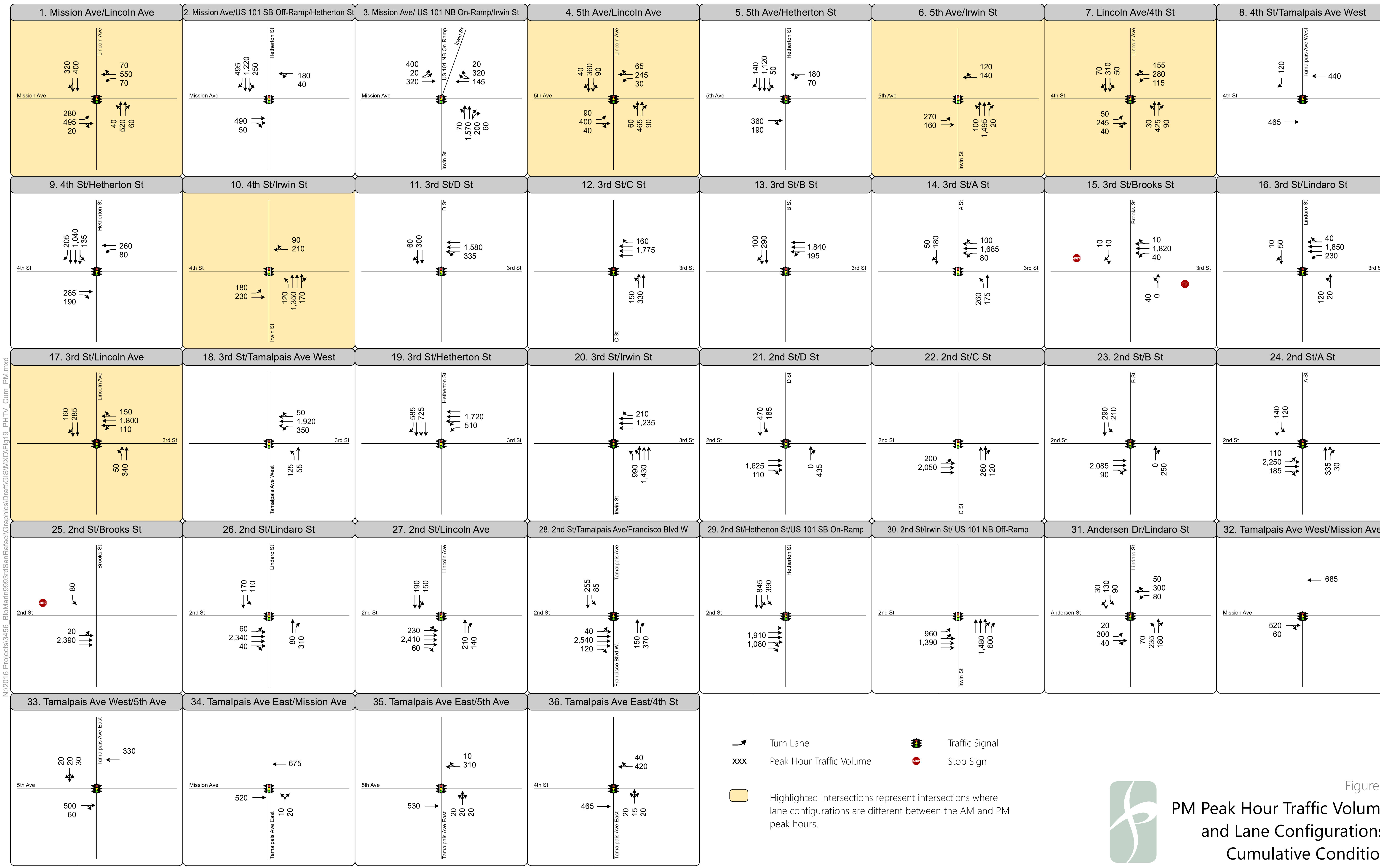


Figure 19

PM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Conditions

N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig19_PHTV_Cum_PM.mxd

Intersection Operations

Table 35 summarizes the Cumulative levels of service (LOS) at the study intersections. All intersections operate acceptably except for the 3rd Street and Tamalpais Avenue West intersection (PM peak hour only) and 2nd Street and Hetherton Street/US 101 Southbound Ramp intersection (AM peak hour only). Appendix E presents all LOS calculations.

TABLE 35: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE CONDITIONS

Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 27.5	C / 31.6
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	C / 23.9	B / 19.1
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 27.2	C / 28.1
4. 5th Avenue and Lincoln Avenue	Signal	C / 25.2	A / 9.8
5. 5th Avenue and Hetherton Street[3]	Signal	B / 13.0	B / 13.9
6. 5th Avenue and Irwin Street	Signal	C / 33.3	C / 31.0
7. 4th Street and Lincoln Avenue	Signal	C / 27.7	C / 22.1
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 7.0	A / 6.4
9. 4th Street and Hetherton Street[3]	Signal	B / 10.1	A / 9.6
10. 4th Street and Irwin Street	Signal	D / 48.6	C / 31.7
11. 3rd Street and D Street	Signal	C / 23.6	C / 27.4
12. 3rd Street and C Street	Signal	C / 23.2	C / 28.1
13. 3rd Street and B Street	Signal	C / 25.3	C / 32.5
14. 3rd Street and A Street	Signal	C / 26.7	C / 34.2
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.8 (13.5)	A (B) / 3.3 (13.9)
16. 3rd Street and Lindaro Street	Signal	A / 8.2	A / 9.4
17. 3rd Street and Lincoln Avenue	Signal	D / 52.2	C / 29.6
18. 3rd Street and Tamalpais Avenue West	Signal	E / 65.6	**F / 86.4**
19. 3rd Street and Hetherton Street	Signal	D / 38.3	D / 47.1
20. 3rd Street and Irwin Street	Signal	C / 28.3	D / 38.3
21. 2nd Street and D Street	Signal	D / 39.1	C / 32.5
22. 2nd Street and C Street	Signal	C / 28.6	C / 28.9
23. 2nd Street and B Street	Signal	C / 32.2	E / 56.4

TABLE 35: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE CONDITIONS			
Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
24. 2nd Street and A Street	Signal	C / 27.4	C / 30.5
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.6 (21.2)	A (D) / 3.4 (27.5)
26. 2nd Street and Lindaro Street	Signal	B / 14.3	B / 14.9
27. 2nd Street and Lincoln Avenue	Signal	D / 38.2	D / 38.3
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 35.7	D / 46.5
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	**F / 95.9**	C / 34.7
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 27.5	D / 39.6
31. Andersen Drive and Lindaro Street	Signal	C / 27.2	C / 24.0
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 27.1	B / 12.5
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.6	A / 9.0
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 46.1	C / 27.1
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 7.3	A / 5.7
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 16.1	A / 9.9

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 36 summarizes the cumulative levels of service on the arterials in the analysis area. Mission Avenue, 3rd Street, and 2nd Street all experience unacceptable operations. Appendix E includes arterial LOS calculations.

TABLE 36: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – CUMULATIVE CONDITIONS			
Arterial	Standard	LOS / Average Speed [1]	
		AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	**F / 7**	E / 8
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 4
3. 3rd Street WB from Hetherton Street to D Street	D	**F / 6**	**F / 6**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 6**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 4	E / 7
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 8	E / 7

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 20 presents cumulative conditions freeway volumes, and Table 37 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix E. As shown, all segments operate at acceptable levels with the exception of the northbound weave segment between the I-580 EB on-ramp and the 2nd Street off-ramp during the PM peak hour, the southbound Mission Avenue off-ramp diverge segment, and the southbound weave segment between the 2nd Street on-ramp and the I-580 EB off-ramp during the AM peak hour.

TABLE 37: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – CUMULATIVE CONDITIONS				
Segment	**Segment Type**	**Standard**	**LOS / Density (pc/mi/ln[1])**	
			AM	**PM**
Northbound				
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	**F / -[2]**
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 25	D / 33
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	E / 39
Southbound				
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 43	D / 34
Mission Avenue Off-Ramp	Diverge	E	**F / -[2]**	**F / -[2]**
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 26	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology or when V/C>1.

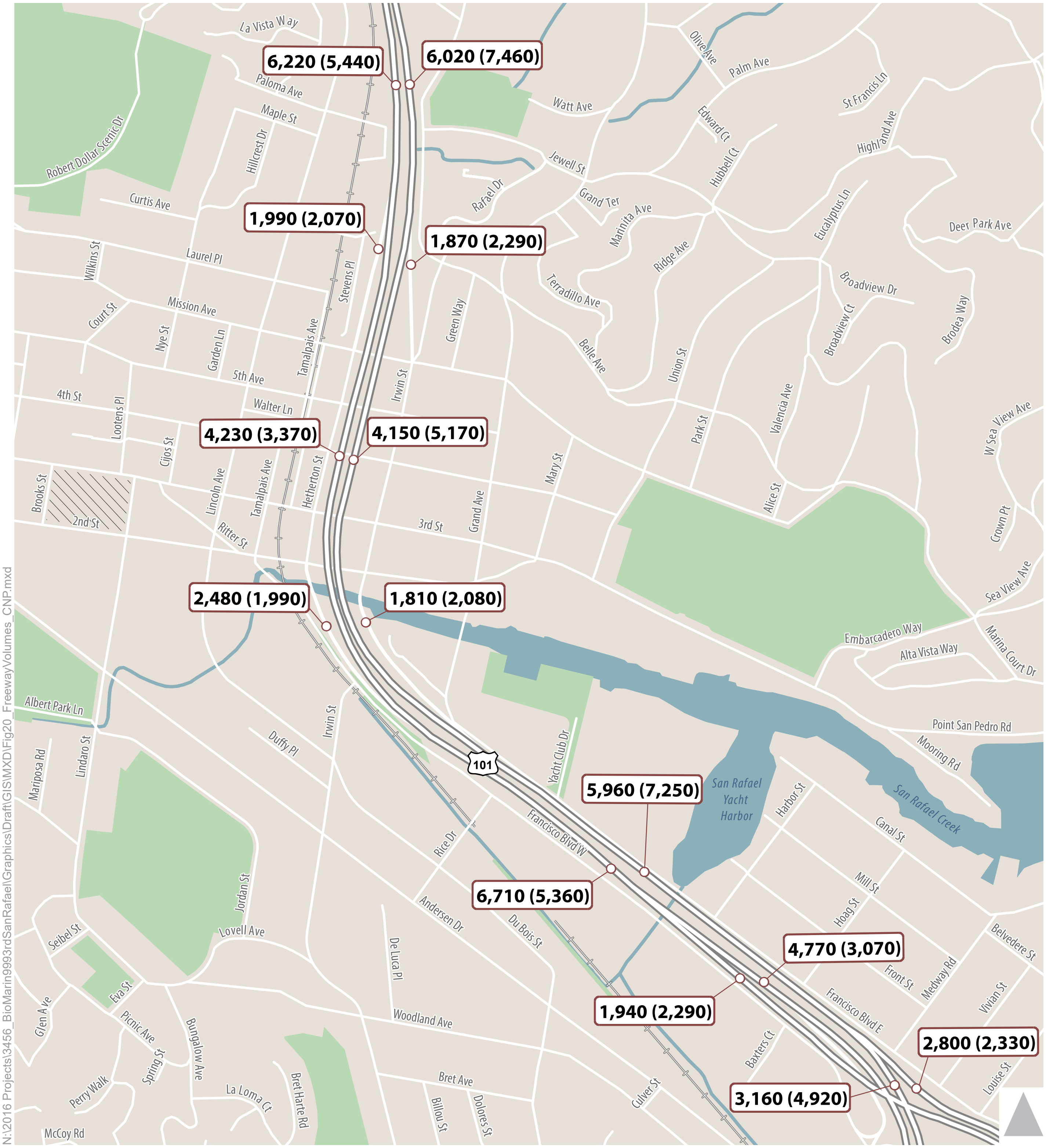
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to existing conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 38 summarizes these calculations. Expected signal improvements in the cumulative scenario contribute to these results.

TABLE 38: WEEKDAY PEAK HOUR OFF-RAMP QUEUES – CUMULATIVE CONDITIONS		
Off-Ramp	**Increased Queue Length (feet)[1]**	
	AM	**PM**
US 101 NB to 2nd Street	225	75
US 101 SB to Mission Avenue	0	0

Notes:
1. Compared to existing conditions

Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 20

Weekday Peak Hour Freeway Volumes - Cumulative Conditions

Cumulative Plus Project Conditions (R&D Only)

The Cumulative Plus Project (R&D Only) scenario includes cumulative transportation conditions plus trips generated from the new R&D buildings. It does not include trips generated by the senior services and housing building.

Figure 21 and Figure 22 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

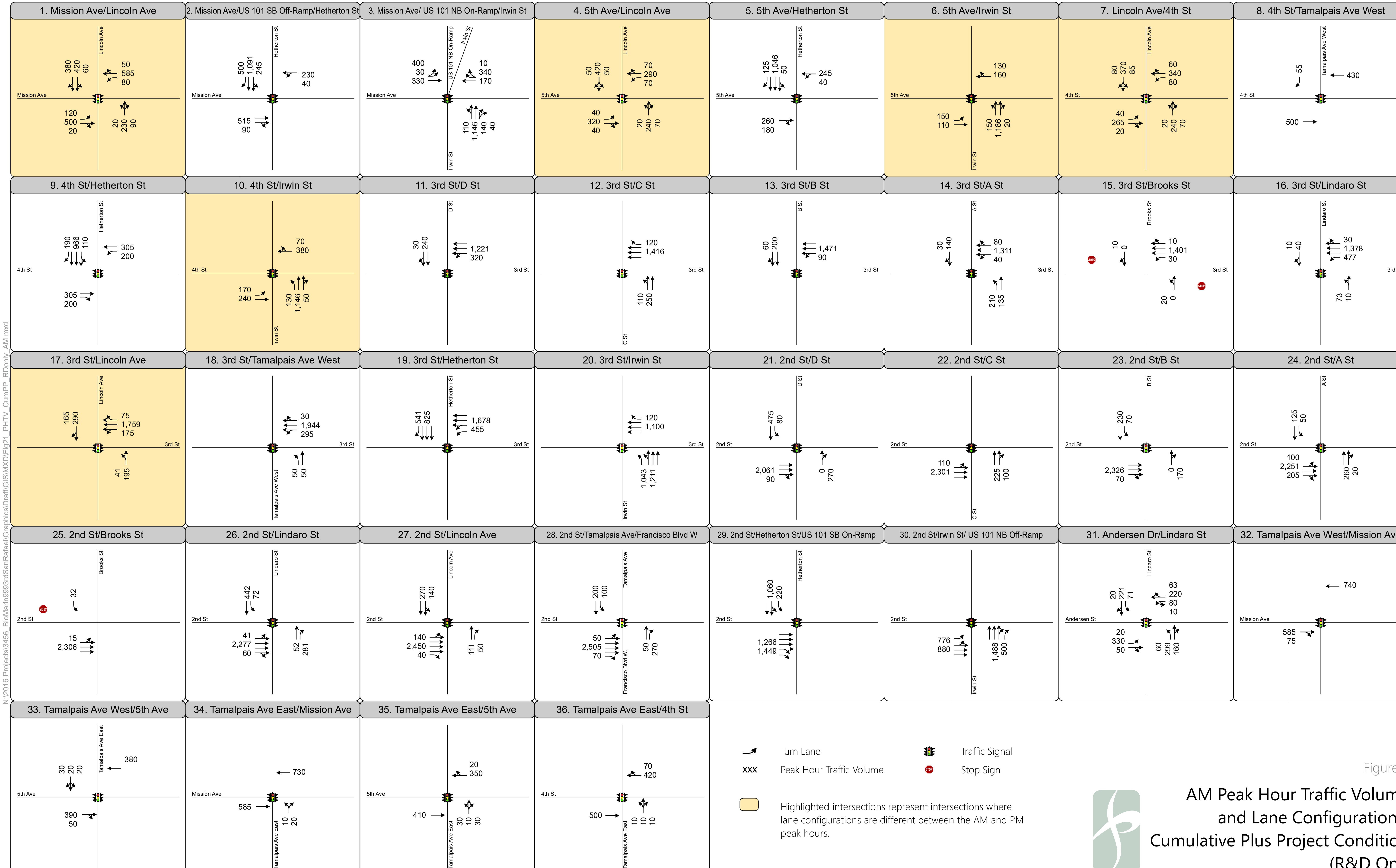
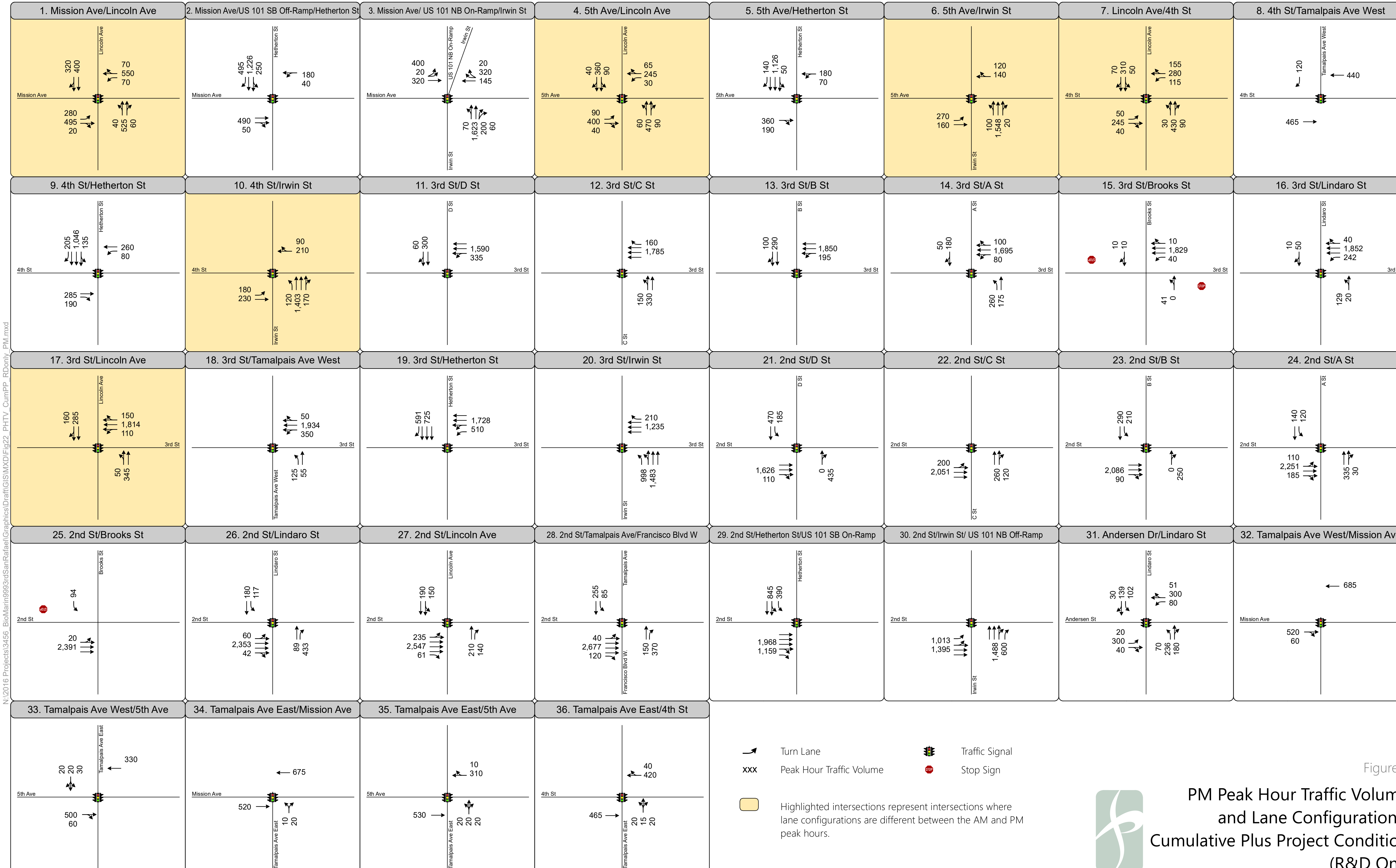


Figure 21

AM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D Only)

N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig21_PHTV_CumPP_RDonly_AM.mxd



Turn Lane
XXX Peak Hour Traffic Volume
Traffic Signal
Stop Sign

Highlighted intersections represent intersections where lane configurations are different between the AM and PM peak hours.

Figure 22

PM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D Only)

Intersection Operations

Table 39 summarizes cumulative plus project (R& D only) levels of service (LOS) at the study intersections. All intersections operate acceptably except for 3rd Street and Tamalpais Avenue West, where increasing westbound volumes create unacceptable AM peak hour conditions and worsen unacceptable operations slightly in the PM peak hour; and 2nd Street and Hetherton Street/US 101 Southbound Ramp, where operations worsen slightly in the AM peak hour. Appendix F presents all LOS calculations.

TABLE 39: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Intersection	Control Type	Cumulative LOS / Average Delay [1, 2]		Cumulative Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 27.5	C / 31.6	C / 27.5	C / 31.6
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	C / 23.9	B / 19.1	C / 24.7	B / 19.2
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 27.2	C / 28.1	C / 27.3	C / 31.2
4. 5th Avenue and Lincoln Avenue	Signal	C / 25.2	A / 9.8	C / 25.1	A / 9.8
5. 5th Avenue and Hetherton Street[3]	Signal	B / 13.0	B / 13.9	B / 12.8	B / 14.5
6. 5th Avenue and Irwin Street	Signal	C / 33.3	C / 31.0	C / 33.7	C / 31.4
7. 4th Street and Lincoln Avenue	Signal	C / 27.7	C / 22.1	C / 27.6	C / 22.2
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 7.0	A / 6.4	A / 7.0	A / 6.3
9. 4th Street and Hetherton Street[3]	Signal	B / 10.1	A / 9.6	A / 9.9	A / 9.3
10. 4th Street and Irwin Street	Signal	D / 48.6	C / 31.7	D / 48.0	C / 31.8
11. 3rd Street and D Street	Signal	C / 23.6	C / 27.4	C / 23.6	C / 27.5
12. 3rd Street and C Street	Signal	C / 23.2	C / 28.1	C / 23.2	C / 28.2
13. 3rd Street and B Street	Signal	C / 25.3	C / 32.5	C / 25.3	C / 32.6
14. 3rd Street and A Street	Signal	C / 26.7	C / 34.2	B / 18.2	C / 24.5
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.8 (13.5)	A (B) / 3.3 (13.9)	A (A) / 2.1 (8.3)	A (C) / 3.7 (16.1)
16. 3rd Street and Lindaro Street	Signal	A / 8.2	A / 9.4	B / 12.2	B / 10.6
17. 3rd Street and Lincoln Avenue	Signal	D / 52.2	C / 29.6	E / 60.7	C / 29.6
18. 3rd Street and Tamalpais Avenue West	Signal	E / 65.6	**F / 86.4**	**F / 93.4**	**F / 89.0**
19. 3rd Street and Hetherton Street	Signal	D / 38.3	D / 47.1	D / 46.0	D / 48.2
20. 3rd Street and Irwin Street	Signal	C / 28.3	D / 38.3	C / 28.7	D / 38.4
21. 2nd Street and D Street	Signal	D / 39.1	C / 32.5	D / 39.1	C / 32.5

TABLE 39: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)					
Intersection	**Control Type**	**Cumulative LOS / Average Delay [1, 2]**		**Cumulative Plus Project LOS / Average Delay [1, 2]**	
		AM	**PM**	**AM**	**PM**
22. 2nd Street and C Street	Signal	C / 28.6	C / 28.9	C / 28.7	C / 28.9
23. 2nd Street and B Street	Signal	C / 32.2	E / 56.4	C / 32.2	E / 56.4
24. 2nd Street and A Street	Signal	C / 27.4	C / 30.5	C / 27.5	C / 30.5
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.6 (21.2)	A (D) / 3.4 (27.5)	A (C) / 2.9 (19.9)	A (D) / 3.8 (29.9)
26. 2nd Street and Lindaro Street	Signal	B / 14.3	B / 14.9	B / 18.5	C / 21.7
27. 2nd Street and Lincoln Avenue	Signal	D / 38.2	D / 38.3	D / 36.4	D / 44.4
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 35.7	D / 46.5	D / 36.4	E / 60.4
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	**F / 95.9**	C / 34.7	**F / 97.0**	D / 35.9
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 27.5	D / 39.6	C / 27.2	D / 41.9
31. Andersen Drive and Lindaro Street	Signal	C / 27.2	C / 24.0	C / 27.7	C / 24.3
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 27.1	B / 12.5	C / 27.1	B / 12.5
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.6	A / 9.0	A / 6.6	A / 9.1
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 46.1	C / 27.1	D / 46.1	C / 27.1
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 7.3	A / 5.7	A / 7.1	A / 5.8
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 16.1	A / 9.9	B / 16.0	A / 9.9

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 40 summarizes the cumulative plus project (R& D only) levels of service on the arterials in the analysis area. The speed decrease on Mission Avenue is less than one mile per hour and thus acceptable. Appendix F includes arterial LOS calculations.

TABLE 40: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)					
Arterial	Standard	Cumulative LOS / Average Speed [1]		Cumulative Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	**F / 7**	E / 8	**F / 7**	E / 8
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 4	F / 3	F / 4
3. 3rd Street WB from Hetherton Street to D Street	D	**F / 6**	**F / 6**	**F / 5**	**F / 5**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 6**	**F / 6**	**F / 5**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 4	E / 7	F / 4	E / 7
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 8	E / 7	E / 7	E / 7

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 41. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 41: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)						
Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.865	0.960	0.925	0.966	**0.060**	0.006
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.844	0.934	0.848	0.977	0.005	0.043

Notes:
1. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Freeway Operations

Figure 23 presents cumulative plus project (R&D only) conditions freeway volumes, and Table 42 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix F. As shown, project traffic does not cause any segment density to increase to an unacceptable LOS.

TABLE 42: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)						
Segment	**Segment Type**	**Standard**	**Cumulative LOS / Density (pc/mi/ln[1])**		**Cumulative Plus Project LOS / Density (pc/mi/ln[1])**	
			AM	**PM**	**AM**	**PM**
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	**F / -[2]**	D / -[2]	**F / -[2]**
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 25	D / 33	C / 25	D / 33
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	E / 39	D / 29	E / 40
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 43	D / 34	E / 43	D / 34
Mission Avenue Off-Ramp	Diverge	E	**F / -[2]**	**F / -[2]**	**F / -[2]**	**F / -[2]**
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 26	C / 21	D / 26	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
4. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
5. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segments with unacceptable operations, as shown in Table 43. Increases due to the project were acceptable (less than 0.01), except for the Mission Avenue off-ramp in the AM peak hour.

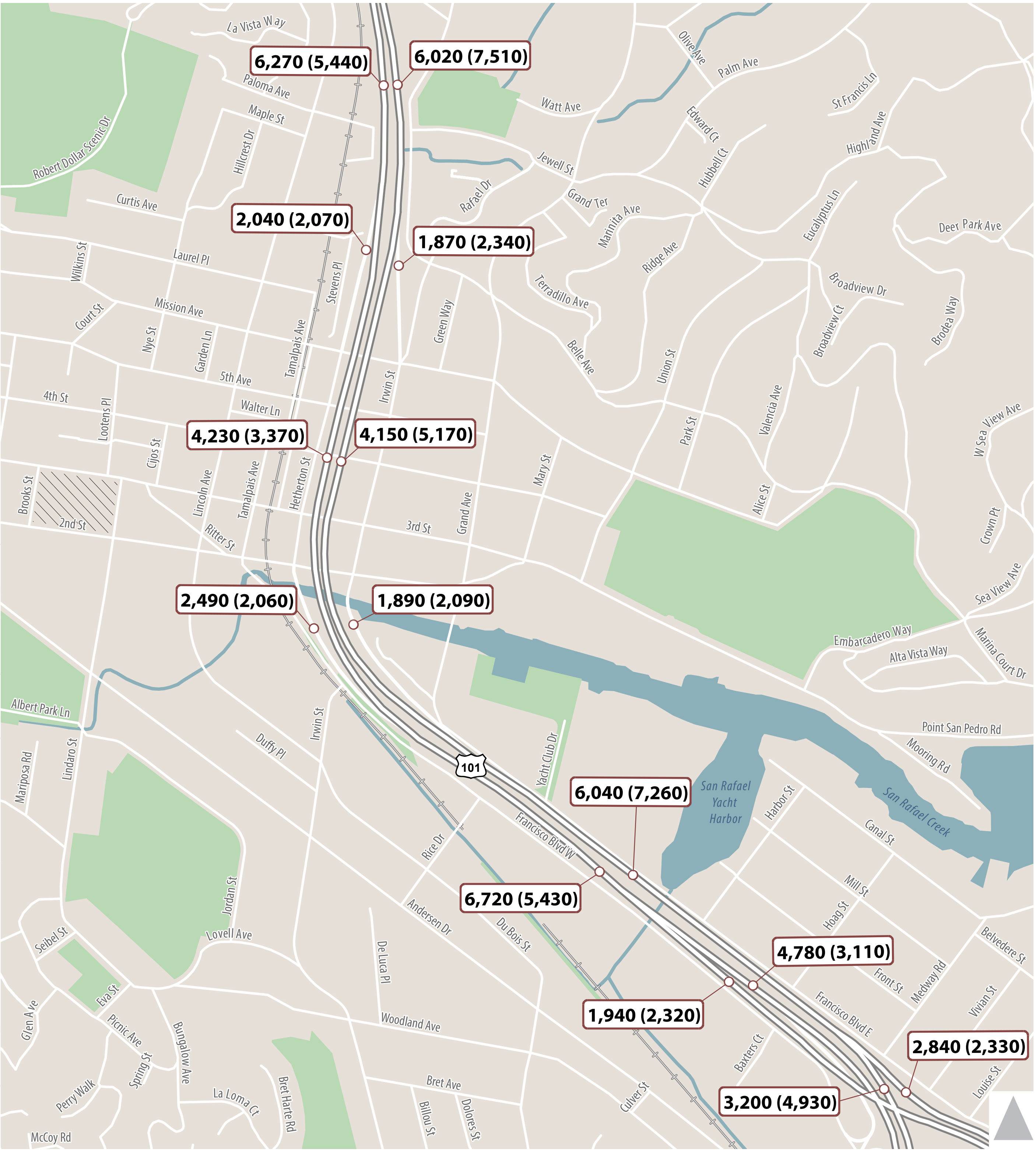
TABLE 43: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)						
Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	NA[1]	1.043	NA[1]	1.045	NA[1]	0.002
Southbound						
Mission Avenue Off-Ramp (Freeway)	0.977	0.854	0.986	0.856	0.009	0.002
Mission Avenue Off-Ramp (Ramp)	1.073	1.054	1.106	1.060	**0.033**	0.006
2nd Street On-Ramp to I-580 EB Off-Ramp	1.201	NA[1]	1.203	NA[1]	0.002	NA[1]

Notes:
1. NA, acceptable operations. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to cumulative conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 44 summarizes these results.

TABLE 44: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)		
Off-Ramp	Increased Queue Length (feet)[1]	
	AM	PM
US 101 NB to 2nd Street	0	25
US 101 SB to Mission Avenue	0	0

Notes:
1. Compared to cumulative conditions
Source: Fehr & Peers, 2018



N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig23_FreewayVolumes_CPP_R&Donly.mxd

AM (PM) Freeway Volume

Figure 23

Weekday Peak Hour Freeway Volumes - Cumulative Plus Project Conditions (R&D Only)

Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

The Cumulative Plus Project (R&D and Senior Services and Housing) scenario includes cumulative transportation conditions plus trips generated from the new R&D buildings and the senior services and housing building.

Figure 24 and Figure 25 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

This page intentionally left blank.

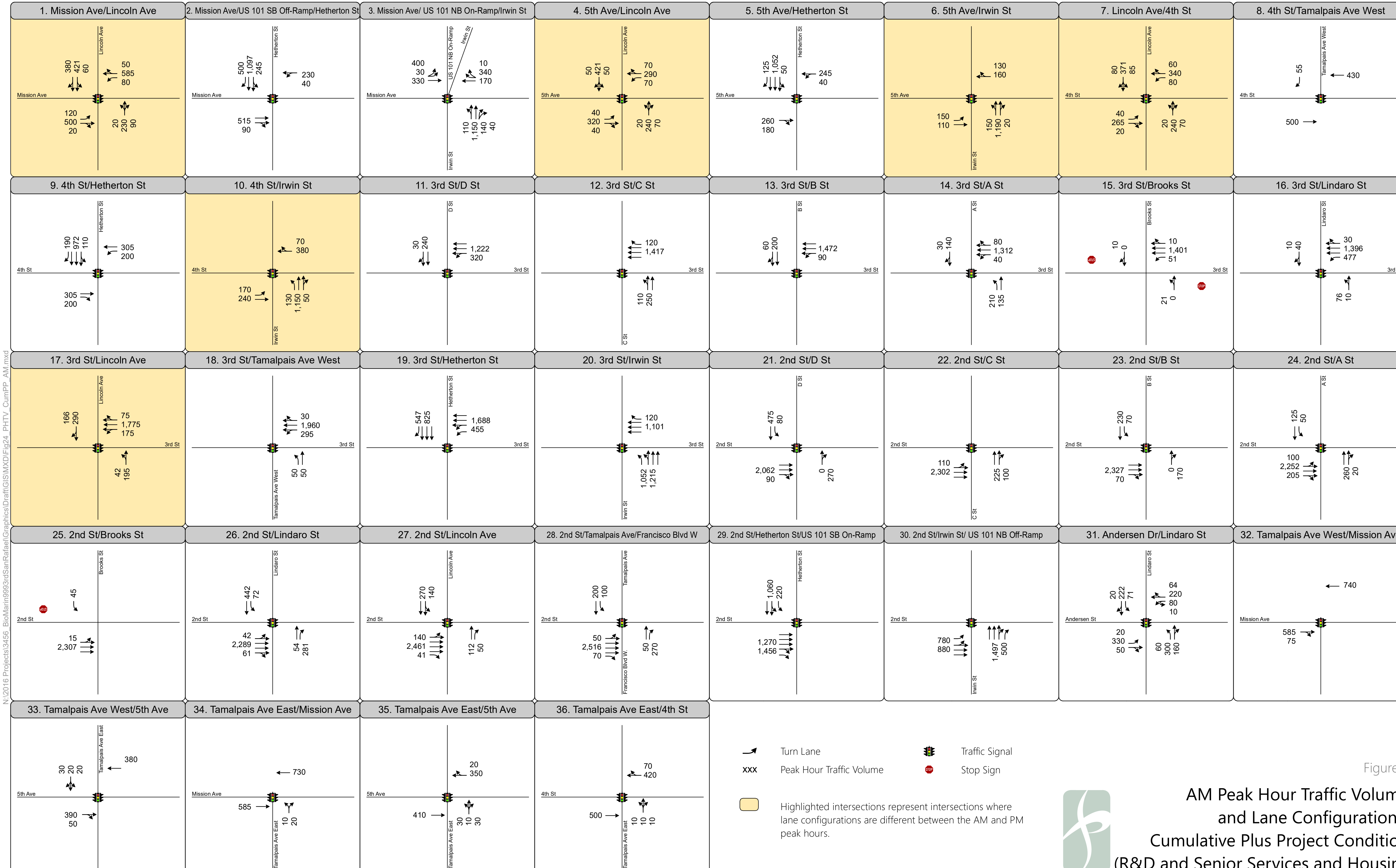


Figure 24

AM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

N:\2016 Projects\3456_BioMarin999\3rdSanRafael\Graphics\Draft\GIS\MXD\Fig24_PHTV_CumPP_AM.mxd

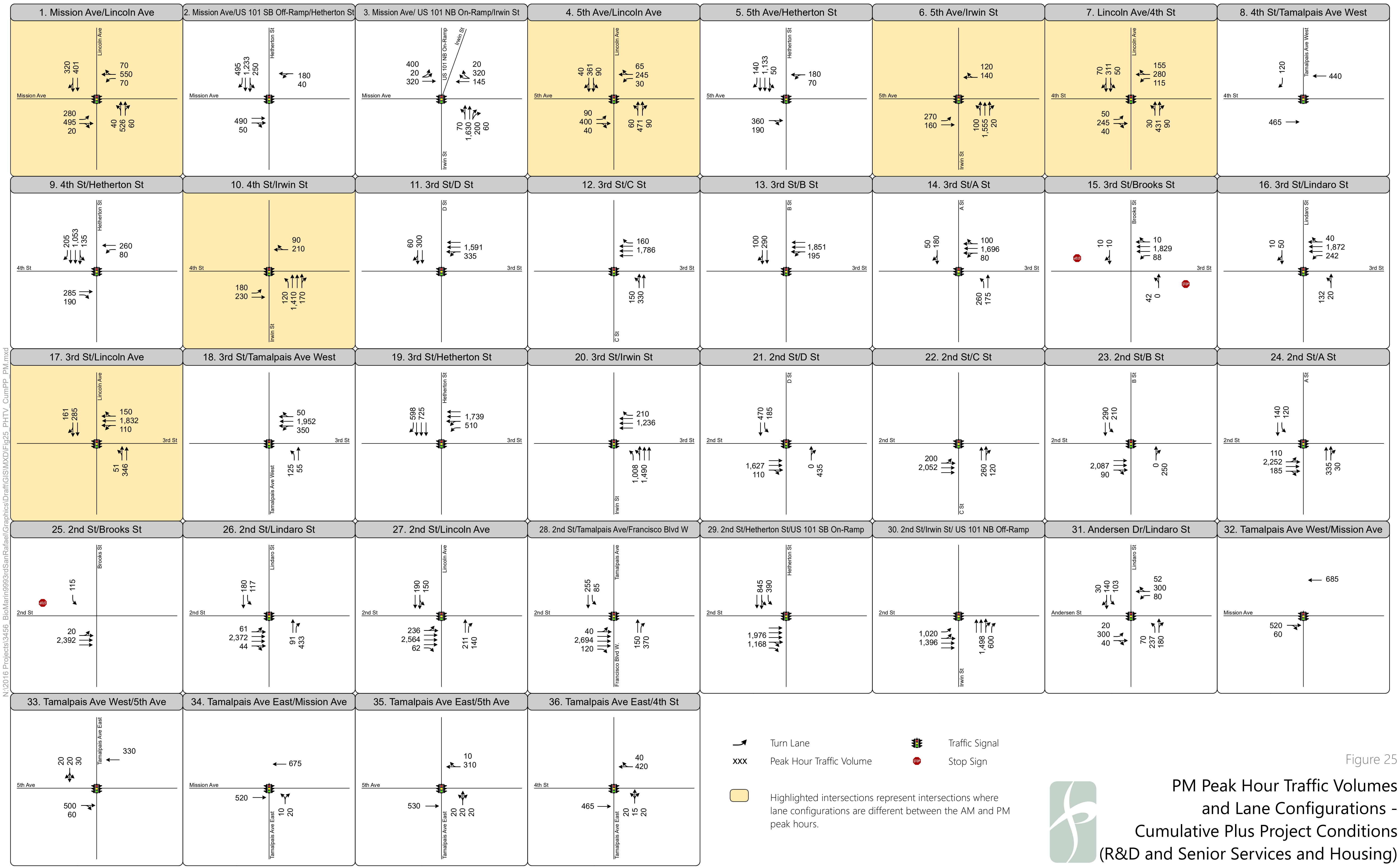


Figure 25

PM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Intersection Operations

Table 45 summarizes cumulative plus project (R& D and Senior Services and Housing) levels of service (LOS) at the study intersections. All intersections operate acceptably except for 3rd Street and Tamalpais Avenue West, where increasing westbound volumes create unacceptable AM peak hour conditions and worsen unacceptable operations significantly in the PM peak hour; and 2nd Street and Hetherton Street/US 101 Southbound Ramp, where operations worsen slightly in the AM peak hour. Appendix G presents all LOS calculations.

TABLE 45: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Intersection	Control Type	Cumulative LOS / Average Delay [1, 2]		Cumulative Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 27.5	C / 31.6	C / 27.5	C / 31.6
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	C / 23.9	B / 19.1	C / 24.8	B / 18.5
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 27.2	C / 28.1	C / 27.4	C / 31.7
4. 5th Avenue and Lincoln Avenue	Signal	C / 25.2	A / 9.8	C / 25.1	A / 9.8
5. 5th Avenue and Hetherton Street[3]	Signal	B / 13.0	B / 13.9	B / 12.9	B / 14.2
6. 5th Avenue and Irwin Street	Signal	C / 33.3	C / 31.0	C / 33.9	C / 31.5
7. 4th Street and Lincoln Avenue	Signal	C / 27.7	C / 22.1	C / 27.6	C / 22.2
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 7.0	A / 6.4	A / 7.0	A / 6.3
9. 4th Street and Hetherton Street[3]	Signal	B / 10.1	A / 9.6	A / 9.9	A / 9.5
10. 4th Street and Irwin Street	Signal	D / 48.6	C / 31.7	D / 48.0	C / 31.8
11. 3rd Street and D Street	Signal	C / 23.6	C / 27.4	C / 23.6	C / 27.5
12. 3rd Street and C Street	Signal	C / 23.2	C / 28.1	C / 23.2	C / 28.2
13. 3rd Street and B Street	Signal	C / 25.3	C / 32.5	C / 25.3	C / 32.7
14. 3rd Street and A Street	Signal	C / 26.7	C / 34.2	B / 18.2	C / 24.6
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.8 (13.5)	A (B) / 3.3 (13.9)	A (B) / 2.3 (10.6)	A (B) / 2.8 (13.3)
16. 3rd Street and Lindaro Street	Signal	A / 8.2	A / 9.4	B / 15.3	A / 9.4
17. 3rd Street and Lincoln Avenue	Signal	D / 52.2	C / 29.6	E / 63.2	C / 29.8
18. 3rd Street and Tamalpais Avenue West	Signal	E / 65.6	**F / 86.4**	**F / 96.7**	**F / 94.0**
19. 3rd Street and Hetherton Street	Signal	D / 38.3	D / 47.1	D / 47.1	D / 49.4
20. 3rd Street and Irwin Street	Signal	C / 28.3	D / 38.3	C / 28.8	D / 38.6
21. 2nd Street and D Street	Signal	D / 39.1	C / 32.5	D / 39.1	C / 32.5
22. 2nd Street and C Street	Signal	C / 28.6	C / 28.9	C / 28.7	C / 28.9

TABLE 45: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)					
Intersection	Control Type	Cumulative LOS / Average Delay [1, 2]		Cumulative Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
23. 2nd Street and B Street	Signal	C / 32.2	E / 56.4	C / 32.2	E / 56.4
24. 2nd Street and A Street	Signal	C / 27.4	C / 30.5	C / 27.5	C / 30.5
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.6 (21.2)	A (D) / 3.4 (27.5)	A (C) / 2.9 (22.0)	A (D) / 3.8 (27.7)
26. 2nd Street and Lindaro Street	Signal	B / 14.3	B / 14.9	B / 18.6	C / 21.0
27. 2nd Street and Lincoln Avenue	Signal	D / 38.2	D / 38.3	D / 37.1	D / 46.1
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 35.7	D / 46.5	D / 37.0	E / 61.4
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	**F / 95.9**	C / 34.7	**F / 97.9**	D / 35.9
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 27.5	D / 39.6	C / 28.0	D / 43.4
31. Andersen Drive and Lindaro Street	Signal	C / 27.2	C / 24.0	C / 27.8	C / 24.3
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 27.1	B / 12.5	C / 27.1	B / 12.5
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.6	A / 9.0	A / 6.6	A / 9.1
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 46.1	C / 27.1	D / 46.1	C / 26.8
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 7.3	A / 5.7	A / 7.1	A / 5.7
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 16.1	A / 9.9	B / 16.0	A / 9.9

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 46 summarizes the cumulative plus project (R& D and Senior Services and Housing) levels of service on the arterials in the analysis area. The speed decrease on Mission Avenue is less than one mile per hour and thus acceptable. Appendix G includes arterial LOS calculations.

TABLE 46: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Arterial	Standard	Cumulative LOS / Average Speed [1]		Cumulative Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	**F / 7**	E / 8	**F / 7**	E / 8
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 4	F / 3	F / 4
3. 3rd Street WB from Hetherton Street to D Street	D	**F / 6**	**F / 6**	**F / 5**	**F / 5**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 6**	**F / 6**	**F / 5**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 4	E / 7	F / 4	E / 7
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 8	E / 7	F / 7	F / 7

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 47. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 47: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.865	0.960	0.931	0.974	**0.067**	0.013
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.844	0.934	0.852	0.983	0.008	0.048

Notes:
1. NA = not applicable, calculation not required. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Freeway Operations

Figure 26 presents cumulative plus project (R&D and Senior Services and Housing) conditions freeway volumes, and Table 48 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix G. As shown, project traffic does not cause any segment density to increase to an unacceptable LOS.

TABLE 48: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Segment Type	Standard	Cumulative LOS / Density (pc/mi/ln[1])		Cumulative Plus Project LOS / Density (pc/mi/ln[1])	
			AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	**F / -[2]**	D / -[2]	**F / -[2]**
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 25	D / 33	C / 25	D / 33
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	E / 39	D / 29	E / 40
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 43	D / 34	E / 44	D / 34
Mission Avenue Off-Ramp	Diverge	E	**F / -[2]**	**F / -[2]**	**F / -[2]**	**F / -[2]**
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 26	C / 21	D / 26	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
2. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
3. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segments with unacceptable operations, as shown in Table 49. Increases due to the project were acceptable (less than 0.01), except for the Mission Avenue off-ramp in the AM peak hour.

TABLE 49: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING

Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	NA[1]	1.043	NA[1]	1.047	NA[1]	0.004
Southbound						
Mission Avenue Off-Ramp (Freeway)	0.9774	0.854	0.9868	0.856	0.0094	0.002
Mission Avenue Off-Ramp (Ramp)	1.073	1.054	1.106	1.060	**0.033**	0.006
2nd Street On-Ramp to I-580 EB Off-Ramp	1.201	NA[1]	1.204	NA[1]	0.003	NA[1]

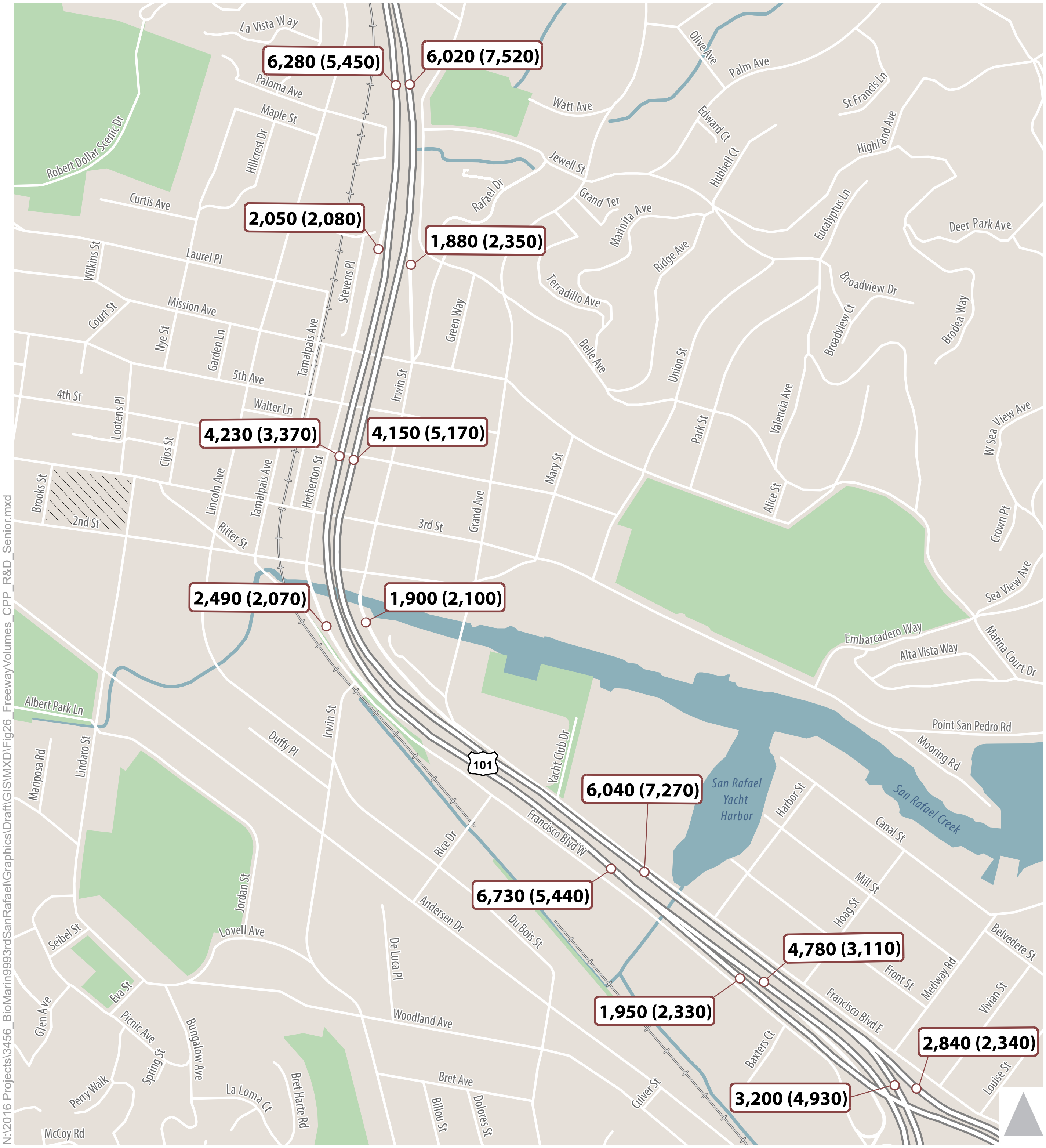
Notes:
2. NA, acceptable operations. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to cumulative conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 50 summarizes these calculations.

TABLE 50: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Off-Ramp	Increased Queue Length (feet)[1]	
	AM	PM
US 101 NB to 2nd Street	0	25
US 101 SB to Mission Avenue	0	0

Notes:
1. Compared to cumulative conditions
Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 26

Weekday Peak Hour Freeway Volumes - Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\GIS\MXD\Fig26_FreewayVolumes_CPP_R&D_Senior.mxd

Impacts and Mitigation Measures

This chapter summarizes the significance of transportation and traffic impacts using the criteria described in Study Methodology. Where impacts are deemed significant, mitigation measures are recommended to lessen their significance. This study identifies the transportation and traffic impacts of the BioMarin R&D buildings only as well as the impacts of the BioMarin R&D buildings with the senior services and housing. In all cases, the transportation/traffic effects of these two scenarios would be similar or the same. Therefore, a single impact statement is provided that applies to both plus-project scenarios.

Project-Specific Impacts

Vehicle Travel

Vehicle trips generated by the proposed project would increase traffic volumes on study roadway segments and intersections, as described below.

Intersection Operations

All intersections would continue to operate at an acceptable LOS under Baseline Plus Project conditions.

Arterial Operations

Under baseline plus project conditions, most arterials would experience a less than significant increase in delay (City arterials) or volume to capacity (congestion management arterials). Adaptive signal implementation is planned under cumulative conditions in Downtown San Rafael, which would improve vehicle operations compared to the existing pretimed signal system. Earlier implementation would improve baseline conditions. A second exclusive eastbound right turn lane at the 2nd Street and Hetherton Street/ US 101 Southbound Ramp intersection was also reviewed to see if it would improve 2nd Street speed; however, there is limited space (less than 100 feet) between the SMART extension and the ramp, and improvements would be minor. 2nd Street cannot be widened without significant impacts to downtown.

However, 3rd Street volume to capacity would increase significantly (by 0.067) during the AM peak hour.

Impacts and Mitigation Measures

<u>Impact-1</u>: Vehicle trips generated by the proposed project would increase traffic levels on study arterials. These project trips would cause volume to capacity to increase unacceptably on the 3rd Street arterial during the AM peak hour. Therefore, this is considered a significant impact.

<u>Mitigation Measure-1</u>: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) Plan and conduct ongoing annual monitoring.

TDM can be a mitigation measure to reduce trips, as recommended in the recent Governor's Office of Planning Research "Technical Advisory on Evaluating Transportation Impacts in CEQA" (December 2018). BioMarin has developed a TDM plan and would monitor progress of this plan with annual counts. Trip generation calculations for this project show that current TDM measures provided by the campus have helped reduce peak hour trip rates 12-15% below levels generated by R&D uses in suburban areas without trip reduction programs based on national (i.e., ITE) trip rates.

Mitigation Measure 1 refers to additional trip reduction strategies described in the BioMarin TDM Plan prepared for this project that, if implemented and monitored on an ongoing basis, would reduce peak hour trips by another 10%, based on California Air Pollution Control Officers (CAPCOA) estimates and the surrounding Downtown San Rafael transportation and land use context.

<u>Mitigation Measure-2</u>: Employ signal optimization technology on 3rd Street.

Adaptive signal implementation is planned under cumulative conditions in Downtown San Rafael, and this arterial would be included in implementation. By replacing the current pretimed signal control system, earlier implementation of signal optimization technology would improve baseline conditions. However, per discussion with the City of San Rafael in a meeting on November 8, 2018, the City noted that these improvements are not likely to be implemented in this timeframe.

Mitigation Measures 1 and 2 would increase traffic speed along the corridor, but the corridor would still continue to operate unacceptably. 3rd Street cannot be widened without significant impacts to downtown San Rafael.

Improvements at the 3rd Street and Hetherton Street intersection would also improve 3rd Street arterial speed. A mitigation measure that would involve converting the southbound through lane on Hetherton Street that is adjacent to the exclusive right turn lane into a second right-turn lane (i.e., resulting in two through lanes and two right turn lanes onto 3rd Street, given the approximate 50/50 balance between through and right turn movements) was evaluated. This would reduce vehicle delays, but result in a potential secondary impact to pedestrians using the west crosswalk as motorists making a right turn from the new second right turn lane may find it difficult to see pedestrians, particularly those walking in the southbound direction. Given the potential secondary pedestrian impacts of the above mitigation measure, it is deemed to be infeasible.

Significance after Mitigation: Because this impact cannot be fully mitigated, it remains **significant and unavoidable**.

Freeway Operations

The project will add vehicle trips to US 101. Most segments are expected to operate acceptably under baseline plus project conditions. The US 101 SB weave segment from 2nd Street to I-580 EB operates at LOS F under baseline conditions. Project trips will increase volume to capacity by less than 0.01 on this segment. Therefore, this impact is considered **less than significant**.

Bicycle and Pedestrian Travel

Bicycle trips in the study area would increase as a result of the proposed project, as supported by the discussion in Project Conditions. Pedestrian trips in the study area will increase as a result of the proposed project, particularly at the 2nd Street and Lindaro Street intersection. The projected increase in vehicles at the intersections in the vicinity of the proposed project may result in an increase in vehicle-bicycle-pedestrian conflicts at intersections in the study area. However, the proposed project would not create potentially hazardous conditions for bicycles and pedestrians, or otherwise interfere with bicycle and pedestrian accessibility to the site and adjoining areas because the project does not remove existing facilities and does not prohibit the construction of proposed future facilities in the project vicinity. The project's impact to bicycle and pedestrian facilities is therefore considered less than significant.

To accommodate bicyclists, both the BioMarin R&D facilities and the senior services and housing facilities should include safe, secure bicycle parking.

Additionally, construction of the facilities proposed in the 2018 San Rafael Bicycle & Pedestrian Master Plan would support bicyclists and pedestrians accessing this project. In particular, the east-west bikeway through downtown, conceptually shown as along 4th Street, would create improved bicycle connections that would serve the project. For pedestrians, the planned improvements at and between the US 101 ramp intersections on 2nd Street would be beneficial. The other proposed US 101 undercrossing improvements would also benefit both pedestrians and bicyclists.

Construction of an additional crosswalk is recommended on the west leg of the signalized intersection of 3rd Street and Lindaro Street. This crosswalk would create a more direct connection between the project site, Lootens Place, and business areas to the north. Vehicle level of service at the intersection would not be reduced.

Transit Travel

Transit trips in the study area would increase as a result of the project, as supported by the discussion in Project Conditions. Most employees at the project site would walk to the San Rafael Transportation Center and SMART station to access the rail and bus service provided there. A total of 22 bus routes currently stop at the San Rafael Transportation Center. A survey of BioMarin employees at the San Rafael campus in the spring of 2018 indicated that 16 percent of employees travel by transit on a typical day. The proposed project, with 550 employees, would generate 88 new daily transit trips. The BioMarin employees using transit split their trips among SMART (77 percent), Golden Gate Transit (17 percent), and Marin Transit (6 percent). The project would thus add 68 daily riders to SMART, 15 daily riders to Golden Gate Transit routes, and 5 daily riders to Marin Transit routes on a typical weekday. This level of added transit ridership would not have a significant impact on the SMART, Golden Gate Transit, or Marin Transit routes serving Downtown San Rafael. Therefore, the project impacts to transit facilities are considered less than significant.

Cumulative Impacts

Vehicle Travel

Vehicle trips generated by the proposed project would increase traffic volumes on study roadway segments and intersections, as described below.

Intersection Operations

Most study intersections would continue to operate at an acceptable LOS under cumulative plus project conditions.

Project traffic would increase the average control delay by two seconds at the 2nd Street and Hetherton Street/ US 101 Southbound Ramp intersection during the AM peak hour, when it is already expected to operate at an unacceptable LOS. Because this increase is less than five seconds, it is considered less than significant. Addition of a second exclusive eastbound right turn lane at this intersection would reduce delay at this intersection. However, there is limited space (less than 100 feet) between the SMART extension and the ramp, and improvements would be insufficient to eliminate the increase.

One intersection would experience significant impacts.

Impacts and Mitigation Measures

Impact-2: Vehicle trips generated by the proposed project would increase cumulative traffic volumes at study intersections. These project trips would cause operations to degrade from an acceptable LOS to an unacceptable LOS at the 3rd Street and Tamalpais Avenue West intersection during the AM peak hour and increase delay significantly during the PM peak hour. Therefore, this is considered a significant impact.

Mitigation Measure-1: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) Plan and conduct ongoing annual monitoring.

Mitigation Measure-3: Reduce lane widths and add a westbound left-turn pocket at the 3rd Street and Tamalpais Avenue intersection.

This measure would provide additional capacity for the westbound through and left-turn movements. This change would improve operations to LOS D. This improvement could be accomplished during planned redesign of the transit center at the southeast corner of this intersection. However, this may not be feasible within the transit center design. TDM measures alone would not completely mitigate this impact.

Significance after Mitigation: Because the feasibility of the proposed mitigation measure is uncertain given the ongoing process of selecting a preferred alternative for the transit center and trip reduction strategies in the new TDM Plan would not reduce trips to a level that would reduce added intersection delay to a less than significant level, the impact remains **significant and unavoidable.**

Arterial Operations

Under cumulative plus project conditions, most arterials would experience a less than significant increase in delay (City arterials) or volume to capacity (congestion management arterials). Eliminating parking on Irwin Street in the AM peak hour as currently done in the PM peak hour was evaluated, but the improvement to speed was less than 1 mile per hour. Irwin Street cannot be widened without significant impacts to adjacent properties. Similarly, a second exclusive eastbound right turn lane at the 2nd Street and Hetherton Street/ US 101 Southbound Ramp intersection was reviewed to see if it would improve 2nd Street speed; however, there is limited space (less than 100 feet) between the SMART extension and the ramp, and improvements would be minor. 2nd Street cannot be widened without significant impacts to downtown.

However, 3rd Street volume to capacity would increase significantly (by 0.067) during the AM peak hour.

Impacts and Mitigation Measures

Impact-3: Vehicle trips generated by the proposed project would add vehicle trips to study arterials. These project trips would cause volume to capacity to increase unacceptably on the 3rd Street arterial during the AM peak hour. Therefore, this is considered a significant impact.

Mitigation Measure-1: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) Plan and conduct ongoing annual monitoring.

Intersection improvements at the 3rd Street and Tamalpais Avenue West intersection would also benefit 3rd Street arterial speed. This improvement could be accomplished during planned redesign of the Transit Center at the southeast corner of this intersection. However, this may not be feasible within the Transit Center design. TDM measures alone would not completely mitigate this impact.

Intersection improvements at the 3rd Street and Hetherton Street intersection would also benefit 3rd Street arterial speed. Converting the southbound through lane on Hetherton Street that is adjacent to the exclusive right turn lane into a second right-turn lane (i.e., resulting in two through lanes and two right turn lanes onto 3rd Street, given the approximate 50/50 balance between through and right turn movements) was evaluated. This would reduce vehicle delays, but result in a potential secondary impact to pedestrians using the west crosswalk as motorists making a right turn from the new second right turn lane may find it difficult to see pedestrians, particularly those walking in the southbound direction. Given the potential secondary pedestrian impacts of the above mitigation measure, it is deemed to be infeasible.

The TDM mitigation measure described above would not result in a sufficient reduction in traffic to reduce the increase in volume to capacity to an acceptable level. 3rd Street cannot be widened without significant impacts to downtown San Rafael. Therefore, the impact is considered significant and unavoidable on this arterial.

Significance after Mitigation: Significant and unavoidable

Freeway Operations

The project will add vehicle trips to US 101. Three segments will experience unacceptable operations under cumulative plus project conditions. For two segments (US 101 NB I-580 On-Ramp to 2nd Street Off-Ramp and US 101 SB 2nd Street On-ramp to I-580 EB Off-Ramp), project trips will increase volume to capacity by less than 0.01. However, for one segment, US 101 SB Mission Avenue Off-Ramp, project trips will increase volume to capacity by more than 0.01.

Impacts and Mitigation Measures

Impact-4: Vehicle trips generated by the proposed project would add vehicle trips to study freeway segments. These project trips would cause volume to capacity to increase unacceptably on the US 101 SB Mission Avenue Off-Ramp diverge segment during the AM peak hour. Therefore, this is considered a significant impact.

Mitigation Measure-1: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) plan and conduct ongoing annual monitoring.

TDM improvements alone would reduce the increase in volume to capacity, but not to an acceptable level. Insufficient width exists to add lanes to this segment of US 101 SB.

Significance after Mitigation: Significant and unavoidable

Vehicle Miles Traveled

A vehicle miles traveled (VMT) analysis was completed in preparation for City of San Rafael implementation of Senate Bill (SB) 743. The City has not yet adopted policies relating to SB 743. Therefore, results of this analysis are for informational purposes only. This section describes the methodology used to calculate the daily home-work VMT per employee. This VMT is that generated by an employee's trips between work and home. The results are presented along with a short discussion below.

Assumptions and Methodology

To determine the average daily home-work VMT per employee at the existing BioMarin San Rafael campus, zip code data provided by BioMarin that listed employee residential locations was analyzed. Figure 27 illustrates the existing employee residential distribution.

This data was used to calculate the distance between existing employee zip codes and the project site. The average home-work travel distance per driver was calculated by using the weighted average of distances between each zip code and the project site based on the number of employees residing in each zip code. Using the mode share data discussed in Project Conditions, this number was adjusted by reducing the number of vehicle trips to account for transit, carpooling, walking, and bicycling, resulting in the average VMT per employee.

Comparable data was not available for the senior services and housing. However, residents will not be able to own vehicles, as a restriction of the lease, and the facility manager will reside in an on-site apartment. These factors will reduce VMT for the site. BioMarin will also generate more than 80% of project site trips.

The main limitations of this approach are that distances were calculated based on zip codes, which provides an approximate estimate of distance traveled. Workers residing at longer distances may be more likely to telecommute or use transit such as SMART rail or Golden Gate Transit buses, which may cause VMT forecasts to be overestimated.

Results

The average trip driver trip length for employees at the proposed project based on existing BioMarin employee zip code data is estimated to be approximately 21.6 miles, or 43 VMT. Adjusting for mode share, the average home-work daily VMT per driver is estimated to be 37.

For comparison purposes, the average home-work VMT per worker for San Rafael and the Bay Area was determined using the Metropolitan Transportation Commission (MTC) Regional Travel Model.

The results of this analysis are presented in Table 51. BioMarin employees would have 61% greater VMT than the average San Rafael employee as determined by the MTC travel model.

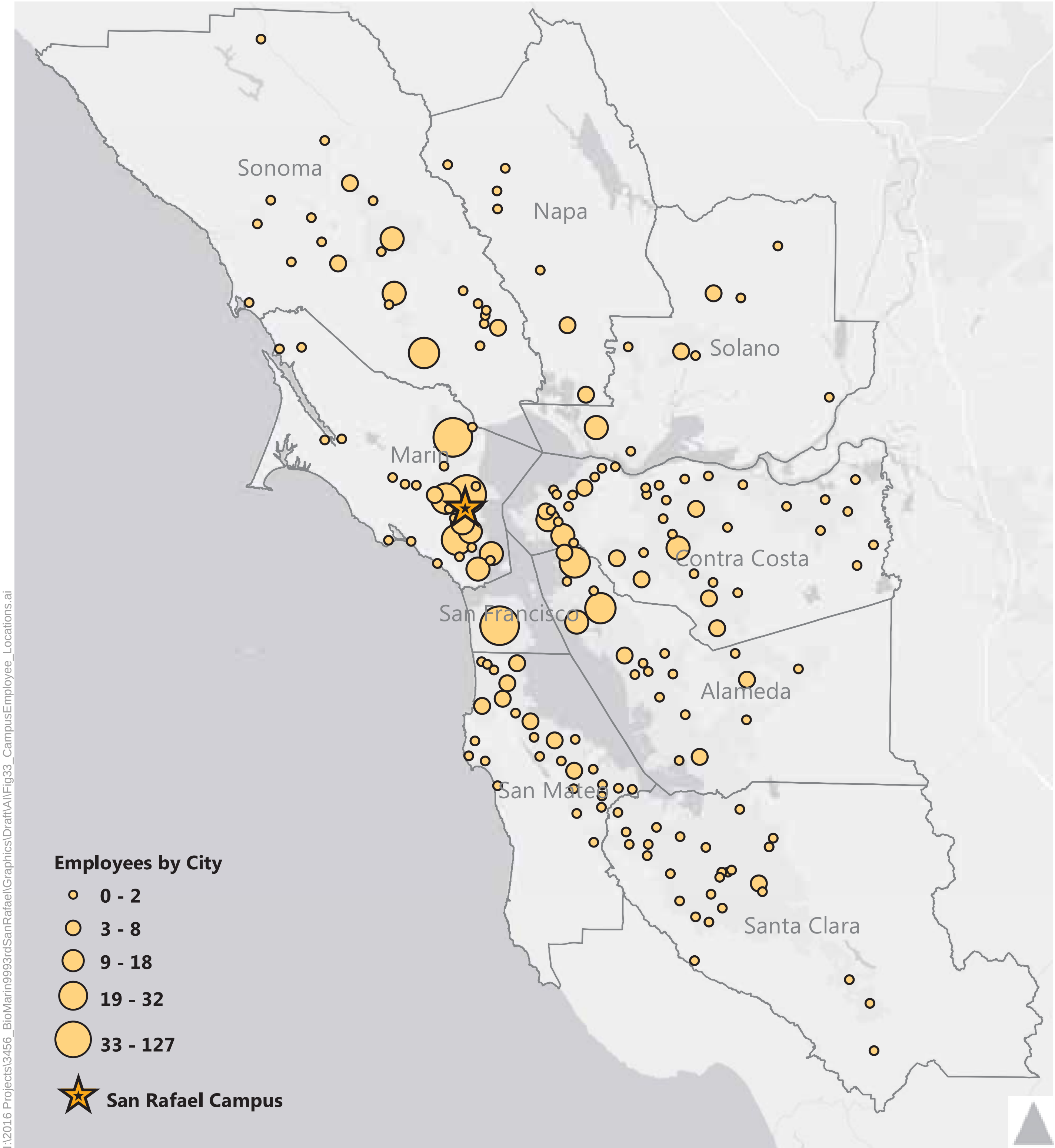
TABLE 51: HOME-WORK VEHICLE MILES TRAVELED

Location	Estimated Average Home-Work VMT / Employee
BioMarin R&D[1]	37
Downtown San Rafael[2]	20
San Rafael[2]	23
Bay Area[2]	17

Notes:

1. BioMarin data based on employee survey data provided by BioMarin
2. San Rafael and Bay Area data estimated using the MTC Regional Travel Model

Source: Fehr & Peers, 2018



N:\2016 Projects\3456_BioMarin9993rdSanRafael\Graphics\Draft\AI\Fig33_CampusEmployee_Locations.ai

Figure 27

2018 BioMarin San Rafael Campus Employee Home Locations

Site Plan Review

This chapter analyzes site access and internal circulation for vehicles, bicycles, and pedestrians. Site recommendations are presented in Figure 28.

Access to the project would be provided from six unsignalized driveways as indicated in Figure 28. One-way driveways on Lindaro Street would provide access to the east side of the BioMarin R&D facility, and a one-way entrance driveway from 3rd Street and exit driveway to Brooks Street would provide access to the west side of the BioMarin R&D facility. Parking on the ground floor of the senior services and housing building will be accessed from one-way driveways on Brooks Street.

> ***Recommendation:*** Maintain landscaping at project driveways to avoid sight distance conflicts. Shrubs should not be higher than approximately 30 inches and tree canopies should be approximately six feet from the ground.

> ***Recommendation:*** Prohibit parking for approximately 20 feet on either side of project driveways to maintain proper sight distances.

> ***Recommendation:*** Consider adding westbound left turn pocket for the driveway at 3rd Street.

Engineering Study Guide for Evaluating Intersection Improvements, NCHRP Report 457, provides guidance for determining the need for a major-road right-turn pocket, which is comparable to a left-turn pocket on a one-way street. This location does not meet the conditions of the guidance under project conditions. However, a turn pocket could improve safety for drivers and pedestrians by allowing turning vehicles to wait for pedestrians crossing the driveway without impeding vehicle flow on 3rd Street.

> ***Recommendation:*** Consider stop sign pavement legends to control which traffic movements within the parking lot have priority.

> ***Recommendation:*** Consider vehicle activated audible and visual warning for pedestrians of cars exiting project driveways with restricted views.

> ***Recommendation:*** Update curb ramps to be ADA compliant pairs on all corners of project site. Where feasible, curb ramps should be directional.

Emergency vehicles can access the site using the Lindaro Street driveways, 3rd Street driveway, and the southernmost Brooks Street driveway. The 3rd Street driveway and Brooks Street driveway will be gated.

> ***Recommendation:*** Coordinate with San Rafael fire and police services to provide access to gated driveways on 3rd Street and Brooks Street.

Bicycle parking is planned for both the BioMarin R&D facility and the senior services and housing.

- BioMarin R&D facility
  - Short term: Bike racks accommodating four bikes are planned on Lindaro Street.
  - Long term: A bike storage room accommodating 34 bikes is planned on the first floor of Building A.
- Senior services and housing
  - Short term: Four bike racks are planned along 3rd Street.
  - Long term: A bike storage room accommodating six bikes is planned on the first floor.

This bicycle parking will meet the requirements of San Rafael Municipal Code section 14.18.090.

Project Driveway

Consider vehicle activated audible and visual warning of cars exiting driveway for pedestrians

STOP Consider stop sign legends to control which movements have priority

Maintain landscaping and prohibit parking 20ft on either side of driveways and sidewalks to limit sight distance issues

Figure 28

Site Plan Review

Crossing Treatments and Intersection Controls

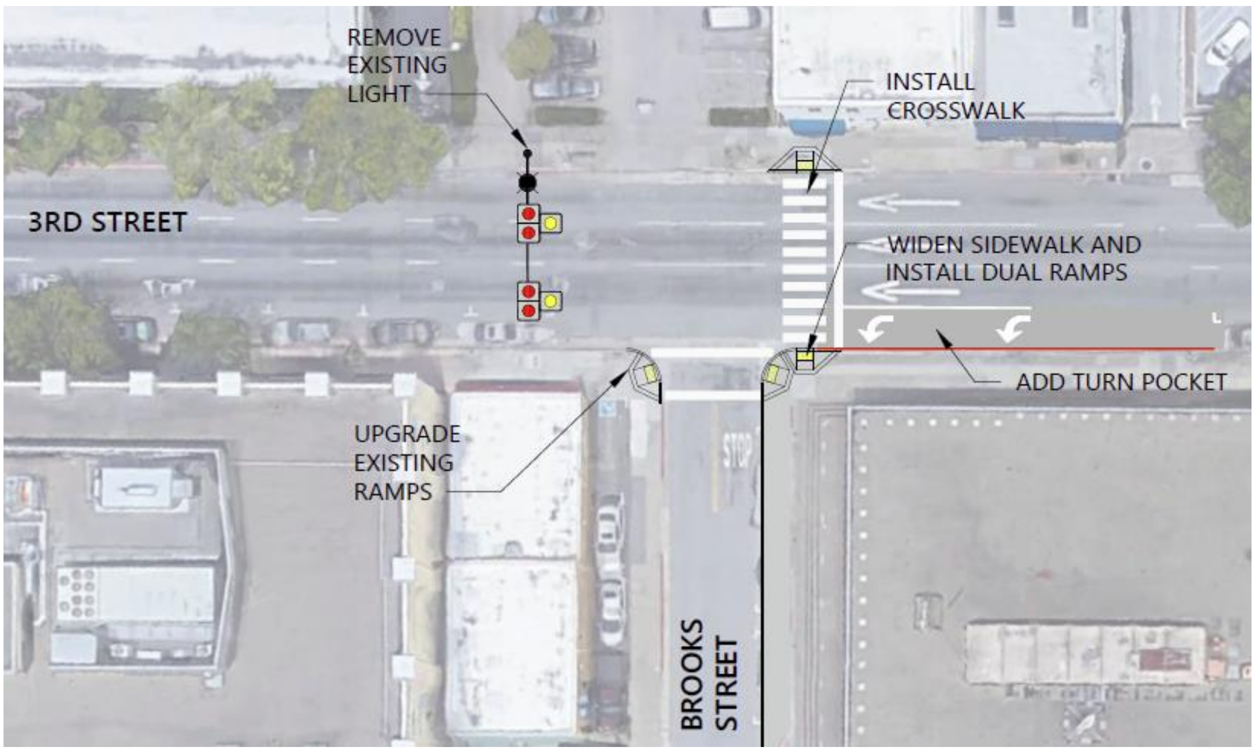
Crossing treatments and intersection controls were reviewed at the four intersections adjacent to the project site, based on the pedestrian crossings discussed in the Project Conditions chapter. The City is currently conducting the 3rd Street Corridor Rehabilitation project study, which has included discussion of a crossing at Brooks Street and other changes along the 3rd Street corridor.

3rd Street and Brooks Street

Currently, pedestrian crossing of 3rd Street at Brooks Street is prohibited. A signalized crossing is present at A Street 240 feet to the west, providing connectivity to downtown destinations. However, entrances to the senior center and housing near the intersection of 3rd Street and Brooks Street are expected to increase pedestrian crossing demands at this intersection, as described in Project Conditions. Pedestrian hybrid beacon (PHB) and signalization options were evaluated for this intersection to better accommodate pedestrians.

Installation of a Pedestrian Hybrid Beacon

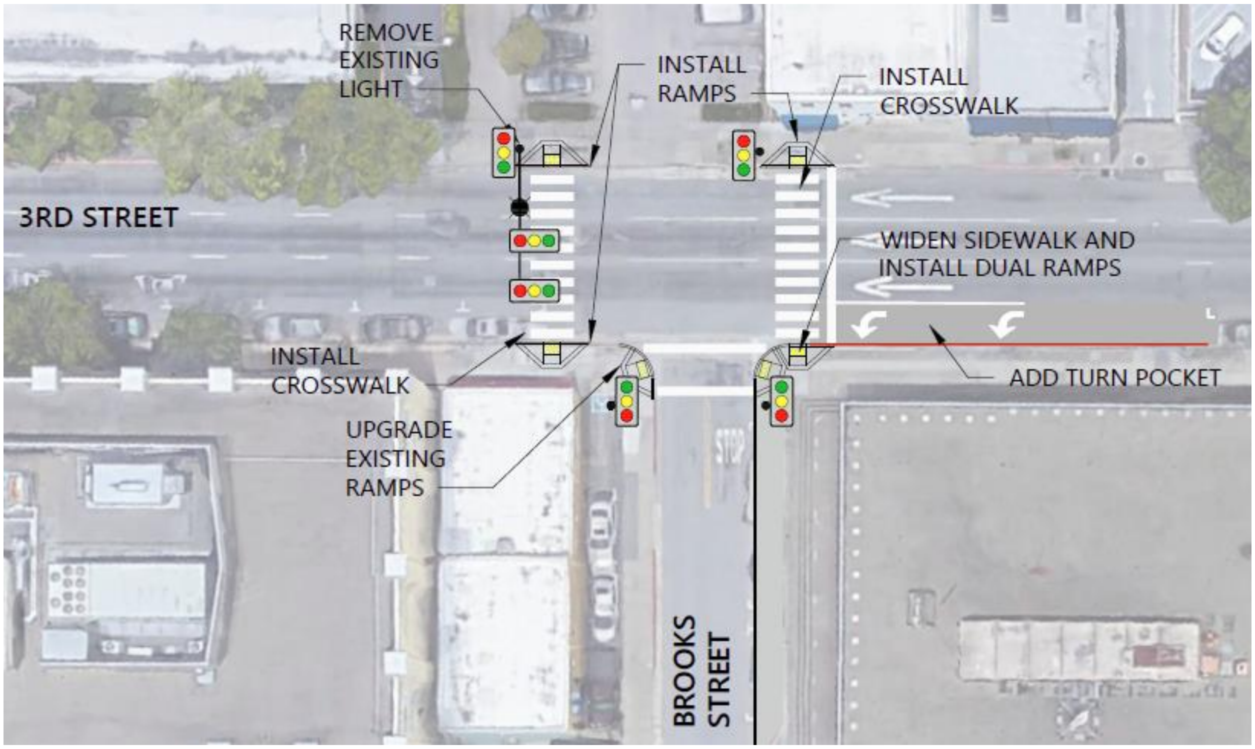
Considering current illegal crossings, new demand, and shift of some demand from the crosswalk on the east leg of the intersection of 3rd Street and A Street, 3rd Street and Brooks Street may meet the warrant for a PHB. Seven pedestrians were observed crossing illegally during the PM peak hour, and demand for another five crossings is expected to be generated by the project. Shifting eight of the 57 crossings on the east leg of the intersection of 3rd Street and A Street would meet the warrant. A PHB on the east leg of the intersection would operate at LOS A.



Conceptual - not for construction. Additional detailed analysis and engineering design required.

Signalization

The intersection is not projected to meet the peak hour warrant for signalization. However, the California Manual on Uniform Traffic Control Devices, 2014 Edition, notes that information about nearby facilities and activity centers that serve the elderly may also be considered as part of a full analysis. The intersection would operate at LOS A if signalized.



Conceptual - not for construction. Additional detailed analysis and engineering design required.

Intersection operations impacts are shown in Table 52. The intersection would operate at LOS A under both options.

TABLE 52: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND BROOKS STREET

Intersection	LOS/Average Delay[1,2]					
	SSSC		SSSC with PHB		Signal	
	AM	PM	AM	PM	AM	PM
15. 3rd Street and Brooks Street	A (B) / 2.3 (10.6)	A (B) / 2.8 (13.3)	A (C) / 3.7 (11.7)	A (C) / 7.6 (16.7)	A / 6.5	A / 5.0

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.

1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown in Table 53. Both options would change speed on 3rd Street by less than one mile per hour in the AM and PM peak hours.

TABLE 53: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND BROOKS STREET (ARTERIAL RESULTS)

Arterial	Standard	LOS / Average Speed [1,2]					
		SSSC		SSSC with PHB		Signal	
		AM	PM	AM	PM	AM	PM
3rd Street WB from Hetherton Street to D Street	D	**F / 5**	**F / 5**	**F /5**	**F / 5**	**F /5**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

To assess the effects of pedestrian crossings of 3rd Street during the lunch hour, an analysis of the intersection of 3rd Street and Brooks Street was conducted based on the application of alternative traffic control devices. Table 54 shows that the intersection would operate at level of service A/B with each traffic control alternative. For additional information on the number of new lunchtime pedestrian crossings, see Table 22.

TABLE 54: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND BROOKS STREET (LUNCHTIME PEAK HOUR)

Intersection	LOS/Average Delay[1,2]		
	SSSC	SSSC with PHB	Signal
15. 3rd Street and Brooks Street	A (B) / 1.4 (14.9)	A (B) / 3.5 (10.4)	A / 4.2

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.

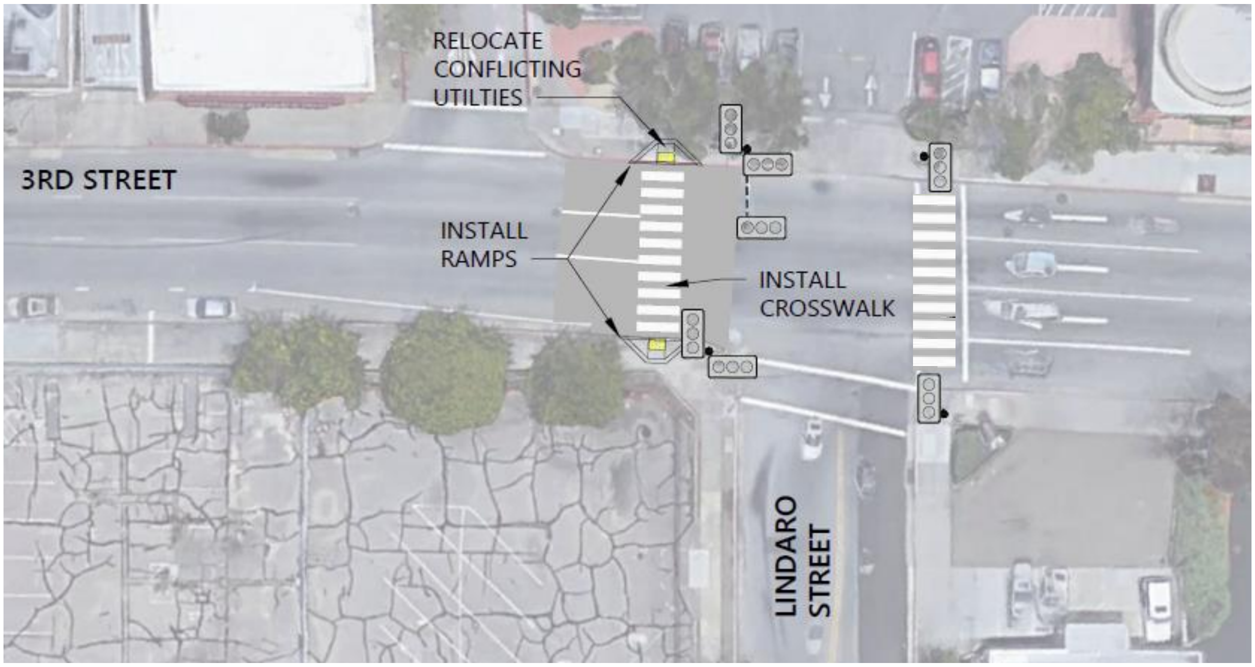
1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

3rd Street and Lindaro Street

Currently a marked crosswalk is not present on the west leg of the 3rd Street and Lindaro Street intersection. Pedestrians walking between the project site (or existing pedestrians arriving at the southwest corner of the intersection) and downtown would need to cross the other three legs of the intersection. Creating a more direct connection would also improve pedestrian safety by reducing the number of pedestrian/vehicle conflict point exposures. In all cases, pedestrian signals should be updated to meet current ADA standards, including countdown timers.

Adding a crosswalk on the west leg of the intersection would create a more direct connection to downtown. Although the northbound movements at the intersection would experience approximately three seconds greater delay, most of the vehicle volume is on the westbound movements, and overall operations for the intersection would improve (Table 55).



Conceptual - not for construction. Additional detailed analysis and engineering design required.

TABLE 55: COMPARISON OF CROSSWALK OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET

Intersection	LOS/Average Delay[1,2]			
	No crosswalk on west leg		Crosswalk on west leg	
	AM	PM	AM	PM
16. 3rd Street and Lindaro Street	B / 15.3	A / 9.4	B / 11.7	A / 8.5

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches.
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown below in Table 56. Adding the crosswalk would change speed on 3rd Street by less than one mile per hour in the AM and PM peak hours.

TABLE 56: COMPARISON OF CROSSWALK OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET (ARTERIAL RESULTS)					
Arterial	**Standard**	**LOS / Average Speed** [1,2]			
		No crosswalk on west leg		**Crosswalk on west leg**	
		AM	**PM**	**AM**	**PM**
3rd Street WB from Hetherton Street to D Street	D	**F / 5**	**F / 5**	**F / 5**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

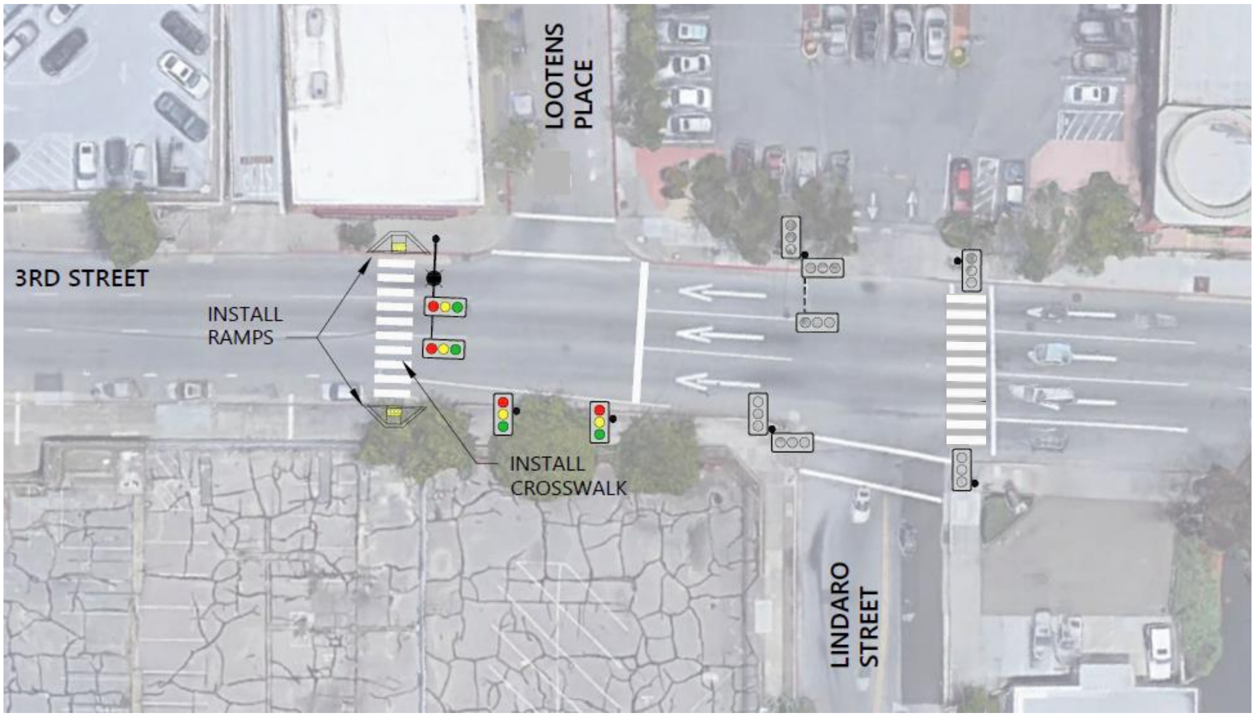
To assess the effects of pedestrian crossings of 3rd Street during the lunch hour, an analysis of the intersection of 3rd Street and Lindaro Street was conducted for each crosswalk option. Table 57 shows that the intersection would operate at level of service A with each crosswalk alternative. For additional information on the number of new lunchtime pedestrian crossings, see Table 22.

TABLE 57: COMPARISON OF CROSSWALK OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET (LUNCHTIME PEAK HOUR)		
Intersection	**LOS/Average Delay**[1,2]	
	No crosswalk on west leg	**Crosswalk on west leg**
16. 3rd Street and Lindaro Street	A / 9.1	A / 9.1

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches.
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Alternatively, the Lindaro intersection and Lootens Place intersections could be configured with clustered signals, with a crosswalk on the west leg of the Lootens Place intersection. The intersection would operate acceptably at LOS C under Cumulative Plus Project conditions, though delay would increase somewhat. Removing the Walgreens driveway from the intersection would reduce delay somewhat in the AM peak hour and leave it essentially unchanged in the PM peak hour. These options are summarized in Table 58.



Conceptual - not for construction. Additional detailed analysis and engineering design required.

TABLE 58: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET

Intersection	LOS/Average Delay[1,2]					
	Signal at Lindaro Street only		Signals at Lindaro and Lootens Place		Signals at Lindaro and Lootens Place, no Walgreens driveway	
	AM	PM	AM	PM	AM	PM
16. 3rd Street and Lindaro Street	B / 15.3	A / 9.4	C / 31.3	C / 22.7	C / 25.0	C / 24.1

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control.
1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches.
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown below (Table 59). Signalizing Lootens Place would change speed on 3rd Street by less than one mile per hour in the AM and PM peak hours.

TABLE 59: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET (ARTERIAL RESULTS)							
Arterial	Standard	LOS / Average Speed [1]					
		Signal at Lindaro Street only		Signals at Lindaro and Lootens Place		Signals at Lindaro and Lootens Place, no Walgreens driveway	
		AM	PM	AM	PM	AM	PM
3rd Street WB from Hetherton Street to D Street	D	**F / 5**	**F / 5**	**F / 5**	**F / 5**	**F / 5**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

To assess the effects of pedestrian crossings of 3rd Street during the lunch hour, an analysis of the intersection of 3rd Street and Lindaro Street was conducted for each control option. Table 60 shows that the intersection would operate at level of service A without a signal at Lootens Place and at level of service D with a signal at Lootens Place. For additional information on the number of new lunchtime pedestrian crossings, see Table 22.

TABLE 60: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET (LUNCHTIME PEAK HOUR)			
Intersection	LOS/Average Delay[1,2]		
	Signal at Lindaro Street only	Signals at Lindaro and Lootens Place	Signals at Lindaro and Lootens Place, no Walgreens driveway
16. 3rd Street and Lindaro Street	A / 9.1	D / 38.3	D / 38.1

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control.
1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches.
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

2nd Street and Brooks Street

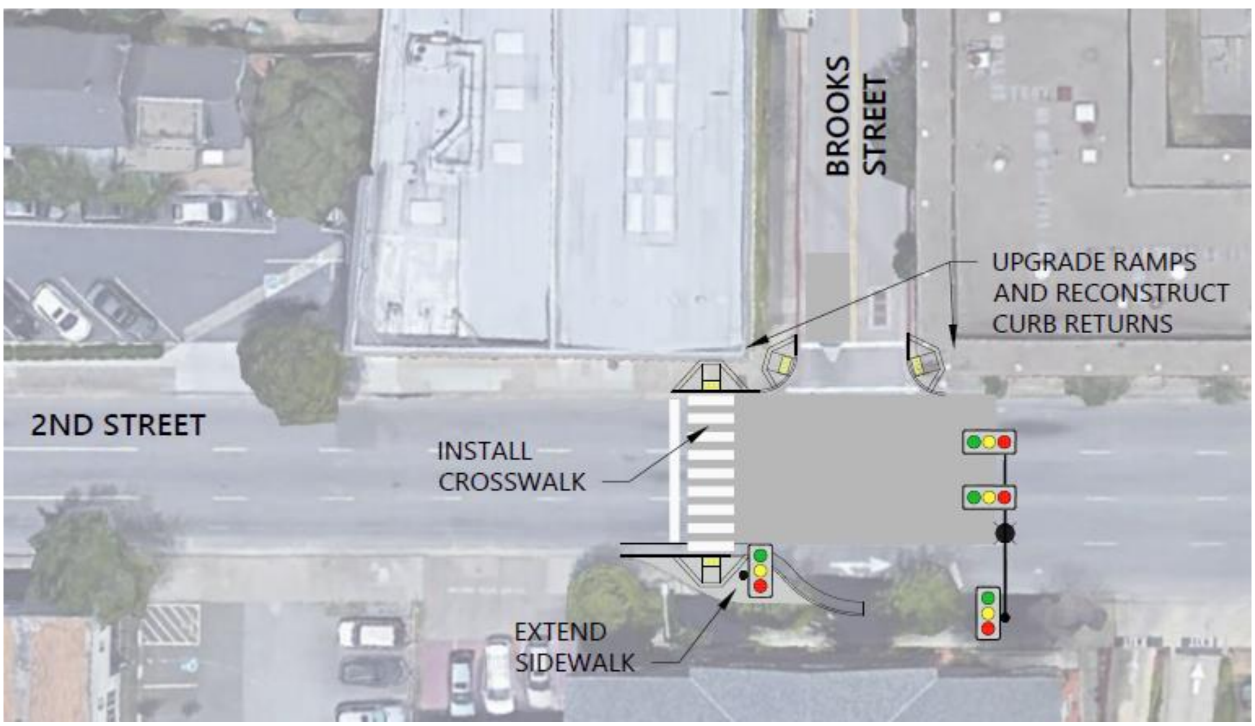
Vehicles turning from southbound Brooks Street to eastbound 2nd Street currently have limited visibility to eastbound vehicles at this side-street stop controlled intersection because of the siting of the building on the northwest corner of the intersection. Southbound vehicles must proceed into the crosswalk on the north leg of the intersection, blocking pedestrian crossings, to increase the view of eastbound traffic.

Although a marked crosswalk across 2nd Street is not provided at this intersection, pedestrian crossings are not prohibited. However, due to the proximity of the signalized crossing at A Street (200 feet to the west) and the locations of likely pedestrian destinations, little demand is expected for a crossing at this location.

Two options for improving the visibility concern were evaluated: signalization of the intersection and conversion of Brooks Street to one-way northbound. A PHB was considered for this intersection, as was conversion of Brooks Street to one-way southbound, but neither of these options would resolve the visibility issue, so they were not evaluated.

Signalization

Although a peak hour signal warrant is not met for this intersection, adding a signal would improve safety at this intersection by addressing limited sight distance. The overall impacts of installing a traffic signal at this location on adjacent intersections would be small (Table 61).



Conceptual - not for construction. Additional detailed analysis and engineering design required.

TABLE 61: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 2ND STREET AND BROOKS STREET				
Intersection	**LOS/Average Delay[1,2]**			
	SSSC		**Signal**	
	AM	**PM**	**AM**	**PM**
25. 2nd Street and Brooks Street	A (C) / 2.9 (22.0)	A (D) / 3.8 (27.7)	A / 6.4	A / 8.1

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control.
1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown below (Table 62). Addition of the signal would reduce speed on 2nd Street by one mile per hour in the AM peak hour and less than one mile per hour in the PM peak hour.

TABLE 62: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 2ND STREET AND BROOKS STREET (ARTERIAL RESULTS)					
Arterial	**Standard**	**LOS / Average Speed [1,2]**			
		SSSC		**Signal**	
		AM	**PM**	**AM**	**PM**
2nd Street from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 5**	**F / 5**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Conversion of Brooks to One-Way Northbound

By removing southbound traffic on Brooks Street, the limited visibility condition for vehicles turning from southbound Brooks Street to eastbound 2nd Street would be eliminated. Some traffic would have to make additional turns; however, overall impacts on adjacent intersections would be small (Table 63), with some improvements due to one-way flows.

TABLE 63: EFFECT OF ONE-WAY CONVERSION OF BROOKS STREET

Intersection	Control Type	LOS/Average Delay[1,2]			
		Two-Way		One-Way Northbound	
		AM	PM	AM	PM
14. 3rd Street and A Street	Signal	B / 18.2	C / 24.6	B / 18.3	C / 24.2
15. 3rd Street and Brooks Street	SSSC	A (B) / 2.3 (10.6)	A (B) / 2.8 (13.3)	A (B) / 2.1 (13.4)	A (C) / 3.9 (22.6)
16. 3rd Street and Lindaro Street	Signal	B / 15.3	A / 9.4	B / 13.0	A / 8.7
24. 2nd Street and A Street	Signal	C / 27.5	C / 30.5	C / 27.9	C / 34.6
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.9 (22.0)	A (D) / 3.8 (27.7)	A (A) / 2.7 (2.9)	A (A) / 2.7 (3.0)
26. 2nd Street and Lindaro Street	Signal	B / 18.6	C / 21.0	B / 18.0	B / 18.5

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control.
1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown in Table 64. Addition of the signal would reduce speed on 2nd Street by less than one mile per hour in the AM and PM peak hours.

TABLE 64: EFFECT OF ONE-WAY CONVERSION OF BROOKS STREET (ARTERIAL RESULTS)

Arterial	Standard	LOS / Average Speed [1,2]			
		SSSC		Signal	
		AM	PM	AM	PM
2nd Street from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 5**	**F / 6**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

2nd Street and Lindaro Street

Crosswalks are present on all four legs of this intersection, and the intersection operates acceptably during the AM and PM peak hours. An analysis was also conducted to assess the effects of pedestrian crossings during the lunch hour. The analysis showed that the intersection would operate at LOS B and with average delay of 15.7 seconds under Cumulative Plus Project Conditions (R&D and Senior Services and Housing).

(For additional information on the number of new lunchtime pedestrian crossings, see Table 22.) No changes to the intersection are recommended.

Appendix A:

Existing Conditions –

Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

April 5, 2019

FEHR PEERS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	103	437	14	59	525	40	9	194	35	53	354	341
Future Volume (veh/h)	103	437	14	59	525	40	9	194	35	53	354	341
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	0.99		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1710	1660	1660	1710	1800	1678	1728	1800	1748	1728
Adj Flow Rate, veh/h	112	475	14	64	571	39	10	211	29	58	385	151
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	148	876	26	395	634	43	58	538	72	146	871	329
Arrive On Green	0.09	0.55	0.55	0.55	0.55	0.55	0.85	0.85	0.85	0.43	0.43	0.43
Sat Flow, veh/h	1581	1602	47	840	1533	105	19	1261	168	208	2042	771
Grp Volume(v), veh/h	112	0	489	64	0	610	250	0	0	320	0	274
Grp Sat Flow(s),veh/h/ln	1581	0	1649	840	0	1638	1448	0	0	1625	0	1396
Q Serve(g_s), s	5.2	0.0	14.3	3.4	0.0	24.9	0.0	0.0	0.0	1.1	0.0	10.5
Cycle Q Clear(g_c), s	5.2	0.0	14.3	7.7	0.0	24.9	2.8	0.0	0.0	9.8	0.0	10.5
Prop In Lane	1.00		0.03	1.00		0.06	0.04		0.12	0.18		0.55
Lane Grp Cap(c), veh/h	148	0	902	395	0	677	668	0	0	750	0	596
V/C Ratio(X)	0.76	0.00	0.54	0.16	0.00	0.90	0.37	0.00	0.00	0.43	0.00	0.46
Avail Cap(c_a), veh/h	148	0	902	395	0	677	668	0	0	750	0	596
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.76	0.00	0.76	0.92	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.2	0.0	11.0	12.9	0.0	15.5	3.4	0.0	0.0	15.1	0.0	15.3
Incr Delay (d2), s/veh	30.1	0.0	2.3	0.7	0.0	14.1	1.5	0.0	0.0	1.8	0.0	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	0.0	7.1	0.8	0.0	13.8	1.3	0.0	0.0	5.0	0.0	4.4
LnGrp Delay(d),s/veh	63.2	0.0	13.3	13.6	0.0	29.6	4.8	0.0	0.0	16.9	0.0	17.9
LnGrp LOS	E		B	B		C	A			B		B
Approach Vol, veh/h		601			674			250			594	
Approach Delay, s/veh		22.6			28.1			4.8			17.3	
Approach LOS		C			C			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		45.2		36.8	10.0	35.2		36.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 41		25.4	7.0	* 31		25.4
Max Q Clear Time (g_c+I1), s		16.3		4.8	7.2	26.9		12.5
Green Ext Time (p_c), s		4.9		2.1	0.0	2.1		4.3

Intersection Summary			
HCM 2010 Ctrl Delay			20.8
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	461	74	33	201	0	0	0	0	211	931	436
Future Volume (vph)	0	461	74	33	201	0	0	0	0	211	931	436
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.97
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2717			1767						2961	1302
Flt Permitted		1.00			0.88						0.99	1.00
Satd. Flow (perm)		2717			1573						2961	1302
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	501	80	36	218	0	0	0	0	229	1012	474
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	564	0	0	254	0	0	0	0	0	1241	474
Confl. Peds. (#/hr)	15		22	22		15			16			1
Confl. Bikes (#/hr)			3			2			1			3
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1188			687						1318	458
v/s Ratio Prot		c0.21									c0.42	
v/s Ratio Perm					0.16							c0.36
v/c Ratio		0.47			0.37						0.94	1.03
Uniform Delay, d1		15.0			14.2						19.9	24.3
Progression Factor		0.55			1.50						1.00	1.00
Incremental Delay, d2		1.1			1.3						14.3	51.4
Delay (s)		9.4			22.5						34.1	75.7
Level of Service		A			C						C	E
Approach Delay (s)		9.4			22.5			0.0			45.6	
Approach LOS		A			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	35.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	358	19	295	149	309	3	97	1008	121	29
Future Volume (vph)	358	19	295	149	309	3	97	1008	121	29
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1494	1794	1615	1471			3430	1295	
Flt Permitted		0.62	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		969	1794	1615	1471			3430	1295	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	389	21	321	162	336	3	105	1096	132	32
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	44	0
Lane Group Flow (vph)	0	410	321	162	339	0	0	1201	120	0
Confl. Peds. (#/hr)							13			6
Confl. Bikes (#/hr)					2	2				2
Parking (#/hr)				0				2		
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Effective Green, g (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Actuated g/C Ratio		0.45	0.45	0.25	0.25			0.44	0.44	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		512	808	404	368			1500	566	
v/s Ratio Prot		c0.12	0.18	0.10	c0.23					
v/s Ratio Perm		0.25						0.35	0.09	
v/c Ratio		0.80	0.40	0.40	0.92			0.80	0.21	
Uniform Delay, d1		18.6	13.8	23.4	27.4			18.3	13.1	
Progression Factor		0.96	0.90	1.00	1.00			0.76	0.66	
Incremental Delay, d2		9.9	1.1	3.0	30.7			2.6	0.5	
Delay (s)		27.7	13.6	26.4	58.0			16.5	9.1	
Level of Service		C	B	C	E			B	A	
Approach Delay (s)			21.5	47.8				15.6		
Approach LOS			C	D				B		

Intersection Summary			
HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	285	34	55	265	27	7	193	38	30	361	38
Future Volume (veh/h)	29	285	34	55	265	27	7	193	38	30	361	38
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.97	0.98		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1398	1545	1530	1398	1485	1530	1440	1485	1469	1440	1485	1469
Adj Flow Rate, veh/h	32	310	32	60	288	24	8	210	31	33	392	36
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	257	538	56	271	529	44	55	535	77	75	544	48
Arrive On Green	0.39	0.39	0.39	0.13	0.13	0.13	0.97	0.97	0.97	0.97	0.97	0.97
Sat Flow, veh/h	840	1372	142	816	1349	112	12	1102	158	49	1120	99
Grp Volume(v), veh/h	32	0	342	60	0	312	249	0	0	461	0	0
Grp Sat Flow(s),veh/h/ln	840	0	1513	816	0	1461	1272	0	0	1268	0	0
Q Serve(g_s), s	2.4	0.0	13.3	5.2	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	17.4	0.0	13.3	18.6	0.0	15.0	0.7	0.0	0.0	2.7	0.0	0.0
Prop In Lane	1.00		0.09	1.00		0.08	0.03		0.12	0.07		0.08
Lane Grp Cap(c), veh/h	257	0	593	271	0	573	667	0	0	667	0	0
V/C Ratio(X)	0.12	0.00	0.58	0.22	0.00	0.54	0.37	0.00	0.00	0.69	0.00	0.00
Avail Cap(c_a), veh/h	257	0	593	271	0	573	667	0	0	667	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.96	0.00	0.96	0.91	0.00	0.00	0.62	0.00	0.00
Uniform Delay (d), s/veh	25.5	0.0	17.9	34.3	0.0	26.4	0.6	0.0	0.0	0.6	0.0	0.0
Incr Delay (d2), s/veh	1.0	0.0	4.0	1.8	0.0	3.5	1.5	0.0	0.0	3.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	6.2	1.3	0.0	6.6	0.5	0.0	0.0	1.1	0.0	0.0
LnGrp Delay(d),s/veh	26.4	0.0	22.0	36.1	0.0	29.9	2.0	0.0	0.0	4.3	0.0	0.0
LnGrp LOS	C		C	D		C	A			A		
Approach Vol, veh/h		374			372			249			461	
Approach Delay, s/veh		22.3			30.9			2.0			4.3	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		34.0		41.0		34.0		41.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		29.4		36.4		29.4		36.4
Max Q Clear Time (g_c+I1), s		19.4		2.7		20.6		4.7
Green Ext Time (p_c), s		1.2		1.1		1.1		2.2

Intersection Summary		
HCM 2010 Ctrl Delay		15.3
HCM 2010 LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	217	150	32	228	0	0	0	0	42	892	104
Future Volume (vph)	0	217	150	32	228	0	0	0	0	42	892	104
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.94			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1665			1770						4119	1127
Flt Permitted		1.00			0.93						1.00	1.00
Satd. Flow (perm)		1665			1648						4119	1127
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	236	163	35	248	0	0	0	0	46	970	113
RTOR Reduction (vph)	0	32	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	367	0	0	283	0	0	0	0	0	1016	113
Confl. Peds. (#/hr)			15	15		14			22	22		10
Confl. Bikes (#/hr)			4			2			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		728			720						1834	396
v/s Ratio Prot		c0.22										
v/s Ratio Perm					0.17						0.25	0.10
v/c Ratio		0.50			0.39						0.55	0.29
Uniform Delay, d1		15.2			14.3						15.3	17.5
Progression Factor		0.38			1.23						0.17	0.24
Incremental Delay, d2		2.4			1.1						0.5	0.8
Delay (s)		8.3			18.7						3.1	5.0
Level of Service		A			B						A	A
Approach Delay (s)		8.3			18.7			0.0			3.3	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	89	0	0	141	113	146	1051	10	0	0	0
Future Volume (veh/h)	120	89	0	0	141	113	146	1051	10	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	0.89	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1620	1573	1620			
Adj Flow Rate, veh/h	130	97	0	0	153	81	159	1142	10			
Adj No. of Lanes	1	1	0	0	1	0	0	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	0	3	0			
Cap, veh/h	260	491	0	0	266	141	182	1377	13			
Arrive On Green	0.10	0.10	0.00	0.00	0.31	0.31	0.19	0.19	0.19			
Sat Flow, veh/h	1014	1573	0	0	853	452	322	2435	22			
Grp Volume(v), veh/h	130	97	0	0	0	234	684	0	627			
Grp Sat Flow(s),veh/h/ln	1014	1573	0	0	0	1305	1384	0	1396			
Q Serve(g_s), s	9.5	4.2	0.0	0.0	0.0	11.3	36.0	0.0	32.2			
Cycle Q Clear(g_c), s	20.8	4.2	0.0	0.0	0.0	11.3	36.0	0.0	32.2			
Prop In Lane	1.00		0.00	0.00		0.35	0.23		0.02			
Lane Grp Cap(c), veh/h	260	491	0	0	0	407	782	0	789			
V/C Ratio(X)	0.50	0.20	0.00	0.00	0.00	0.57	0.87	0.00	0.79			
Avail Cap(c_a), veh/h	260	491	0	0	0	407	782	0	789			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	38.0	25.0	0.0	0.0	0.0	21.6	27.9	0.0	26.3			
Incr Delay (d2), s/veh	6.7	0.9	0.0	0.0	0.0	5.8	13.0	0.0	8.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	3.2	2.0	0.0	0.0	0.0	4.7	16.6	0.0	14.2			
LnGrp Delay(d),s/veh	44.8	25.9	0.0	0.0	0.0	27.4	40.9	0.0	34.5			
LnGrp LOS	D	C				C	D		C			
Approach Vol, veh/h		227			234			1311				
Approach Delay, s/veh		36.7			27.4			37.8				
Approach LOS		D			C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		28.0		47.0		28.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		23.4		42.4		23.4		
Max Q Clear Time (g_c+I1), s		22.8		38.0		13.3		
Green Ext Time (p_c), s		0.1		2.5		0.7		

Intersection Summary		
HCM 2010 Ctrl Delay		36.3
HCM 2010 LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	237	18	68	293	24	15	193	50	66	323	65
Future Volume (veh/h)	31	237	18	68	293	24	15	193	50	66	323	65
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.92	0.98		0.92	0.96		0.91	0.98		0.91
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1573	1510	1620	1573	1573	1620	1620	1573	1555	1620	1573	1555
Adj Flow Rate, veh/h	34	258	16	74	318	22	16	210	42	72	351	62
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	257	537	33	330	555	38	67	541	104	123	496	83
Arrive On Green	0.38	0.38	0.38	0.13	0.13	0.13	0.17	0.17	0.17	1.00	1.00	1.00
Sat Flow, veh/h	912	1399	87	958	1445	100	32	1073	205	135	984	164
Grp Volume(v), veh/h	34	0	274	74	0	340	268	0	0	485	0	0
Grp Sat Flow(s),veh/h/ln	912	0	1485	958	0	1545	1311	0	0	1283	0	0
Q Serve(g_s), s	2.4	0.0	10.5	5.5	0.0	15.5	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	17.9	0.0	10.5	15.9	0.0	15.5	13.4	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.06	1.00		0.06	0.06		0.16	0.15		0.13
Lane Grp Cap(c), veh/h	257	0	570	330	0	593	712	0	0	702	0	0
V/C Ratio(X)	0.13	0.00	0.48	0.22	0.00	0.57	0.38	0.00	0.00	0.69	0.00	0.00
Avail Cap(c_a), veh/h	257	0	570	330	0	593	712	0	0	702	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.93	0.00	0.93	0.81	0.00	0.00	0.61	0.00	0.00
Uniform Delay (d), s/veh	26.4	0.0	17.4	32.1	0.0	27.0	21.1	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	1.1	0.0	2.9	1.5	0.0	3.7	1.2	0.0	0.0	3.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	4.7	1.6	0.0	7.3	5.2	0.0	0.0	0.7	0.0	0.0
LnGrp Delay(d),s/veh	27.5	0.0	20.3	33.5	0.0	30.7	22.3	0.0	0.0	3.4	0.0	0.0
LnGrp LOS	C		C	C		C	C			A		
Approach Vol, veh/h		308			414			268			485	
Approach Delay, s/veh		21.1			31.2			22.3			3.4	
Approach LOS		C			C			C			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0		42.0				
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 29		* 38		* 29		* 38				
Max Q Clear Time (g_c+I1), s		19.9		15.4		17.9		2.0				
Green Ext Time (p_c), s		1.6		2.4		2.7		5.6				
Intersection Summary												
HCM 2010 Ctrl Delay			18.3									
HCM 2010 LOS			B									
Notes												

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	374	370	21	0	21
Future Volume (vph)	0	374	370	21	0	21
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6	5.6			5.2
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.99			0.87
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.99			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1573	1552			1188
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1573	1552			1188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	407	402	23	0	23
RTOR Reduction (vph)	0	0	2	0	0	19
Lane Group Flow (vph)	0	407	423	0	0	4
Confl. Peds. (#/hr)				39		46
Confl. Bikes (#/hr)				4		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		51.1	52.3			11.9
Effective Green, g (s)		51.1	52.3			11.9
Actuated g/C Ratio		0.68	0.70			0.16
Clearance Time (s)						5.2
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1071	1082			188
v/s Ratio Prot		c0.26	c0.27			
v/s Ratio Perm						0.00
v/c Ratio		0.38	0.39			0.02
Uniform Delay, d1		5.1	4.7			26.6
Progression Factor		1.66	0.42			1.00
Incremental Delay, d2		0.2	0.2			0.0
Delay (s)		8.7	2.2			26.7
Level of Service		A	A			C
Approach Delay (s)		8.7	2.2		26.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	259	119	174	269	0	0	0	0	99	800	175
Future Volume (vph)	0	259	119	174	269	0	0	0	0	99	800	175
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00						1.00	0.89
Flpb, ped/bikes		1.00	1.00	0.98	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1625	1180	1604	1520						4262	1185
Flt Permitted		1.00	1.00	0.52	1.00						0.99	1.00
Satd. Flow (perm)		1625	1180	880	1520						4262	1185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	282	129	189	292	0	0	0	0	108	870	190
RTOR Reduction (vph)	0	0	38	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	282	91	189	292	0	0	0	0	0	978	190
Confl. Peds. (#/hr)			40	40		22			9	9		30
Confl. Bikes (#/hr)			8			4						2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		32.8	32.8	32.8	32.8						33.4	26.4
Effective Green, g (s)		32.8	32.8	32.8	32.8						33.4	26.4
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.45	0.35
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		710	516	384	664						1898	417
v/s Ratio Prot		0.17			0.19							
v/s Ratio Perm			0.08	c0.21							0.23	0.16
v/c Ratio		0.40	0.18	0.49	0.44						0.52	0.46
Uniform Delay, d1		14.4	12.9	15.1	14.7						15.0	18.8
Progression Factor		0.40	0.18	0.99	1.00						0.33	0.42
Incremental Delay, d2		1.6	0.7	3.5	1.6						0.9	3.0
Delay (s)		7.3	3.0	18.5	16.3						5.8	10.9
Level of Service		A	A	B	B						A	B
Approach Delay (s)		5.9			17.2			0.0			6.6	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	139	214	0	0	328	60	118	1039	44	0	0	0
Future Volume (veh/h)	139	214	0	0	328	60	118	1039	44	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1510	1573	1620			
Adj Flow Rate, veh/h	151	233	0	0	357	55	128	1129	44			
Adj No. of Lanes	1	1	0	0	1	0	1	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	173	604	0	0	452	70	725	1394	54			
Arrive On Green	0.77	0.77	0.00	0.00	0.13	0.13	0.17	0.17	0.17			
Sat Flow, veh/h	864	1573	0	0	1176	181	1438	2766	108			
Grp Volume(v), veh/h	151	233	0	0	0	412	128	610	563			
Grp Sat Flow(s),veh/h/ln	864	1573	0	0	0	1358	1438	1494	1380			
Q Serve(g_s), s	6.7	3.7	0.0	0.0	0.0	22.1	5.7	29.5	29.5			
Cycle Q Clear(g_c), s	28.8	3.7	0.0	0.0	0.0	22.1	5.7	29.5	29.5			
Prop In Lane	1.00		0.00	0.00		0.13	1.00		0.08			
Lane Grp Cap(c), veh/h	173	604	0	0	0	521	725	753	696			
V/C Ratio(X)	0.87	0.39	0.00	0.00	0.00	0.79	0.18	0.81	0.81			
Avail Cap(c_a), veh/h	173	604	0	0	0	521	725	753	696			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.92	0.92	0.00	0.00	0.00	1.00	0.43	0.43	0.43			
Uniform Delay (d), s/veh	21.4	5.8	0.0	0.0	0.0	29.8	17.9	27.8	27.8			
Incr Delay (d2), s/veh	38.8	1.7	0.0	0.0	0.0	11.6	0.2	4.1	4.5			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.9	1.8	0.0	0.0	0.0	10.0	2.3	13.1	12.1			
LnGrp Delay(d),s/veh	60.2	7.5	0.0	0.0	0.0	41.4	18.1	31.9	32.3			
LnGrp LOS	E	A				D	B	C	C			
Approach Vol, veh/h		384			412			1301				
Approach Delay, s/veh		28.2			41.4			30.7				
Approach LOS		C			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 29		* 38		* 29		
Max Q Clear Time (g_c+I1), s		30.8		31.5		24.1		
Green Ext Time (p_c), s		0.0		3.3		0.8		

Intersection Summary	
HCM 2010 Ctrl Delay	32.4
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	273	1077	0	0	0	0	0	217	21
Future Volume (veh/h)	0	0	0	273	1077	0	0	0	0	0	217	21
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.99
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1530	1485	0				0	1485	1530
Adj Flow Rate, veh/h				297	1171	0				0	236	12
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				494	1728	0				0	804	41
Arrive On Green				0.19	0.19	0.00				0.00	0.31	0.31
Sat Flow, veh/h				734	3149	0				0	2652	130
Grp Volume(v), veh/h				527	941	0				0	129	119
Grp Sat Flow(s),veh/h/ln				1302	1230	0				0	1411	1297
Q Serve(g_s), s				28.4	26.7	0.0				0.0	5.2	5.2
Cycle Q Clear(g_c), s				28.4	26.7	0.0				0.0	5.2	5.2
Prop In Lane				0.56		0.00				0.00		0.10
Lane Grp Cap(c), veh/h				818	1404	0				0	440	405
V/C Ratio(X)				0.64	0.67	0.00				0.00	0.29	0.30
Avail Cap(c_a), veh/h				818	1404	0				0	440	405
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				24.6	23.9	0.0				0.0	19.5	19.6
Incr Delay (d2), s/veh				3.9	2.6	0.0				0.0	1.7	1.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.1	9.6	0.0				0.0	2.2	2.1
LnGrp Delay(d),s/veh				28.5	26.5	0.0				0.0	21.2	21.4
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1468						248	
Approach Delay, s/veh					27.2						21.3	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		47.0		28.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 43		23.4				
Max Q Clear Time (g_c+I1), s		30.4		7.2				
Green Ext Time (p_c), s		6.0		0.8				

Intersection Summary	
HCM 2010 Ctrl Delay	26.3
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1246	107	91	223	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1246	107	91	223	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1398	1398	1440	1398	0			
Adj Flow Rate, veh/h				0	1354	77	99	242	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	2229	679	259	561	0			
Arrive On Green				0.00	0.19	0.19	0.10	0.10	0.00			
Sat Flow, veh/h				0	3943	1163	609	1909	0			
Grp Volume(v), veh/h				0	1354	77	185	156	0			
Grp Sat Flow(s),veh/h/ln				0	1272	1163	1246	1209	0			
Q Serve(g_s), s				0.0	24.3	4.1	8.7	9.1	0.0			
Cycle Q Clear(g_c), s				0.0	24.3	4.1	10.4	9.1	0.0			
Prop In Lane				0.00		1.00	0.53		0.00			
Lane Grp Cap(c), veh/h				0	2229	679	452	367	0			
V/C Ratio(X)				0.00	0.61	0.11	0.41	0.42	0.00			
Avail Cap(c_a), veh/h				0	2229	679	452	367	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.4	14.2	28.1	27.6	0.0			
Incr Delay (d2), s/veh				0.0	1.2	0.3	2.7	3.6	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	8.8	1.4	4.0	3.4	0.0			
LnGrp Delay(d),s/veh				0.0	23.7	14.6	30.8	31.1	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1431			341				
Approach Delay, s/veh					23.2			31.0				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		48.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 44		* 23				
Max Q Clear Time (g_c+I1), s		26.3		12.4				
Green Ext Time (p_c), s		7.5		1.0				

Intersection Summary		
HCM 2010 Ctrl Delay		24.7
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	81	1304	0	0	0	0	0	180	46
Future Volume (veh/h)	0	0	0	81	1304	0	0	0	0	0	180	46
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.87
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1398	0				0	1398	1440
Adj Flow Rate, veh/h				88	1417	0				0	196	17
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				157	2141	0				0	640	54
Arrive On Green				0.20	0.20	0.00				0.00	0.28	0.28
Sat Flow, veh/h				167	3620	0				0	2378	196
Grp Volume(v), veh/h				560	945	0				0	111	102
Grp Sat Flow(s),veh/h/ln				1356	1158	0				0	1328	1176
Q Serve(g_s), s				18.7	28.3	0.0				0.0	5.0	5.1
Cycle Q Clear(g_c), s				28.4	28.3	0.0				0.0	5.0	5.1
Prop In Lane				0.16		0.00				0.00		0.17
Lane Grp Cap(c), veh/h				884	1414	0				0	368	326
V/C Ratio(X)				0.63	0.67	0.00				0.00	0.30	0.31
Avail Cap(c_a), veh/h				884	1414	0				0	368	326
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				22.9	22.9	0.0				0.0	21.4	21.4
Incr Delay (d2), s/veh				3.4	2.5	0.0				0.0	2.1	2.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.6	9.6	0.0				0.0	2.0	1.9
LnGrp Delay(d),s/veh				26.3	25.5	0.0				0.0	23.5	23.9
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1505						213	
Approach Delay, s/veh					25.8						23.7	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		50.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 46		* 21				
Max Q Clear Time (g_c+I1), s		30.4		7.1				
Green Ext Time (p_c), s		7.0		0.6				

Intersection Summary	
HCM 2010 Ctrl Delay	25.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	34	1173	69	181	112	0	0	119	21
Future Volume (veh/h)	0	0	0	34	1173	69	181	112	0	0	119	21
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.96		1.00	1.00		0.93
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				37	1275	66	197	122	0	0	129	13
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				65	2380	127	389	685	0	0	377	38
Arrive On Green				0.17	0.17	0.17	0.02	0.12	0.00	0.00	0.26	0.26
Sat Flow, veh/h				127	4637	248	1748	1835	0	0	1449	146
Grp Volume(v), veh/h				509	423	447	197	122	0	0	0	142
Grp Sat Flow(s),veh/h/ln				1741	1590	1681	1748	1835	0	0	0	1595
Q Serve(g_s), s				20.1	18.1	18.2	0.0	4.5	0.0	0.0	0.0	5.4
Cycle Q Clear(g_c), s				20.1	18.1	18.2	0.0	4.5	0.0	0.0	0.0	5.4
Prop In Lane				0.07		0.15	1.00		0.00	0.00		0.09
Lane Grp Cap(c), veh/h				894	816	863	389	685	0	0	0	415
V/C Ratio(X)				0.57	0.52	0.52	0.51	0.18	0.00	0.00	0.00	0.34
Avail Cap(c_a), veh/h				894	816	863	389	685	0	0	0	415
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				23.5	22.7	22.7	28.7	22.6	0.0	0.0	0.0	22.5
Incr Delay (d2), s/veh				2.6	2.3	2.2	4.6	0.6	0.0	0.0	0.0	2.2
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				10.4	8.5	9.0	4.5	2.4	0.0	0.0	0.0	2.6
LnGrp Delay(d),s/veh				26.1	25.0	24.9	33.4	23.1	0.0	0.0	0.0	24.8
LnGrp LOS				C	C	C	C	C				C
Approach Vol, veh/h					1378			319			142	
Approach Delay, s/veh					25.4			29.5			24.8	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.0	24.0		43.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			4.0	19.5		38.5		28.0
Max Q Clear Time (g_c+I1), s			2.0	7.4		22.1		6.5
Green Ext Time (p_c), s			0.3	0.7		10.8		0.8

Intersection Summary		
HCM 2010 Ctrl Delay		26.1
HCM 2010 LOS		C

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	12	10	85.9%	13.3	4.0	B
	Through						
	Right Turn						
	Subtotal	12	10	85.9%	13.3	4.0	B
SB	Left Turn						
	Through						
	Right Turn	1	1	73.6%	0.7	1.5	A
	Subtotal	1	1	73.6%	0.7	1.5	A
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	21	18	85.9%	1.8	0.5	A
	Through	1,271	1,260	99.1%	1.6	0.2	A
	Right Turn	8	8	101.2%	1.4	1.8	A
	Subtotal	1,300	1,286	98.9%	1.6	0.2	A
Total		1,313	1,297	98.8%	1.7	0.2	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	65	69	106.4%	14.9	3.9	B
	Through	9	8	85.9%	12.2	15.3	B
	Right Turn						
	Subtotal	74	77	103.9%	14.7	4.6	B
SB	Left Turn						
	Through	34	28	82.3%	15.8	8.5	B
	Right Turn	8	8	101.2%	8.7	8.7	A
	Subtotal	42	36	85.9%	14.7	6.3	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	297	303	102.1%	7.5	1.7	A
	Through	1,227	1,210	98.6%	4.5	0.3	A
	Right Turn	22	24	108.7%	4.3	1.2	A
	Subtotal	1,546	1,537	99.4%	5.1	0.6	A
Total		1,662	1,650	99.3%	5.7	0.7	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	147	1452	42	27	154	0	0	253	143
Future Volume (veh/h)	0	0	0	147	1452	42	27	154	0	0	253	143
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.92	1.00		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1620	1573	1620	1620	1573	0	0	1510	1555
Adj Flow Rate, veh/h				160	1578	42	29	167	0	0	275	143
Adj No. of Lanes				0	3	0	0	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				212	2232	61	55	208	0	0	261	136
Arrive On Green				0.18	0.18	0.18	0.11	0.11	0.00	0.00	0.11	0.11
Sat Flow, veh/h				383	4034	110	0	635	0	0	798	415
Grp Volume(v), veh/h				649	544	587	196	0	0	0	0	418
Grp Sat Flow(s),veh/h/ln				1554	1431	1542	635	0	0	0	0	1213
Q Serve(g_s), s				29.7	26.6	26.7	0.0	0.0	0.0	0.0	0.0	24.5
Cycle Q Clear(g_c), s				29.7	26.6	26.7	24.5	0.0	0.0	0.0	0.0	24.5
Prop In Lane				0.25		0.07	0.15		0.00	0.00		0.34
Lane Grp Cap(c), veh/h				860	792	853	263	0	0	0	0	396
V/C Ratio(X)				0.76	0.69	0.69	0.75	0.00	0.00	0.00	0.00	1.06
Avail Cap(c_a), veh/h				860	792	853	263	0	0	0	0	396
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				25.8	24.6	24.6	26.9	0.0	0.0	0.0	0.0	33.5
Incr Delay (d2), s/veh				6.1	4.8	4.5	17.5	0.0	0.0	0.0	0.0	60.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				14.3	11.6	12.5	5.1	0.0	0.0	0.0	0.0	14.9
LnGrp Delay(d),s/veh				32.0	29.4	29.1	44.4	0.0	0.0	0.0	0.0	93.9
LnGrp LOS				C	C	C	D					F
Approach Vol, veh/h					1780			196			418	
Approach Delay, s/veh					30.2			44.4			93.9	
Approach LOS					C			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				29.0		46.0		29.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				24.5		41.5		24.5
Max Q Clear Time (g_c+I1), s				26.5		31.7		26.5
Green Ext Time (p_c), s				0.0		5.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	42.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	219	1574	14	45	37	0	0	40	9
Future Volume (veh/h)	0	0	0	219	1574	14	45	37	0	0	40	9
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.92	0.91		1.00	1.00		0.88
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1440	1398	1440	1398	1398	0	0	1398	1440
Adj Flow Rate, veh/h				238	1711	14	49	40	0	0	43	2
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				293	2261	19	314	350	0	0	292	14
Arrive On Green				0.21	0.21	0.21	0.25	0.25	0.00	0.00	0.25	0.25
Sat Flow, veh/h				460	3547	30	982	1398	0	0	1165	54
Grp Volume(v), veh/h				712	598	654	49	40	0	0	0	45
Grp Sat Flow(s),veh/h/ln				1375	1272	1390	982	1398	0	0	0	1219
Q Serve(g_s), s				37.0	32.9	33.0	3.1	1.7	0.0	0.0	0.0	2.2
Cycle Q Clear(g_c), s				37.0	32.9	33.0	5.2	1.7	0.0	0.0	0.0	2.2
Prop In Lane				0.33		0.02	1.00		0.00	0.00		0.04
Lane Grp Cap(c), veh/h				876	811	886	314	350	0	0	0	306
V/C Ratio(X)				0.81	0.74	0.74	0.16	0.11	0.00	0.00	0.00	0.15
Avail Cap(c_a), veh/h				876	811	886	314	350	0	0	0	306
HCM Platoon Ratio				0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				25.3	23.7	23.8	23.9	21.7	0.0	0.0	0.0	21.9
Incr Delay (d2), s/veh				8.1	5.9	5.5	1.1	0.7	0.0	0.0	0.0	1.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				16.0	12.9	14.0	0.9	0.7	0.0	0.0	0.0	0.8
LnGrp Delay(d),s/veh				33.4	29.7	29.2	25.0	22.3	0.0	0.0	0.0	22.9
LnGrp LOS				C	C	C	C	C				C
Approach Vol, veh/h					1963			89			45	
Approach Delay, s/veh					30.9			23.8			22.9	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				23.0		52.0		23.0
Change Period (Y+Rc), s				* 4.2		4.2		* 4.2
Max Green Setting (Gmax), s				* 19		47.8		* 19
Max Q Clear Time (g_c+I1), s				7.2		39.0		4.2
Green Ext Time (p_c), s				0.2		6.0		0.1

Intersection Summary		
HCM 2010 Ctrl Delay		30.4
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	408	1378	0	0	0	0	0	729	364
Future Volume (veh/h)	0	0	0	408	1378	0	0	0	0	0	729	364
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1545	1573	0				0	1573	1485
Adj Flow Rate, veh/h				443	1498	0				0	792	383
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				861	2454	0				0	1546	393
Arrive On Green				0.17	0.17	0.00				0.00	0.12	0.12
Sat Flow, veh/h				1471	4718	0				0	4435	1092
Grp Volume(v), veh/h				443	1498	0				0	792	383
Grp Sat Flow(s),veh/h/ln				1471	1573	0				0	1431	1092
Q Serve(g_s), s				20.8	22.0	0.0				0.0	13.0	26.2
Cycle Q Clear(g_c), s				20.8	22.0	0.0				0.0	13.0	26.2
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				861	2454	0				0	1546	393
V/C Ratio(X)				0.51	0.61	0.00				0.00	0.51	0.97
Avail Cap(c_a), veh/h				861	2454	0				0	1546	393
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.5	24.0	0.0				0.0	26.9	32.7
Incr Delay (d2), s/veh				2.2	1.1	0.0				0.0	1.2	39.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				9.0	9.8	0.0				0.0	5.3	12.2
LnGrp Delay(d),s/veh				25.7	25.2	0.0				0.0	28.1	72.1
LnGrp LOS				C	C						C	E
Approach Vol, veh/h					1941						1175	
Approach Delay, s/veh					25.3						42.4	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						43.0		32.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						39.0		27.0
Max Q Clear Time (g_c+I1), s						24.0		28.2
Green Ext Time (p_c), s						9.0		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		31.8
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	963	109	833	1097	0	0	0	0
Future Volume (veh/h)	0	0	0	0	963	109	833	1097	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1485	1485	1398	1398	0			
Adj Flow Rate, veh/h				0	1047	81	917	1175	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	1379	403	1438	1510	0			
Arrive On Green				0.00	0.34	0.34	0.18	0.18	0.00			
Sat Flow, veh/h				0	4189	1186	2663	2796	0			
Grp Volume(v), veh/h				0	1047	81	917	1175	0			
Grp Sat Flow(s),veh/h/ln				0	1352	1186	1331	1398	0			
Q Serve(g_s), s				0.0	17.2	3.6	23.9	30.1	0.0			
Cycle Q Clear(g_c), s				0.0	17.2	3.6	23.9	30.1	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1379	403	1438	1510	0			
V/C Ratio(X)				0.00	0.76	0.20	0.64	0.78	0.00			
Avail Cap(c_a), veh/h				0	1379	403	1438	1510	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.0	17.5	24.0	26.5	0.0			
Incr Delay (d2), s/veh				0.0	4.0	1.1	2.2	4.0	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	6.9	1.3	9.3	12.5	0.0			
LnGrp Delay(d),s/veh				0.0	26.0	18.7	26.2	30.6	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1128			2092				
Approach Delay, s/veh					25.5			28.6				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				45.0		30.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				40.5		25.5		
Max Q Clear Time (g_c+I1), s				32.1		19.2		
Green Ext Time (p_c), s				6.3		3.1		

Intersection Summary	
HCM 2010 Ctrl Delay	27.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1838	76	0	0	0	0	0	240	64	423	0
Future Volume (veh/h)	0	1838	76	0	0	0	0	0	240	64	423	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.99	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1660	1710				0	1573	1620	1748	1748	0
Adj Flow Rate, veh/h	0	1998	76				0	0	245	70	460	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1126	1141	1488	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1323	1111	1748	0
Grp Volume(v), veh/h		0.0					0	0	245	70	460	0
Grp Sat Flow(s),veh/h/ln							0	0	1323	1111	1748	0
Q Serve(g_s), s							0.0	0.0	1.0	1.5	6.4	0.0
Cycle Q Clear(g_c), s							0.0	0.0	1.0	2.5	6.4	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1126	1141	1488	0
V/C Ratio(X)							0.00	0.00	0.22	0.06	0.31	0.00
Avail Cap(c_a), veh/h							0	0	1126	1141	1488	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	2.9	4.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.4	0.1	0.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.5	0.5	3.4	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.9	3.0	4.5	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								245			530	
Approach Delay, s/veh								0.9			4.3	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				31.0				31.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				26.4				26.4
Max Q Clear Time (g_c+I1), s				8.4				3.0
Green Ext Time (p_c), s				1.3				0.7

Intersection Summary			
HCM 2010 Ctrl Delay			3.2
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	98	2045	0	0	0	0	0	192	85	0	0	0
Future Volume (veh/h)	98	2045	0	0	0	0	0	192	85	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1485	0				0	1485	1440			
Adj Flow Rate, veh/h	107	2223	0				0	209	87			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	149	2417	0				0	556	222			
Arrive On Green	0.20	0.20	0.00				0.00	0.28	0.28			
Sat Flow, veh/h	157	3993	0				0	2004	801			
Grp Volume(v), veh/h	821	1509	0				0	153	143			
Grp Sat Flow(s),veh/h/ln	1446	1352	0				0	1485	1320			
Q Serve(g_s), s	34.4	41.1	0.0				0.0	6.2	6.6			
Cycle Q Clear(g_c), s	41.9	41.1	0.0				0.0	6.2	6.6			
Prop In Lane	0.13		0.00				0.00		0.61			
Lane Grp Cap(c), veh/h	930	1637	0				0	412	366			
V/C Ratio(X)	0.88	0.92	0.00				0.00	0.37	0.39			
Avail Cap(c_a), veh/h	930	1637	0				0	412	366			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	28.5	28.3	0.0				0.0	21.8	22.0			
Incr Delay (d2), s/veh	11.9	10.1	0.0				0.0	2.5	3.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	19.9	17.7	0.0				0.0	2.8	2.7			
LnGrp Delay(d),s/veh	40.5	38.4	0.0				0.0	24.4	25.1			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2330						296				
Approach Delay, s/veh		39.1						24.7				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				25.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		45.4		
Max Q Clear Time (g_c+I1), s				8.6		43.9		
Green Ext Time (p_c), s				1.9		1.5		

Intersection Summary	
HCM 2010 Ctrl Delay	37.5
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2064	59	0	0	0	0	0	152	62	207	0
Future Volume (veh/h)	0	2064	59	0	0	0	0	0	152	62	207	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1382				0	1573	1591	1545	1485	0
Adj Flow Rate, veh/h	0	2243	60				0	0	148	67	225	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1077	1135	1238	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.83	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1292	1070	1485	0
Grp Volume(v), veh/h		0.0					0	0	148	67	225	0
Grp Sat Flow(s),veh/h/ln							0	0	1292	1070	1485	0
Q Serve(g_s), s							0.0	0.0	0.6	1.3	3.1	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.6	1.8	3.1	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1077	1135	1238	0
V/C Ratio(X)							0.00	0.00	0.14	0.06	0.18	0.00
Avail Cap(c_a), veh/h							0	0	1077	1135	1238	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	2.5	2.8	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.3	0.1	0.3	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.2	0.4	1.4	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.7	2.6	3.1	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								148			292	
Approach Delay, s/veh								0.7			3.0	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				27.0				27.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				22.5				22.5
Max Q Clear Time (g_c+I1), s				5.1				2.6
Green Ext Time (p_c), s				0.7				0.4

Intersection Summary	
HCM 2010 Ctrl Delay	2.2
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	85	2006	178	0	0	0	0	225	13	45	103	0
Future Volume (veh/h)	85	2006	178	0	0	0	0	225	13	45	103	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.96	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	92	2180	179				0	245	9	49	112	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	100	2506	210				0	692	25	293	530	0
Arrive On Green	0.19	0.19	0.19				0.00	0.22	0.22	0.01	0.11	0.00
Sat Flow, veh/h	177	4445	372				0	3182	113	1581	1660	0
Grp Volume(v), veh/h	901	748	801				0	124	130	49	112	0
Grp Sat Flow(s),veh/h/ln	1739	1590	1666				0	1577	1635	1581	1660	0
Q Serve(g_s), s	38.3	34.1	35.0				0.0	5.0	5.0	0.0	4.6	0.0
Cycle Q Clear(g_c), s	38.3	34.1	35.0				0.0	5.0	5.0	0.0	4.6	0.0
Prop In Lane	0.10		0.22				0.00		0.07	1.00		0.00
Lane Grp Cap(c), veh/h	980	897	939				0	352	365	293	530	0
V/C Ratio(X)	0.92	0.83	0.85				0.00	0.35	0.36	0.17	0.21	0.00
Avail Cap(c_a), veh/h	980	897	939				0	352	365	293	530	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	28.9	27.2	27.6				0.0	24.6	24.6	28.0	25.0	0.0
Incr Delay (d2), s/veh	14.9	9.0	9.7				0.0	2.8	2.7	1.2	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.4	17.3	18.7				0.0	2.4	2.5	1.0	2.3	0.0
LnGrp Delay(d),s/veh	43.8	36.3	37.3				0.0	27.4	27.3	29.2	25.9	0.0
LnGrp LOS	D	D	D					C	C	C	C	
Approach Vol, veh/h		2451						254			161	
Approach Delay, s/veh		39.4						27.3			26.9	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		47.0		28.2			7.2	21.0
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		42.4		* 24			* 3	* 17
Max Q Clear Time (g_c+I1), s		40.3		6.6			2.0	7.0
Green Ext Time (p_c), s		2.1		0.7			0.0	1.3

Intersection Summary		
HCM 2010 Ctrl Delay		37.6
HCM 2010 LOS		D

Notes

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

BioMarin
Existing Conditions
AM Peak Hour

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	21	19	89.4%	15.6	8.1	C
	Through						
	Right Turn						
	Subtotal	21	19	89.4%	15.6	8.1	C
EB	Left Turn	12	9	76.7%	3.3	0.7	A
	Through	2,054	2,053	100.0%	2.4	0.2	A
	Right Turn						
	Subtotal	2,066	2,063	99.8%	2.4	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,087	2,081	99.7%	2.5	0.2	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	44	49	112.1%	16.5	5.9	B
	Right Turn	226	227	100.6%	15.0	3.5	B
	Subtotal	270	277	102.5%	15.3	3.2	B
SB	Left Turn	56	50	88.7%	28.1	3.7	C
	Through	275	281	102.1%	26.9	2.9	C
	Right Turn						
	Subtotal	331	330	99.8%	27.1	2.8	C
EB	Left Turn	30	27	90.8%	11.3	3.7	B
	Through	2,046	2,031	99.3%	11.3	1.0	B
	Right Turn	39	40	101.9%	9.0	3.5	A
	Subtotal	2,115	2,098	99.2%	11.2	1.0	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,716	2,706	99.6%	13.6	0.9	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	113	2181	34	0	0	0	0	85	43	114	231	0
Future Volume (veh/h)	113	2181	34	0	0	0	0	85	43	114	231	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1398	1382	1342	0
Adj Flow Rate, veh/h	123	2371	19				0	92	35	124	251	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	122	2528	598				0	500	411	289	558	0
Arrive On Green	0.18	0.18	0.18				0.00	0.36	0.36	0.12	0.12	0.00
Sat Flow, veh/h	230	4763	1126				0	1398	1151	591	1621	0
Grp Volume(v), veh/h	741	1753	19				0	92	35	196	179	0
Grp Sat Flow(s),veh/h/ln	1387	1202	1126				0	1398	1151	991	1160	0
Q Serve(g_s), s	39.8	35.8	1.0				0.0	3.4	1.5	11.6	10.8	0.0
Cycle Q Clear(g_c), s	39.8	35.8	1.0				0.0	3.4	1.5	15.0	10.8	0.0
Prop In Lane	0.17		1.00				0.00		1.00	0.63		0.00
Lane Grp Cap(c), veh/h	736	1914	598				0	500	411	432	415	0
V/C Ratio(X)	1.01	0.92	0.03				0.00	0.18	0.09	0.45	0.43	0.00
Avail Cap(c_a), veh/h	736	1914	598				0	500	411	432	415	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.9	29.3	15.0				0.0	16.6	16.0	28.6	26.0	0.0
Incr Delay (d2), s/veh	34.9	8.4	0.1				0.0	0.8	0.4	3.4	3.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.4	13.4	0.3				0.0	1.4	0.5	4.3	3.8	0.0
LnGrp Delay(d),s/veh	65.9	37.7	15.0				0.0	17.4	16.4	32.0	29.3	0.0
LnGrp LOS	F	D	B					B	B	C	C	
Approach Vol, veh/h		2513						127			375	
Approach Delay, s/veh		45.8						17.1			30.7	
Approach LOS		D						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		44.0		31.0				31.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 40		* 27				* 27
Max Q Clear Time (g_c+I1), s		41.8		5.4				17.0
Green Ext Time (p_c), s		0.0		0.4				1.1

Intersection Summary	
HCM 2010 Ctrl Delay	42.7
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	2224	57	0	0	0	0	43	240	93	173	0
Future Volume (veh/h)	41	2224	57	0	0	0	0	43	240	93	173	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.90				1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1454	1398	1398	0
Adj Flow Rate, veh/h	45	2417	33				0	47	246	101	188	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	44	2523	549				0	513	442	391	513	0
Arrive On Green	0.17	0.17	0.17				0.00	0.37	0.37	0.12	0.12	0.00
Sat Flow, veh/h	85	4915	1069				0	1398	1206	857	1398	0
Grp Volume(v), veh/h	734	1728	33				0	47	246	101	188	0
Grp Sat Flow(s),veh/h/ln	1394	1202	1069				0	1398	1206	857	1398	0
Q Serve(g_s), s	38.5	35.4	1.9				0.0	1.7	12.2	8.2	9.3	0.0
Cycle Q Clear(g_c), s	38.5	35.4	1.9				0.0	1.7	12.2	9.8	9.3	0.0
Prop In Lane	0.06		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	715	1852	549				0	513	442	391	513	0
V/C Ratio(X)	1.03	0.93	0.06				0.00	0.09	0.56	0.26	0.37	0.00
Avail Cap(c_a), veh/h	715	1852	549				0	513	442	391	513	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	31.1	29.9	16.0				0.0	15.6	18.9	25.9	25.0	0.0
Incr Delay (d2), s/veh	40.4	10.2	0.2				0.0	0.4	5.0	1.6	2.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.9	13.5	0.6				0.0	0.7	4.6	2.1	3.9	0.0
LnGrp Delay(d),s/veh	71.5	40.0	16.2				0.0	15.9	23.9	27.5	27.0	0.0
LnGrp LOS	F	D	B					B	C	C	C	
Approach Vol, veh/h		2495						293			289	
Approach Delay, s/veh		49.0						22.6			27.2	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		43.0		32.0				32.0
Change Period (Y+Rc), s		4.5		4.5				4.5
Max Green Setting (Gmax), s		38.5		27.5				27.5
Max Q Clear Time (g_c+I1), s		40.5		14.2				11.8
Green Ext Time (p_c), s		0.0		1.1				1.3

Intersection Summary		
HCM 2010 Ctrl Delay		44.4
HCM 2010 LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1112	1285	0	0	0	0	0	0	190	947	0
Future Volume (veh/h)	0	1112	1285	0	0	0	0	0	0	190	947	0
Number	5	2	12							3	8	18
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1485							1485	1485	0
Adj Flow Rate, veh/h	0	1209	1371							207	1029	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.92	0.92	0.92							0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3							3	3	0
Cap, veh/h	0	2288	1296							519	1089	0
Arrive On Green	0.00	0.17	0.17							0.12	0.12	0.00
Sat Flow, veh/h	0	4456	2525							1415	2971	0
Grp Volume(v), veh/h	0	1209	1371							207	1029	0
Grp Sat Flow(s),veh/h/ln	0	1485	1263							1415	1485	0
Q Serve(g_s), s	0.0	18.6	38.5							10.1	25.8	0.0
Cycle Q Clear(g_c), s	0.0	18.6	38.5							10.1	25.8	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2288	1296							519	1089	0
V/C Ratio(X)	0.00	0.53	1.06							0.40	0.94	0.00
Avail Cap(c_a), veh/h	0	2288	1296							519	1089	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	1.00	1.00							1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	22.9	31.1							25.3	32.2	0.0
Incr Delay (d2), s/veh	0.0	0.9	41.8							2.3	16.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	7.8	21.0							4.3	13.2	0.0
LnGrp Delay(d),s/veh	0.0	23.7	72.9							27.6	49.0	0.0
LnGrp LOS		C	F							C	D	
Approach Vol, veh/h		2580									1236	
Approach Delay, s/veh		49.9									45.4	
Approach LOS		D									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		43.0						32.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		38.5						27.5
Max Q Clear Time (g_c+I1), s		40.5						27.8
Green Ext Time (p_c), s		0.0						0.0

Intersection Summary		
HCM 2010 Ctrl Delay		48.4
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	678	794	0	0	0	0	0	1262	447	0	0	0
Future Volume (veh/h)	678	794	0	0	0	0	0	1262	447	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1454	1485	0				0	1398	1398			
Adj Flow Rate, veh/h	737	863	0				0	1372	433			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	1440	1339	0				0	1618	499			
Arrive On Green	0.15	0.15	0.00				0.00	0.42	0.42			
Sat Flow, veh/h	2769	2971	0				0	3943	1176			
Grp Volume(v), veh/h	737	863	0				0	1372	433			
Grp Sat Flow(s),veh/h/ln	1385	1485	0				0	1272	1176			
Q Serve(g_s), s	18.6	20.5	0.0				0.0	24.2	25.2			
Cycle Q Clear(g_c), s	18.6	20.5	0.0				0.0	24.2	25.2			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1440	1339	0				0	1618	499			
V/C Ratio(X)	0.51	0.64	0.00				0.00	0.85	0.87			
Avail Cap(c_a), veh/h	1440	1339	0				0	1618	499			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	25.5	26.3	0.0				0.0	19.4	19.7			
Incr Delay (d2), s/veh	1.3	2.4	0.0				0.0	5.7	18.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	7.4	8.9	0.0				0.0	9.2	10.6			
LnGrp Delay(d),s/veh	26.8	28.7	0.0				0.0	25.1	37.9			
LnGrp LOS	C	C						C	D			
Approach Vol, veh/h		1600						1805				
Approach Delay, s/veh		27.8						28.2				
Approach LOS		C						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		38.0		37.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 34		* 32				
Max Q Clear Time (g_c+I1), s		22.5		27.2				
Green Ext Time (p_c), s		9.0		4.2				

Intersection Summary		
HCM 2010 Ctrl Delay		28.0
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Traffic Volume (veh/h)	15	298	39	1	70	200	41	46	255	138	58	194	10
Future Volume (veh/h)	15	298	39	1	70	200	41	46	255	138	58	194	10
Number	5	2	12		1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94		1.00		0.97	1.00		0.97	1.00		0.91
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2019	2019	2000		1942	1942	2000	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	16	324	37		76	217	36	50	277	126	63	211	9
Adj No. of Lanes	1	1	0		1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3		3	3	3	3	3	3	3	3	3
Cap, veh/h	45	419	48		154	480	80	148	359	163	170	551	23
Arrive On Green	0.02	0.24	0.24		0.08	0.30	0.30	0.08	0.30	0.30	0.10	0.31	0.31
Sat Flow, veh/h	1923	1767	202		1849	1617	268	1757	1188	540	1757	1749	75
Grp Volume(v), veh/h	16	0	361		76	0	253	50	0	403	63	0	220
Grp Sat Flow(s),veh/h/ln	1923	0	1969		1849	0	1885	1757	0	1728	1757	0	1823
Q Serve(g_s), s	0.5	0.0	10.4		2.4	0.0	6.6	1.6	0.0	12.9	2.0	0.0	5.7
Cycle Q Clear(g_c), s	0.5	0.0	10.4		2.4	0.0	6.6	1.6	0.0	12.9	2.0	0.0	5.7
Prop In Lane	1.00		0.10		1.00		0.14	1.00		0.31	1.00		0.04
Lane Grp Cap(c), veh/h	45	0	466		154	0	559	148	0	523	170	0	574
V/C Ratio(X)	0.36	0.00	0.77		0.49	0.00	0.45	0.34	0.00	0.77	0.37	0.00	0.38
Avail Cap(c_a), veh/h	253	0	715		304	0	746	260	0	761	260	0	802
HCM Platoon Ratio	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00		1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.3	0.0	21.7		26.7	0.0	17.4	26.3	0.0	19.3	25.8	0.0	16.3
Incr Delay (d2), s/veh	1.8	0.0	2.9		0.9	0.0	0.6	0.5	0.0	3.0	0.5	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	6.0		1.3	0.0	3.5	0.8	0.0	6.6	1.0	0.0	2.9
LnGrp Delay(d),s/veh	31.1	0.0	24.6		27.6	0.0	18.0	26.8	0.0	22.3	26.3	0.0	16.7
LnGrp LOS	C		C		C		B	C		C	C		B
Approach Vol, veh/h		377				329			453			283	
Approach Delay, s/veh		24.9				20.2			22.8			18.8	
Approach LOS		C				C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.1	19.3	9.1	23.4	5.4	23.0	9.9	22.6
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	22.1	9.0	* 27	8.0	24.1	9.0	* 27
Max Q Clear Time (g_c+I1), s	4.4	12.4	3.6	7.7	2.5	8.6	4.0	14.9
Green Ext Time (p_c), s	0.0	1.1	0.0	0.8	0.0	0.8	0.0	1.4

Intersection Summary	
HCM 2010 Ctrl Delay	22.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	246	420	12	40	496	62	8	454	42	0	348	288
Future Volume (veh/h)	246	420	12	40	496	62	8	454	42	0	348	288
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1676	1676	1710	1676	1676	1710	1800	1694	1728	0	1765	1728
Adj Flow Rate, veh/h	256	438	11	42	517	59	8	473	36	0	362	104
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	2	2
Cap, veh/h	180	956	24	476	645	74	52	1136	85	0	987	279
Arrive On Green	0.11	0.59	0.59	0.87	0.87	0.87	0.77	0.77	0.77	0.00	0.39	0.39
Sat Flow, veh/h	1597	1627	41	887	1474	168	14	2932	220	0	2636	719
Grp Volume(v), veh/h	256	0	449	42	0	576	274	0	243	0	236	230
Grp Sat Flow(s),veh/h/ln	1597	0	1668	887	0	1642	1681	0	1485	0	1676	1590
Q Serve(g_s), s	9.0	0.0	12.2	0.5	0.0	11.8	0.0	0.0	4.4	0.0	8.0	8.3
Cycle Q Clear(g_c), s	9.0	0.0	12.2	0.7	0.0	11.8	4.3	0.0	4.4	0.0	8.0	8.3
Prop In Lane	1.00		0.02	1.00		0.10	0.03		0.15	0.00		0.45
Lane Grp Cap(c), veh/h	180	0	980	476	0	718	698	0	575	0	650	616
V/C Ratio(X)	1.43	0.00	0.46	0.09	0.00	0.80	0.39	0.00	0.42	0.00	0.36	0.37
Avail Cap(c_a), veh/h	180	0	980	476	0	718	698	0	575	0	650	616
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.84	0.00	0.84	0.87	0.00	0.87	0.00	1.00	1.00
Uniform Delay (d), s/veh	35.5	0.0	9.3	2.9	0.0	3.5	6.0	0.0	6.0	0.0	17.5	17.5
Incr Delay (d2), s/veh	220.5	0.0	1.5	0.3	0.0	7.8	1.4	0.0	2.0	0.0	1.6	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.9	0.0	5.9	0.2	0.0	6.0	2.1	0.0	2.1	0.0	4.0	3.9
LnGrp Delay(d),s/veh	256.0	0.0	10.9	3.2	0.0	11.4	7.4	0.0	8.0	0.0	19.0	19.3
LnGrp LOS	F		B	A		B	A		A		B	B
Approach Vol, veh/h		705			618			517			466	
Approach Delay, s/veh		99.9			10.8			7.7			19.2	
Approach LOS		F			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		51.2		35.8	12.0	39.2		35.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 47		24.4	9.0	* 35		24.4
Max Q Clear Time (g_c+I1), s		14.2		6.4	11.0	13.8		10.3
Green Ext Time (p_c), s		4.7		4.3	0.0	6.2		3.4

Intersection Summary	
HCM 2010 Ctrl Delay	39.0
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	445	37	31	157	0	0	0	0	224	1100	425
Future Volume (vph)	0	445	37	31	157	0	0	0	0	224	1100	425
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.98
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.99			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2777			1783						2992	1321
Flt Permitted		1.00			0.88						0.99	1.00
Satd. Flow (perm)		2777			1589						2992	1321
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	464	39	32	164	0	0	0	0	233	1146	443
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	495	0	0	196	0	0	0	0	0	1379	443
Confl. Peds. (#/hr)			15	15		4			11			
Confl. Bikes (#/hr)			3			3			3			2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.8			30.8						40.4	33.4
Effective Green, g (s)		30.8			30.8						40.4	33.4
Actuated g/C Ratio		0.39			0.39						0.50	0.42
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1069			611						1510	551
v/s Ratio Prot		c0.18									c0.46	
v/s Ratio Perm					0.12							0.34
v/c Ratio		0.46			0.32						0.91	0.80
Uniform Delay, d1		18.4			17.3						18.2	20.4
Progression Factor		0.27			0.34						1.00	1.00
Incremental Delay, d2		1.3			1.2						10.0	11.8
Delay (s)		6.3			7.1						28.2	32.2
Level of Service		A			A						C	C
Approach Delay (s)		6.3			7.1			0.0			29.2	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	360	18	291	123	288	13	58	1409	178	42
Future Volume (vph)	360	18	291	123	288	13	58	1409	178	42
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1509	1812	1812	1485			3679	1316	
Flt Permitted		0.65	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		1039	1812	1812	1485			3679	1316	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	375	19	303	128	300	14	60	1468	185	44
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	38	0
Lane Group Flow (vph)	0	394	303	128	314	0	0	1528	191	0
Confl. Peds. (#/hr)							8			3
Confl. Bikes (#/hr)					4	4				
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Effective Green, g (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Actuated g/C Ratio		0.41	0.41	0.21	0.21			0.48	0.48	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		495	742	380	311			1784	638	
v/s Ratio Prot		c0.12	0.17	0.07	c0.21					
v/s Ratio Perm		0.21						0.42	0.15	
v/c Ratio		0.80	0.41	0.34	1.01			0.86	0.30	
Uniform Delay, d1		20.9	16.7	26.9	31.6			18.1	12.4	
Progression Factor		0.72	0.76	1.00	1.00			0.47	0.24	
Incremental Delay, d2		10.1	1.3	2.4	53.5			3.8	0.8	
Delay (s)		25.1	14.0	29.3	85.1			12.3	3.7	
Level of Service		C	B	C	F			B	A	
Approach Delay (s)			20.3	68.9				11.2		
Approach LOS			C	E				B		

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	93.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	74	355	35	25	235	40	30	389	44	52	316	32
Future Volume (veh/h)	74	355	35	25	235	40	30	389	44	52	316	32
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	1.00		0.98	0.97		0.92	0.98		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1412	1560	1530	1412	1500	1530	1440	1500	1469	1440	1500	1469
Adj Flow Rate, veh/h	77	370	32	26	245	34	31	405	36	54	329	25
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	529	713	62	347	649	90	90	918	80	155	822	62
Arrive On Green	0.50	0.50	0.50	1.00	1.00	1.00	0.76	0.76	0.76	0.76	0.76	0.76
Sat Flow, veh/h	870	1413	122	782	1285	178	103	2415	210	258	2163	164
Grp Volume(v), veh/h	77	0	402	26	0	279	247	0	225	207	0	201
Grp Sat Flow(s),veh/h/ln	870	0	1535	782	0	1463	1421	0	1307	1265	0	1320
Q Serve(g_s), s	3.8	0.0	14.1	1.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	4.2
Cycle Q Clear(g_c), s	3.8	0.0	14.1	15.0	0.0	0.0	4.7	0.0	5.0	3.7	0.0	4.2
Prop In Lane	1.00		0.08	1.00		0.12	0.13		0.16	0.26		0.12
Lane Grp Cap(c), veh/h	529	0	775	347	0	739	591	0	497	537	0	502
V/C Ratio(X)	0.15	0.00	0.52	0.07	0.00	0.38	0.42	0.00	0.45	0.38	0.00	0.40
Avail Cap(c_a), veh/h	529	0	775	347	0	739	591	0	497	537	0	502
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.98	0.00	0.98	0.88	0.00	0.88	0.77	0.00	0.77
Uniform Delay (d), s/veh	10.8	0.0	13.3	2.6	0.0	0.0	6.5	0.0	6.6	6.4	0.0	6.5
Incr Delay (d2), s/veh	0.6	0.0	2.5	0.4	0.0	1.4	1.9	0.0	2.6	1.6	0.0	1.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	6.5	0.2	0.0	0.3	2.1	0.0	2.1	1.6	0.0	1.7
LnGrp Delay(d),s/veh	11.3	0.0	15.8	3.0	0.0	1.4	8.4	0.0	9.2	8.0	0.0	8.3
LnGrp LOS	B		B	A		A	A		A	A		A
Approach Vol, veh/h		479			305			472			408	
Approach Delay, s/veh		15.0			1.6			8.8			8.1	
Approach LOS		B			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		40.4		30.4		40.4		30.4
Max Q Clear Time (g_c+I1), s		16.1		7.0		17.0		6.2
Green Ext Time (p_c), s		2.3		2.0		1.3		1.8

Intersection Summary			
HCM 2010 Ctrl Delay			9.1
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	307	167	56	160	0	0	0	0	45	1003	120
Future Volume (vph)	0	307	167	56	160	0	0	0	0	45	1003	120
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.96
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1698			1775						4164	1148
Flt Permitted		1.00			0.74						1.00	1.00
Satd. Flow (perm)		1698			1323						4164	1148
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	320	174	58	167	0	0	0	0	47	1045	125
RTOR Reduction (vph)	0	24	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	470	0	0	225	0	0	0	0	0	1092	125
Confl. Peds. (#/hr)	12		12	12		12			12	12		7
Confl. Bikes (#/hr)			6			4			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		35.8			35.8						35.4	28.4
Effective Green, g (s)		35.8			35.8						35.4	28.4
Actuated g/C Ratio		0.45			0.45						0.44	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		759			592						1842	407
v/s Ratio Prot		c0.28										
v/s Ratio Perm					0.17						0.26	0.11
v/c Ratio		0.62			0.38						0.59	0.31
Uniform Delay, d1		16.9			14.7						16.9	18.7
Progression Factor		0.28			1.05						0.32	0.40
Incremental Delay, d2		3.6			1.6						0.6	0.9
Delay (s)		8.4			17.0						6.0	8.3
Level of Service		A			B						A	A
Approach Delay (s)		8.4			17.0			0.0			6.3	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	232	140	0	0	120	103	86	1338	14	0	0	0
Future Volume (veh/h)	232	140	0	0	120	103	86	1338	14	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.97	1.00		0.96			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1620	1588	1620			
Adj Flow Rate, veh/h	242	146	0	0	125	95	90	1394	14			
Adj No. of Lanes	1	1	0	0	1	0	0	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	0	2	0			
Cap, veh/h	379	643	0	0	291	221	125	2061	21			
Arrive On Green	0.68	0.68	0.00	0.00	0.41	0.41	0.16	0.16	0.16			
Sat Flow, veh/h	1035	1588	0	0	718	545	260	4295	44			
Grp Volume(v), veh/h	242	146	0	0	0	220	545	455	497			
Grp Sat Flow(s),veh/h/ln	1035	1588	0	0	0	1263	1575	1445	1578			
Q Serve(g_s), s	16.4	2.8	0.0	0.0	0.0	10.0	26.3	23.7	23.7			
Cycle Q Clear(g_c), s	26.4	2.8	0.0	0.0	0.0	10.0	26.3	23.7	23.7			
Prop In Lane	1.00		0.00	0.00		0.43	0.17		0.03			
Lane Grp Cap(c), veh/h	379	643	0	0	0	512	756	694	758			
V/C Ratio(X)	0.64	0.23	0.00	0.00	0.00	0.43	0.72	0.66	0.66			
Avail Cap(c_a), veh/h	379	643	0	0	0	512	756	694	758			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00			
Uniform Delay (d), s/veh	16.4	8.2	0.0	0.0	0.0	17.1	28.6	27.5	27.5			
Incr Delay (d2), s/veh	8.0	0.8	0.0	0.0	0.0	2.6	5.9	4.8	4.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.4	1.4	0.0	0.0	0.0	3.9	12.7	10.4	11.3			
LnGrp Delay(d),s/veh	24.3	9.0	0.0	0.0	0.0	19.8	34.5	32.3	31.9			
LnGrp LOS	C	A				B	C	C	C			
Approach Vol, veh/h		388			220			1498				
Approach Delay, s/veh		18.6			19.8			32.9				
Approach LOS		B			B			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		37.0		43.0		37.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		32.4		38.4		32.4		
Max Q Clear Time (g_c+I1), s		28.4		28.3		12.0		
Green Ext Time (p_c), s		0.8		5.1		0.9		

Intersection Summary		
HCM 2010 Ctrl Delay		28.9
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	216	31	90	238	65	27	366	78	43	271	62
Future Volume (veh/h)	45	216	31	90	238	65	27	366	78	43	271	62
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.91	0.97		0.91	0.92		0.83	0.95		0.83
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1588	1525	1620	1588	1588	1620	1620	1588	1555	1620	1588	1555
Adj Flow Rate, veh/h	47	225	26	94	248	56	28	381	60	45	282	43
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	403	676	78	490	626	141	85	907	138	128	735	118
Arrive On Green	0.51	0.51	0.51	0.17	0.17	0.17	0.13	0.13	0.13	0.77	0.77	0.77
Sat Flow, veh/h	948	1326	153	977	1228	277	91	2356	358	188	1909	305
Grp Volume(v), veh/h	47	0	251	94	0	304	252	0	217	184	0	186
Grp Sat Flow(s),veh/h/ln	948	0	1479	977	0	1505	1512	0	1293	1084	0	1318
Q Serve(g_s), s	2.8	0.0	8.0	6.9	0.0	14.4	0.0	0.0	12.4	2.5	0.0	3.6
Cycle Q Clear(g_c), s	17.2	0.0	8.0	14.9	0.0	14.4	11.7	0.0	12.4	14.9	0.0	3.6
Prop In Lane	1.00		0.10	1.00		0.18	0.11		0.28	0.24		0.23
Lane Grp Cap(c), veh/h	403	0	754	490	0	768	632	0	498	473	0	507
V/C Ratio(X)	0.12	0.00	0.33	0.19	0.00	0.40	0.40	0.00	0.44	0.39	0.00	0.37
Avail Cap(c_a), veh/h	403	0	754	490	0	768	632	0	498	473	0	507
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.94	0.00	0.94	0.91	0.00	0.91	0.89	0.00	0.89
Uniform Delay (d), s/veh	18.9	0.0	11.6	26.1	0.0	22.3	26.6	0.0	26.9	6.7	0.0	6.1
Incr Delay (d2), s/veh	0.6	0.0	1.2	0.8	0.0	1.4	1.7	0.0	2.5	2.1	0.0	1.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	3.5	2.0	0.0	6.3	5.4	0.0	4.8	1.4	0.0	1.5
LnGrp Delay(d),s/veh	19.5	0.0	12.8	26.9	0.0	23.7	28.3	0.0	29.4	8.8	0.0	7.9
LnGrp LOS	B		B	C		C	C		C	A		A
Approach Vol, veh/h		298			398			469			370	
Approach Delay, s/veh		13.8			24.5			28.8			8.3	
Approach LOS		B			C			C			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0				
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 41		* 31		* 41		* 31				
Max Q Clear Time (g_c+I1), s		19.2		14.4		16.9		16.9				
Green Ext Time (p_c), s		2.6		3.8		3.9		2.7				
Intersection Summary												
HCM 2010 Ctrl Delay			19.8									
HCM 2010 LOS			B									
Notes												

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	348	363	45	0	40
Future Volume (vph)	0	348	363	45	0	40
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0	6.0			5.6
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.98			0.78
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.99			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1588	1533			1074
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1588	1533			1074
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	362	378	47	0	42
RTOR Reduction (vph)	0	0	5	0	0	36
Lane Group Flow (vph)	0	363	420	0	0	6
Confl. Peds. (#/hr)				59		78
Confl. Bikes (#/hr)				14		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		55.4	56.1			12.3
Effective Green, g (s)		55.4	56.1			12.3
Actuated g/C Ratio		0.69	0.70			0.15
Clearance Time (s)						5.6
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1099	1075			165
v/s Ratio Prot		c0.23	c0.27			
v/s Ratio Perm						0.01
v/c Ratio		0.33	0.39			0.04
Uniform Delay, d1		4.9	4.9			28.8
Progression Factor		0.92	0.13			1.00
Incremental Delay, d2		0.2	0.2			0.1
Delay (s)		4.7	0.8			28.9
Level of Service		A	A			C
Approach Delay (s)		4.7	0.8		28.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	3.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	247	104	71	224	0	0	0	0	118	913	195
Future Volume (vph)	0	247	104	71	224	0	0	0	0	118	913	195
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.93	1.00	1.00						1.00	0.92
Flpb, ped/bikes		1.00	1.00	0.97	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1173	1602	1535						4143	1102
Flt Permitted		1.00	1.00	0.54	1.00						0.99	1.00
Satd. Flow (perm)		1641	1173	915	1535						4143	1102
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	257	108	74	233	0	0	0	0	123	951	203
RTOR Reduction (vph)	0	0	34	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	257	74	74	233	0	0	0	0	0	1074	203
Confl. Peds. (#/hr)			51	51		28			11	11		19
Confl. Bikes (#/hr)			10			16			1			1
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		34.8	34.8	34.8	34.8						36.4	29.4
Effective Green, g (s)		34.8	34.8	34.8	34.8						36.4	29.4
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.45	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		713	510	398	667						1885	404
v/s Ratio Prot		c0.16			0.15							
v/s Ratio Perm			0.06	0.08							0.26	0.18
v/c Ratio		0.36	0.15	0.19	0.35						0.57	0.50
Uniform Delay, d1		15.1	13.6	13.9	15.1						16.0	19.6
Progression Factor		0.53	0.37	0.88	0.92						0.38	0.47
Incremental Delay, d2		1.4	0.6	1.0	1.3						1.0	3.6
Delay (s)		9.5	5.6	13.2	15.2						7.1	12.9
Level of Service		A	A	B	B						A	B
Approach Delay (s)		8.3			14.7			0.0			8.0	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	154	203	0	0	182	79	111	1210	153	0	0	0
Future Volume (veh/h)	154	203	0	0	182	79	111	1210	153	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1525	1588	1620			
Adj Flow Rate, veh/h	160	211	0	0	190	61	116	1260	138			
Adj No. of Lanes	1	1	0	0	1	0	1	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	256	552	0	0	343	110	795	2170	238			
Arrive On Green	0.11	0.11	0.00	0.00	0.11	0.11	0.18	0.18	0.18			
Sat Flow, veh/h	1005	1588	0	0	988	317	1452	3963	434			
Grp Volume(v), veh/h	160	211	0	0	0	251	116	919	479			
Grp Sat Flow(s),veh/h/ln	1005	1588	0	0	0	1305	1452	1445	1506			
Q Serve(g_s), s	12.7	9.8	0.0	0.0	0.0	14.5	5.4	23.3	23.3			
Cycle Q Clear(g_c), s	27.3	9.8	0.0	0.0	0.0	14.5	5.4	23.3	23.3			
Prop In Lane	1.00		0.00	0.00		0.24	1.00		0.29			
Lane Grp Cap(c), veh/h	256	552	0	0	0	453	795	1583	825			
V/C Ratio(X)	0.62	0.38	0.00	0.00	0.00	0.55	0.15	0.58	0.58			
Avail Cap(c_a), veh/h	256	552	0	0	0	453	795	1583	825			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.94	0.94	0.00	0.00	0.00	1.00	0.43	0.43	0.43			
Uniform Delay (d), s/veh	42.4	27.5	0.0	0.0	0.0	29.5	17.0	24.4	24.4			
Incr Delay (d2), s/veh	10.3	1.9	0.0	0.0	0.0	4.8	0.2	0.7	1.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.3	4.6	0.0	0.0	0.0	5.9	2.2	9.5	10.0			
LnGrp Delay(d),s/veh	52.8	29.3	0.0	0.0	0.0	34.4	17.2	25.0	25.7			
LnGrp LOS	D	C				C	B	C	C			
Approach Vol, veh/h		371			251			1514				
Approach Delay, s/veh		39.4			34.4			24.6				
Approach LOS		D			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		32.0		48.0		32.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 28		* 44		* 28		
Max Q Clear Time (g_c+I1), s		29.3		25.3		16.5		
Green Ext Time (p_c), s		0.0		7.6		0.8		

Intersection Summary		
HCM 2010 Ctrl Delay		28.4
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	291	1425	0	0	0	0	0	269	47
Future Volume (veh/h)	0	0	0	291	1425	0	0	0	0	0	269	47
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.95
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.82
Adj Sat Flow, veh/h/ln				1530	1500	0				0	1500	1530
Adj Flow Rate, veh/h				303	1484	0				0	280	30
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				459	1989	0				0	630	67
Arrive On Green				0.21	0.21	0.00				0.00	0.27	0.27
Sat Flow, veh/h				632	3318	0				0	2430	249
Grp Volume(v), veh/h				644	1143	0				0	168	142
Grp Sat Flow(s),veh/h/ln				1342	1242	0				0	1425	1179
Q Serve(g_s), s				36.2	34.5	0.0				0.0	7.8	8.0
Cycle Q Clear(g_c), s				36.2	34.5	0.0				0.0	7.8	8.0
Prop In Lane				0.47		0.00				0.00		0.21
Lane Grp Cap(c), veh/h				902	1546	0				0	381	315
V/C Ratio(X)				0.71	0.74	0.00				0.00	0.44	0.45
Avail Cap(c_a), veh/h				902	1546	0				0	381	315
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				26.4	25.7	0.0				0.0	24.3	24.4
Incr Delay (d2), s/veh				4.8	3.2	0.0				0.0	3.7	4.6
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				14.7	12.6	0.0				0.0	3.5	3.0
LnGrp Delay(d),s/veh				31.2	28.9	0.0				0.0	28.0	29.0
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1787						310	
Approach Delay, s/veh					29.7						28.5	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.0		26.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 50		21.4				
Max Q Clear Time (g_c+I1), s		38.2		10.0				
Green Ext Time (p_c), s		7.0		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	29.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1597	141	128	298	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1597	141	128	298	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1412	1412	1440	1412	0			
Adj Flow Rate, veh/h				0	1664	111	133	310	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	2	2	0			
Cap, veh/h				0	2351	717	255	519	0			
Arrive On Green				0.00	0.20	0.20	0.09	0.09	0.00			
Sat Flow, veh/h				0	3981	1175	649	1885	0			
Grp Volume(v), veh/h				0	1664	111	239	204	0			
Grp Sat Flow(s),veh/h/ln				0	1285	1175	1250	1220	0			
Q Serve(g_s), s				0.0	32.2	6.2	13.4	12.8	0.0			
Cycle Q Clear(g_c), s				0.0	32.2	6.2	14.7	12.8	0.0			
Prop In Lane				0.00		1.00	0.56		0.00			
Lane Grp Cap(c), veh/h				0	2351	717	426	348	0			
V/C Ratio(X)				0.00	0.71	0.15	0.56	0.59	0.00			
Avail Cap(c_a), veh/h				0	2351	717	426	348	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	25.3	14.9	32.5	31.7	0.0			
Incr Delay (d2), s/veh				0.0	1.8	0.5	5.3	7.1	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	11.9	2.1	5.7	5.0	0.0			
LnGrp Delay(d),s/veh				0.0	27.1	15.4	37.8	38.8	0.0			
LnGrp LOS					C	B	D	D				
Approach Vol, veh/h					1775			443				
Approach Delay, s/veh					26.4			38.2				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		53.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 49		* 23				
Max Q Clear Time (g_c+I1), s		34.2		16.7				
Green Ext Time (p_c), s		8.5		1.0				

Intersection Summary			
HCM 2010 Ctrl Delay			28.8
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	169	1659	0	0	0	0	0	263	84
Future Volume (veh/h)	0	0	0	169	1659	0	0	0	0	0	263	84
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1412	0				0	1412	1440
Adj Flow Rate, veh/h				176	1728	0				0	274	69
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				256	2131	0				0	507	123
Arrive On Green				0.21	0.21	0.00				0.00	0.26	0.26
Sat Flow, veh/h				315	3472	0				0	2021	471
Grp Volume(v), veh/h				701	1203	0				0	185	158
Grp Sat Flow(s),veh/h/ln				1333	1169	0				0	1341	1081
Q Serve(g_s), s				37.3	39.2	0.0				0.0	9.5	10.1
Cycle Q Clear(g_c), s				40.2	39.2	0.0				0.0	9.5	10.1
Prop In Lane				0.25		0.00				0.00		0.44
Lane Grp Cap(c), veh/h				903	1485	0				0	349	281
V/C Ratio(X)				0.78	0.81	0.00				0.00	0.53	0.56
Avail Cap(c_a), veh/h				903	1485	0				0	349	281
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				27.3	27.0	0.0				0.0	25.4	25.7
Incr Delay (d2), s/veh				6.5	4.9	0.0				0.0	5.7	7.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				16.5	13.7	0.0				0.0	4.0	3.7
LnGrp Delay(d),s/veh				33.8	31.9	0.0				0.0	31.1	33.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1904						343	
Approach Delay, s/veh					32.6						32.2	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		55.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 51		* 21				
Max Q Clear Time (g_c+I1), s		42.2		12.1				
Green Ext Time (p_c), s		5.9		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	32.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	65	1523	83	220	146	0	0	160	45
Future Volume (veh/h)	0	0	0	65	1523	83	220	146	0	0	160	45
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				68	1586	79	229	152	0	0	167	35
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				102	2519	130	310	649	0	0	301	63
Arrive On Green				0.18	0.18	0.18	0.10	0.58	0.00	0.00	0.23	0.23
Sat Flow, veh/h				187	4632	238	1765	1853	0	0	1300	273
Grp Volume(v), veh/h				639	532	562	229	152	0	0	0	202
Grp Sat Flow(s),veh/h/ln				1755	1606	1696	1765	1853	0	0	0	1573
Q Serve(g_s), s				27.2	24.4	24.4	0.3	3.2	0.0	0.0	0.0	9.1
Cycle Q Clear(g_c), s				27.2	24.4	24.4	0.3	3.2	0.0	0.0	0.0	9.1
Prop In Lane				0.11		0.14	1.00		0.00	0.00		0.17
Lane Grp Cap(c), veh/h				954	873	922	310	649	0	0	0	364
V/C Ratio(X)				0.67	0.61	0.61	0.74	0.23	0.00	0.00	0.00	0.56
Avail Cap(c_a), veh/h				954	873	922	310	649	0	0	0	364
HCM Platoon Ratio				0.33	0.33	0.33	1.67	1.67	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				26.1	25.0	25.0	31.8	11.5	0.0	0.0	0.0	27.1
Incr Delay (d2), s/veh				3.7	3.2	3.0	14.6	0.8	0.0	0.0	0.0	6.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				14.2	11.6	12.2	5.8	1.8	0.0	0.0	0.0	4.5
LnGrp Delay(d),s/veh				29.8	28.1	28.0	46.4	12.3	0.0	0.0	0.0	33.1
LnGrp LOS				C	C	C	D	B				C
Approach Vol, veh/h					1733			381			202	
Approach Delay, s/veh					28.7			32.8			33.1	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			9.0	23.0		48.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			5.0	18.5		43.5		28.0
Max Q Clear Time (g_c+I1), s			2.3	11.1		29.2		5.2
Green Ext Time (p_c), s			0.4	0.8		11.5		1.1

Intersection Summary	
HCM 2010 Ctrl Delay	29.8
HCM 2010 LOS	C

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **Existing Conditions**
Volume and Delay by Movement **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	35	29	83.1%	9.0	2.1	A
	Through						
	Right Turn						
	Subtotal	35	29	83.1%	9.0	2.1	A
SB	Left Turn						
	Through	4	4	92.0%	15.2	19.7	C
	Right Turn	3	3	85.9%	6.9	13.5	A
	Subtotal	7	6	89.4%	13.9	18.1	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	60	49	81.6%	2.0	0.3	A
	Through	1,640	1,571	95.8%	1.4	0.3	A
	Right Turn	4	4	92.0%	0.6	0.7	A
	Subtotal	1,704	1,624	95.3%	1.4	0.3	A
Total		1,746	1,659	95.0%	1.6	0.3	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	99	95	96.3%	25.1	3.1	C
	Through	18	18	98.1%	24.2	5.2	C
	Right Turn						
	Subtotal	117	113	96.6%	24.9	2.4	C
SB	Left Turn						
	Through	39	36	91.5%	19.5	6.2	B
	Right Turn	8	7	87.4%	15.2	9.7	B
	Subtotal	47	43	90.8%	18.6	5.5	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	200	193	96.4%	10.5	2.1	B
	Through	1,681	1,588	94.5%	8.5	1.8	A
	Right Turn	35	38	109.3%	7.2	2.1	A
	Subtotal	1,916	1,819	95.0%	8.7	1.8	A
Total		2,080	1,975	95.0%	9.8	1.7	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	199	1681	35	98	18	0	0	39	8
Future Volume (veh/h)	0	0	0	199	1681	35	98	18	0	0	39	8
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1412	1412	1440	1440	1412	0	0	1412	1440
Adj Flow Rate, veh/h				207	1751	33	102	19	0	0	41	2
Adj No. of Lanes				1	3	0	0	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				820	2372	45	332	53	0	0	381	19
Arrive On Green				0.20	0.20	0.20	0.28	0.28	0.00	0.00	0.28	0.28
Sat Flow, veh/h				1345	3889	73	875	186	0	0	1335	65
Grp Volume(v), veh/h				207	1157	627	121	0	0	0	0	43
Grp Sat Flow(s),veh/h/ln				1345	1285	1393	1061	0	0	0	0	1400
Q Serve(g_s), s				10.4	33.8	33.8	6.6	0.0	0.0	0.0	0.0	1.8
Cycle Q Clear(g_c), s				10.4	33.8	33.8	8.4	0.0	0.0	0.0	0.0	1.8
Prop In Lane				1.00		0.05	0.84		0.00	0.00		0.05
Lane Grp Cap(c), veh/h				820	1567	850	385	0	0	0	0	399
V/C Ratio(X)				0.25	0.74	0.74	0.31	0.00	0.00	0.00	0.00	0.11
Avail Cap(c_a), veh/h				820	1567	850	385	0	0	0	0	399
HCM Platoon Ratio				0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				16.6	26.0	26.0	23.9	0.0	0.0	0.0	0.0	21.1
Incr Delay (d2), s/veh				0.7	3.1	5.7	2.1	0.0	0.0	0.0	0.0	0.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				4.0	12.7	14.4	2.4	0.0	0.0	0.0	0.0	0.8
LnGrp Delay(d),s/veh				17.3	29.1	31.7	26.0	0.0	0.0	0.0	0.0	21.6
LnGrp LOS				B	C	C	C					C
Approach Vol, veh/h					1991			121			43	
Approach Delay, s/veh					28.7			26.0			21.6	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				27.0		53.0		27.0
Change Period (Y+Rc), s				* 4.2		4.2		* 4.2
Max Green Setting (Gmax), s				* 23		48.8		* 23
Max Q Clear Time (g_c+I1), s				10.4		35.8		3.8
Green Ext Time (p_c), s				0.3		8.2		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	28.4
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	90	1633	122	36	296	0	0	236	135
Future Volume (veh/h)	0	0	0	90	1633	122	36	296	0	0	236	135
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.96		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1620	1588	1620	1620	1588	0	0	1525	1555
Adj Flow Rate, veh/h				94	1701	117	38	308	0	0	246	133
Adj No. of Lanes				0	3	0	0	2	0	0	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				119	2296	163	106	758	0	0	554	277
Arrive On Green				0.19	0.19	0.19	0.64	0.64	0.00	0.00	0.11	0.11
Sat Flow, veh/h				210	4037	286	160	2451	0	0	1814	869
Grp Volume(v), veh/h				706	588	618	175	171	0	0	202	177
Grp Sat Flow(s),veh/h/ln				1578	1445	1511	1166	1373	0	0	1448	1159
Q Serve(g_s), s				34.1	30.6	30.7	1.6	4.8	0.0	0.0	10.5	11.5
Cycle Q Clear(g_c), s				34.1	30.6	30.7	13.2	4.8	0.0	0.0	10.5	11.5
Prop In Lane				0.13		0.19	0.22		0.00	0.00		0.75
Lane Grp Cap(c), veh/h				897	822	859	426	438	0	0	462	369
V/C Ratio(X)				0.79	0.72	0.72	0.41	0.39	0.00	0.00	0.44	0.48
Avail Cap(c_a), veh/h				897	822	859	426	438	0	0	462	369
HCM Platoon Ratio				0.33	0.33	0.33	2.00	2.00	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				27.9	26.4	26.5	11.0	10.7	0.0	0.0	29.1	29.5
Incr Delay (d2), s/veh				6.9	5.3	5.2	2.9	2.6	0.0	0.0	3.0	4.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				16.6	13.4	14.1	2.1	2.0	0.0	0.0	4.6	4.1
LnGrp Delay(d),s/veh				34.8	31.7	31.6	13.9	13.4	0.0	0.0	32.0	34.0
LnGrp LOS				C	C	C	B	B			C	C
Approach Vol, veh/h					1912			346			379	
Approach Delay, s/veh					32.8			13.6			32.9	
Approach LOS					C			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				30.0		50.0		30.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				25.5		45.5		25.5
Max Q Clear Time (g_c+I1), s				15.2		36.1		13.5
Green Ext Time (p_c), s				1.1		6.1		1.4

Intersection Summary	
HCM 2010 Ctrl Delay	30.3
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	273	1701	27	108	38	0	0	28	21
Future Volume (veh/h)	0	0	0	273	1701	27	108	38	0	0	28	21
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.90	0.94		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1440	1412	1440	1412	1412	0	0	1412	1440
Adj Flow Rate, veh/h				284	1772	26	112	40	0	0	29	4
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				344	2305	35	310	332	0	0	249	34
Arrive On Green				0.22	0.22	0.22	0.23	0.23	0.00	0.00	0.23	0.23
Sat Flow, veh/h				521	3493	52	1033	1412	0	0	1060	146
Grp Volume(v), veh/h				755	635	691	112	40	0	0	0	33
Grp Sat Flow(s),veh/h/ln				1386	1285	1396	1033	1412	0	0	0	1206
Q Serve(g_s), s				41.6	37.0	37.1	7.7	1.8	0.0	0.0	0.0	1.7
Cycle Q Clear(g_c), s				41.6	37.0	37.1	9.4	1.8	0.0	0.0	0.0	1.7
Prop In Lane				0.38		0.04	1.00		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				915	848	921	310	332	0	0	0	283
V/C Ratio(X)				0.83	0.75	0.75	0.36	0.12	0.00	0.00	0.00	0.12
Avail Cap(c_a), veh/h				915	848	921	310	332	0	0	0	283
HCM Platoon Ratio				0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				26.9	25.1	25.1	27.8	24.1	0.0	0.0	0.0	24.1
Incr Delay (d2), s/veh				8.4	6.0	5.6	3.2	0.7	0.0	0.0	0.0	0.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				18.1	14.5	15.8	2.5	0.8	0.0	0.0	0.0	0.6
LnGrp Delay(d),s/veh				35.3	31.1	30.7	31.0	24.8	0.0	0.0	0.0	24.9
LnGrp LOS				D	C	C	C	C				C
Approach Vol, veh/h					2082			152			33	
Approach Delay, s/veh					32.5			29.4			24.9	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				23.0		57.0		23.0
Change Period (Y+Rc), s				* 4.2		4.2		* 4.2
Max Green Setting (Gmax), s				* 19		52.8		* 19
Max Q Clear Time (g_c+I1), s				11.4		43.6		3.7
Green Ext Time (p_c), s				0.4		6.5		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	32.2
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	462	1511	0	0	0	0	0	641	447
Future Volume (veh/h)	0	0	0	462	1511	0	0	0	0	0	641	447
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.90
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1560	1588	0				0	1588	1500
Adj Flow Rate, veh/h				481	1574	0				0	668	450
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				926	2680	0				0	1409	374
Arrive On Green				0.19	0.19	0.00				0.00	0.11	0.11
Sat Flow, veh/h				1486	4765	0				0	4479	1150
Grp Volume(v), veh/h				481	1574	0				0	668	450
Grp Sat Flow(s),veh/h/ln				1486	1588	0				0	1445	1150
Q Serve(g_s), s				23.6	24.2	0.0				0.0	11.6	26.0
Cycle Q Clear(g_c), s				23.6	24.2	0.0				0.0	11.6	26.0
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				926	2680	0				0	1409	374
V/C Ratio(X)				0.52	0.59	0.00				0.00	0.47	1.20
Avail Cap(c_a), veh/h				926	2680	0				0	1409	374
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.9	24.1	0.0				0.0	29.3	35.7
Incr Delay (d2), s/veh				2.1	1.0	0.0				0.0	1.1	114.6
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				10.3	10.9	0.0				0.0	4.8	20.2
LnGrp Delay(d),s/veh				26.0	25.0	0.0				0.0	30.4	150.3
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2055						1118	
Approach Delay, s/veh					25.3						78.7	
Approach LOS					C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						49.0		31.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						45.0		26.0
Max Q Clear Time (g_c+I1), s						26.2		28.0
Green Ext Time (p_c), s						11.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	44.1
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1102	183	865	1289	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1102	183	865	1289	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1500	1500	1398	1398	0			
Adj Flow Rate, veh/h				0	1148	172	978	1235	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	3	3	0			
Cap, veh/h				0	1510	441	1381	1450	0			
Arrive On Green				0.00	0.37	0.37	0.17	0.17	0.00			
Sat Flow, veh/h				0	4230	1195	2663	2796	0			
Grp Volume(v), veh/h				0	1148	172	978	1235	0			
Grp Sat Flow(s),veh/h/ln				0	1365	1195	1331	1398	0			
Q Serve(g_s), s				0.0	19.7	8.5	27.7	34.3	0.0			
Cycle Q Clear(g_c), s				0.0	19.7	8.5	27.7	34.3	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1510	441	1381	1450	0			
V/C Ratio(X)				0.00	0.76	0.39	0.71	0.85	0.00			
Avail Cap(c_a), veh/h				0	1510	441	1381	1450	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.1	18.6	27.4	30.2	0.0			
Incr Delay (d2), s/veh				0.0	3.7	2.6	3.1	6.5	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	7.8	3.1	10.8	14.6	0.0			
LnGrp Delay(d),s/veh				0.0	25.8	21.2	30.5	36.6	0.0			
LnGrp LOS					C	C	C	D				
Approach Vol, veh/h					1320			2213				
Approach Delay, s/veh					25.2			33.9				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				46.0		34.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				41.5		29.5		
Max Q Clear Time (g_c+I1), s				36.3		21.7		
Green Ext Time (p_c), s				4.3		4.2		

Intersection Summary	
HCM 2010 Ctrl Delay	30.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1453	93	0	0	0	0	0	389	161	418	0
Future Volume (veh/h)	0	1453	93	0	0	0	0	0	389	161	418	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1676	1710				0	1588	1620	1765	1765	0
Adj Flow Rate, veh/h	0	1514	88				0	0	390	168	435	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1145	1003	1526	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.86	0.29	0.29	0.00
Sat Flow, veh/h		0					0	0	1324	979	1765	0
Grp Volume(v), veh/h		0.0					0	0	390	168	435	0
Grp Sat Flow(s),veh/h/ln							0	0	1324	979	1765	0
Q Serve(g_s), s							0.0	0.0	1.9	4.5	6.5	0.0
Cycle Q Clear(g_c), s							0.0	0.0	1.9	6.5	6.5	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1145	1003	1526	0
V/C Ratio(X)							0.00	0.00	0.34	0.17	0.29	0.00
Avail Cap(c_a), veh/h							0	0	1145	1003	1526	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.7	4.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.8	0.4	0.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.9	1.4	3.5	0.0
LnGrp Delay(d),s/veh							0.0	0.0	1.3	5.1	4.4	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								390			603	
Approach Delay, s/veh								1.3			4.6	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				34.0				34.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				29.4				29.4
Max Q Clear Time (g_c+I1), s				8.5				3.9
Green Ext Time (p_c), s				1.7				1.2

Intersection Summary		
HCM 2010 Ctrl Delay		3.3
HCM 2010 LOS		A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	1833	0	0	0	0	0	232	108	0	0	0
Future Volume (veh/h)	173	1833	0	0	0	0	0	232	108	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1500	0				0	1500	1440			
Adj Flow Rate, veh/h	180	1909	0				0	242	105			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	245	2164	0				0	644	269			
Arrive On Green	0.19	0.19	0.00				0.00	0.32	0.32			
Sat Flow, veh/h	333	3814	0				0	1995	835			
Grp Volume(v), veh/h	727	1362	0				0	180	167			
Grp Sat Flow(s),veh/h/ln	1417	1365	0				0	1500	1331			
Q Serve(g_s), s	37.9	38.8	0.0				0.0	7.4	7.8			
Cycle Q Clear(g_c), s	40.1	38.8	0.0				0.0	7.4	7.8			
Prop In Lane	0.25		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	860	1549	0				0	484	429			
V/C Ratio(X)	0.84	0.88	0.00				0.00	0.37	0.39			
Avail Cap(c_a), veh/h	860	1549	0				0	484	429			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	30.3	29.8	0.0				0.0	20.9	21.0			
Incr Delay (d2), s/veh	10.0	7.4	0.0				0.0	2.2	2.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	18.1	16.3	0.0				0.0	3.3	3.2			
LnGrp Delay(d),s/veh	40.3	37.3	0.0				0.0	23.0	23.7			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2089						347				
Approach Delay, s/veh		38.3						23.3				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				30.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 26		45.4		
Max Q Clear Time (g_c+I1), s				9.8		42.1		
Green Ext Time (p_c), s				2.6		3.1		

Intersection Summary	
HCM 2010 Ctrl Delay	36.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1875	73	0	0	0	0	0	223	186	259	0
Future Volume (veh/h)	0	1875	73	0	0	0	0	0	223	186	259	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1382				0	1588	1591	1560	1500	0
Adj Flow Rate, veh/h	0	1953	71				0	0	216	194	270	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1101	1065	1282	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1288	1008	1500	0
Grp Volume(v), veh/h		0.0					0	0	216	194	270	0
Grp Sat Flow(s),veh/h/ln							0	0	1288	1008	1500	0
Q Serve(g_s), s							0.0	0.0	0.9	4.6	4.3	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.9	5.5	4.3	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1101	1065	1282	0
V/C Ratio(X)							0.00	0.00	0.20	0.18	0.21	0.00
Avail Cap(c_a), veh/h							0	0	1101	1065	1282	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.0	3.1	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.4	0.4	0.4	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.4	1.4	1.9	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.8	4.3	3.5	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								216			464	
Approach Delay, s/veh								0.8			3.9	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				31.0				31.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				26.5				26.5
Max Q Clear Time (g_c+I1), s				7.5				2.9
Green Ext Time (p_c), s				1.3				0.6

Intersection Summary			
HCM 2010 Ctrl Delay			2.9
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	2036	157	0	0	0	0	286	25	106	119	0
Future Volume (veh/h)	91	2036	157	0	0	0	0	286	25	106	119	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.92	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	95	2121	153				0	298	18	110	124	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	111	2617	193				0	636	38	264	543	0
Arrive On Green	0.19	0.19	0.19				0.00	0.21	0.21	0.03	0.21	0.00
Sat Flow, veh/h	191	4523	334				0	3120	182	1597	1744	0
Grp Volume(v), veh/h	871	724	774				0	155	161	110	124	0
Grp Sat Flow(s),veh/h/ln	1755	1606	1687				0	1593	1625	1597	1744	0
Q Serve(g_s), s	38.5	34.4	35.1				0.0	6.8	7.0	0.0	4.7	0.0
Cycle Q Clear(g_c), s	38.5	34.4	35.1				0.0	6.8	7.0	0.0	4.7	0.0
Prop In Lane	0.11		0.20				0.00		0.11	1.00		0.00
Lane Grp Cap(c), veh/h	1015	929	976				0	334	340	264	543	0
V/C Ratio(X)	0.86	0.78	0.79				0.00	0.47	0.47	0.42	0.23	0.00
Avail Cap(c_a), veh/h	1015	929	976				0	334	340	264	543	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.67	0.67	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	29.3	27.6	27.9				0.0	27.8	27.8	33.5	23.7	0.0
Incr Delay (d2), s/veh	9.3	6.4	6.6				0.0	4.6	4.6	4.8	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.4	16.9	18.2				0.0	3.4	3.6	2.7	2.4	0.0
LnGrp Delay(d),s/veh	38.6	34.0	34.4				0.0	32.4	32.4	38.2	24.7	0.0
LnGrp LOS	D	C	C					C	C	D	C	
Approach Vol, veh/h		2369						316			234	
Approach Delay, s/veh		35.8						32.4			31.1	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		51.0		29.2			8.2	21.0
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		46.4		* 25			* 4	* 17
Max Q Clear Time (g_c+I1), s		40.5		6.7			2.0	9.0
Green Ext Time (p_c), s		5.7		0.8			0.1	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	35.1
HCM 2010 LOS	D

Notes

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

BioMarin
Existing Conditions
PM Peak Hour

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	64	52	81.7%	26.0	4.3	D
	Through						
	Right Turn						
	Subtotal	64	52	81.7%	26.0	4.3	D
EB	Left Turn	35	30	85.2%	3.0	0.4	A
	Through	2,165	2,050	94.7%	2.3	0.2	A
	Right Turn						
	Subtotal	2,200	2,080	94.5%	2.4	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,264	2,132	94.2%	2.9	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	70	63	89.4%	17.1	4.4	B
	Right Turn	277	254	91.7%	13.0	2.5	B
	Subtotal	347	316	91.2%	13.7	2.4	B
SB	Left Turn	91	85	93.4%	20.2	4.2	C
	Through	148	143	96.5%	16.3	3.3	B
	Right Turn						
	Subtotal	239	228	95.3%	17.8	2.7	B
EB	Left Turn	47	44	93.2%	14.6	2.5	B
	Through	2,120	1,979	93.4%	12.9	1.1	B
	Right Turn	32	26	82.8%	9.0	2.9	A
	Subtotal	2,199	2,049	93.2%	12.8	1.1	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,785	2,594	93.1%	13.4	1.0	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	200	2182	46	0	0	0	0	182	123	114	155	0
Future Volume (veh/h)	200	2182	46	0	0	0	0	182	123	114	155	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1412	1382	1355	0
Adj Flow Rate, veh/h	208	2273	26				0	190	118	119	161	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	216	2540	642				0	491	404	269	440	0
Arrive On Green	0.18	0.18	0.18				0.00	0.35	0.35	0.69	0.69	0.00
Sat Flow, veh/h	394	4640	1172				0	1412	1162	532	1328	0
Grp Volume(v), veh/h	734	1747	26				0	190	118	137	143	0
Grp Sat Flow(s),veh/h/ln	1392	1214	1172				0	1412	1162	627	1172	0
Q Serve(g_s), s	41.9	37.3	1.5				0.0	8.1	5.9	8.7	3.9	0.0
Cycle Q Clear(g_c), s	41.9	37.3	1.5				0.0	8.1	5.9	16.9	3.9	0.0
Prop In Lane	0.28		1.00				0.00		1.00	0.87		0.00
Lane Grp Cap(c), veh/h	762	1994	642				0	491	404	302	407	0
V/C Ratio(X)	0.96	0.88	0.04				0.00	0.39	0.29	0.45	0.35	0.00
Avail Cap(c_a), veh/h	762	1994	642				0	491	404	302	407	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.0	30.1	15.4				0.0	19.7	19.0	13.0	8.6	0.0
Incr Delay (d2), s/veh	24.8	5.8	0.1				0.0	2.3	1.8	4.9	2.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.4	13.6	0.5				0.0	3.5	2.1	2.5	1.5	0.0
LnGrp Delay(d),s/veh	56.8	35.9	15.5				0.0	22.0	20.8	17.9	10.9	0.0
LnGrp LOS	E	D	B					C	C	B	B	
Approach Vol, veh/h		2507						308			280	
Approach Delay, s/veh		41.8						21.5			14.3	
Approach LOS		D						C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		48.0		32.0				32.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 44		* 28				* 28
Max Q Clear Time (g_c+I1), s		43.9		10.1				18.9
Green Ext Time (p_c), s		0.0		1.2				0.8

Intersection Summary		
HCM 2010 Ctrl Delay		37.3
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	2283	109	0	0	0	0	128	330	75	217	0
Future Volume (veh/h)	27	2283	109	0	0	0	0	128	330	75	217	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93				1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1468	1412	1412	0
Adj Flow Rate, veh/h	28	2378	64				0	133	330	78	226	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	29	2654	593				0	503	434	304	503	0
Arrive On Green	0.18	0.18	0.18				0.00	0.36	0.36	0.71	0.71	0.00
Sat Flow, veh/h	55	4996	1117				0	1412	1217	740	1412	0
Grp Volume(v), veh/h	718	1688	64				0	133	330	78	226	0
Grp Sat Flow(s),veh/h/ln	1409	1214	1117				0	1412	1217	740	1412	0
Q Serve(g_s), s	40.4	36.1	3.9				0.0	5.4	19.2	4.5	5.4	0.0
Cycle Q Clear(g_c), s	40.4	36.1	3.9				0.0	5.4	19.2	9.9	5.4	0.0
Prop In Lane	0.04		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	749	1935	593				0	503	434	304	503	0
V/C Ratio(X)	0.96	0.87	0.11				0.00	0.26	0.76	0.26	0.45	0.00
Avail Cap(c_a), veh/h	749	1935	593				0	503	434	304	503	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.1	30.3	17.1				0.0	18.3	22.7	10.3	8.2	0.0
Incr Delay (d2), s/veh	24.3	5.8	0.4				0.0	1.3	11.9	2.0	2.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.8	13.2	1.3				0.0	2.2	7.8	1.1	2.4	0.0
LnGrp Delay(d),s/veh	56.4	36.1	17.4				0.0	19.6	34.6	12.3	11.1	0.0
LnGrp LOS	E	D	B					B	C	B	B	
Approach Vol, veh/h		2470						463			304	
Approach Delay, s/veh		41.5						30.3			11.4	
Approach LOS		D						C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		47.0		33.0				33.0
Change Period (Y+Rc), s		4.5		4.5				4.5
Max Green Setting (Gmax), s		42.5		28.5				28.5
Max Q Clear Time (g_c+I1), s		42.4		21.2				11.9
Green Ext Time (p_c), s		0.1		1.3				1.4

Intersection Summary			
HCM 2010 Ctrl Delay			37.1
HCM 2010 LOS			D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1717	965	0	0	0	0	0	0	347	756	0
Future Volume (veh/h)	0	1717	965	0	0	0	0	0	0	347	756	0
Number	5	2	12							3	8	18
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1500							1500	1500	0
Adj Flow Rate, veh/h	0	1731	973							361	788	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.96	0.96	0.96							0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2							2	2	0
Cap, veh/h	0	2278	1291							545	1144	0
Arrive On Green	0.00	0.17	0.17							0.13	0.13	0.00
Sat Flow, veh/h	0	4500	2550							1429	3000	0
Grp Volume(v), veh/h	0	1731	973							361	788	0
Grp Sat Flow(s),veh/h/ln	0	1500	1275							1429	1500	0
Q Serve(g_s), s	0.0	29.4	29.1							19.3	20.1	0.0
Cycle Q Clear(g_c), s	0.0	29.4	29.1							19.3	20.1	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2278	1291							545	1144	0
V/C Ratio(X)	0.00	0.76	0.75							0.66	0.69	0.00
Avail Cap(c_a), veh/h	0	2278	1291							545	1144	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	1.00	1.00							1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	28.7	28.6							30.1	30.4	0.0
Incr Delay (d2), s/veh	0.0	2.4	4.1							6.2	3.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	12.7	11.0							8.6	8.9	0.0
LnGrp Delay(d),s/veh	0.0	31.1	32.7							36.3	33.8	0.0
LnGrp LOS		C	C							D	C	
Approach Vol, veh/h		2704									1149	
Approach Delay, s/veh		31.7									34.6	
Approach LOS		C									C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		45.0						35.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		40.5						30.5
Max Q Clear Time (g_c+I1), s		31.4						22.1
Green Ext Time (p_c), s		7.9						3.7

Intersection Summary	
HCM 2010 Ctrl Delay	32.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	855	1259	0	0	0	0	0	1318	542	0	0	0
Future Volume (veh/h)	855	1259	0	0	0	0	0	1318	542	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.94			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1468	1500	0				0	1412	1412			
Adj Flow Rate, veh/h	960	1214	0				0	1373	549			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	1501	1418	0				0	1580	464			
Arrive On Green	0.16	0.16	0.00				0.00	0.41	0.41			
Sat Flow, veh/h	2797	3000	0				0	3981	1132			
Grp Volume(v), veh/h	960	1214	0				0	1373	549			
Grp Sat Flow(s),veh/h/ln	1398	1500	0				0	1285	1132			
Q Serve(g_s), s	26.1	31.5	0.0				0.0	26.1	32.8			
Cycle Q Clear(g_c), s	26.1	31.5	0.0				0.0	26.1	32.8			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1501	1418	0				0	1580	464			
V/C Ratio(X)	0.64	0.86	0.00				0.00	0.87	1.18			
Avail Cap(c_a), veh/h	1501	1418	0				0	1580	464			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	28.8	31.1	0.0				0.0	21.6	23.6			
Incr Delay (d2), s/veh	2.1	6.8	0.0				0.0	6.8	102.6			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	10.6	14.4	0.0				0.0	10.1	23.4			
LnGrp Delay(d),s/veh	30.9	38.0	0.0				0.0	28.4	126.2			
LnGrp LOS	C	D						C	F			
Approach Vol, veh/h		2174						1922				
Approach Delay, s/veh		34.9						56.3				
Approach LOS		C						E				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		42.0		38.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 38		* 33				
Max Q Clear Time (g_c+I1), s		33.5		34.8				
Green Ext Time (p_c), s		4.1		0.0				

Intersection Summary			
HCM 2010 Ctrl Delay			44.9
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	265	34	68	268	43	55	207	156	79	118	21
Future Volume (veh/h)	13	265	34	68	268	43	55	207	156	79	118	21
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		0.96	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2039	2039	2000	1961	1961	2000	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	14	276	29	71	279	38	57	216	130	82	123	15
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	41	381	40	157	461	63	287	301	181	206	381	46
Arrive On Green	0.02	0.21	0.21	0.08	0.27	0.27	0.16	0.28	0.28	0.12	0.24	0.24
Sat Flow, veh/h	1942	1806	190	1867	1681	229	1774	1070	644	1774	1612	197
Grp Volume(v), veh/h	14	0	305	71	0	317	57	0	346	82	0	138
Grp Sat Flow(s),veh/h/ln	1942	0	1996	1867	0	1910	1774	0	1715	1774	0	1808
Q Serve(g_s), s	0.4	0.0	7.9	2.0	0.0	8.0	1.5	0.0	10.1	2.4	0.0	3.5
Cycle Q Clear(g_c), s	0.4	0.0	7.9	2.0	0.0	8.0	1.5	0.0	10.1	2.4	0.0	3.5
Prop In Lane	1.00		0.10	1.00		0.12	1.00		0.38	1.00		0.11
Lane Grp Cap(c), veh/h	41	0	422	157	0	523	287	0	483	206	0	427
V/C Ratio(X)	0.34	0.00	0.72	0.45	0.00	0.61	0.20	0.00	0.72	0.40	0.00	0.32
Avail Cap(c_a), veh/h	279	0	893	336	0	923	319	0	709	319	0	747
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.9	0.0	20.4	24.3	0.0	17.6	20.2	0.0	18.0	22.8	0.0	17.6
Incr Delay (d2), s/veh	1.8	0.0	2.4	0.8	0.0	1.1	0.1	0.0	2.0	0.5	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	4.6	1.1	0.0	4.4	0.8	0.0	5.0	1.2	0.0	1.8
LnGrp Delay(d),s/veh	28.7	0.0	22.8	25.0	0.0	18.7	20.3	0.0	20.0	23.3	0.0	18.0
LnGrp LOS	C		C	C		B	C		C	C		B
Approach Vol, veh/h		319			388			403			220	
Approach Delay, s/veh		23.1			19.9			20.0			20.0	
Approach LOS		C			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.7	16.7	13.0	17.3	5.2	20.2	10.5	19.9
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	24.9	10.0	* 23	8.0	26.9	10.0	* 23
Max Q Clear Time (g_c+I1), s	4.0	9.9	3.5	5.5	2.4	10.0	4.4	12.1
Green Ext Time (p_c), s	0.0	1.1	0.0	0.4	0.0	1.1	0.1	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	20.7
HCM 2010 LOS	C

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	460	28	0	588	6	11
Future Volume (vph)	460	28	0	588	6	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			3.0	5.6	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	0.99	
Frt	0.99			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1571			1588	1408	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1571			1588	1408	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	479	29	0	612	6	11
RTOR Reduction (vph)	3	0	0	0	9	0
Lane Group Flow (vph)	505	0	0	613	8	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA	Perm	
Protected Phases	2			3 4 6		
Permitted Phases					8	
Actuated Green, G (s)	34.7			55.4	13.4	
Effective Green, g (s)	34.7			49.4	13.4	
Actuated g/C Ratio	0.43			0.62	0.17	
Clearance Time (s)	6.0				5.6	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	681			980	235	
v/s Ratio Prot	c0.32			c0.39		
v/s Ratio Perm					c0.01	
v/c Ratio	0.74			0.63	0.03	
Uniform Delay, d1	18.9			9.5	27.9	
Progression Factor	0.65			0.27	0.62	
Incremental Delay, d2	6.5			0.4	0.1	
Delay (s)	18.8			3.0	17.2	
Level of Service	B			A	B	
Approach Delay (s)	18.8			3.0	17.2	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	432	1	0	275	7	22	16	18	9	10	11
Future Volume (vph)	0	432	1	0	275	7	22	16	18	9	10	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			1.00			0.98	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		1.00			1.00			0.96			0.95	
Flt Protected		1.00			1.00			0.98			0.99	
Satd. Flow (prot)		1588			1581			1476			1463	
Flt Permitted		1.00			1.00			0.86			0.88	
Satd. Flow (perm)		1588			1581			1293			1308	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	450	1	0	286	7	23	17	19	9	10	11
RTOR Reduction (vph)	0	0	0	0	1	0	0	17	0	0	10	0
Lane Group Flow (vph)	0	451	0	0	292	0	0	42	0	0	20	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			4 6			8			8	
Permitted Phases							8			8		
Actuated Green, G (s)		44.2			59.5			8.5			8.5	
Effective Green, g (s)		44.2			59.5			8.5			8.5	
Actuated g/C Ratio		0.55			0.74			0.11			0.11	
Clearance Time (s)		6.0						6.0			6.0	
Vehicle Extension (s)		3.0						1.5			1.5	
Lane Grp Cap (vph)		877			1175			137			138	
v/s Ratio Prot		c0.28			c0.18							
v/s Ratio Perm								c0.03			0.02	
v/c Ratio		0.51			0.25			0.31			0.15	
Uniform Delay, d1		11.2			3.2			33.0			32.5	
Progression Factor		0.59			0.06			0.38			0.79	
Incremental Delay, d2		1.9			0.0			0.4			0.1	
Delay (s)		8.4			0.2			12.9			25.7	
Level of Service		A			A			B			C	
Approach Delay (s)		8.4			0.2			12.9			25.7	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	471	0	0	582	6	11
Future Volume (vph)	471	0	0	582	6	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			6.0	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1588			1588	1424	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1588			1588	1424	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	491	0	0	606	6	11
RTOR Reduction (vph)	0	0	0	0	9	0
Lane Group Flow (vph)	491	0	0	606	8	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	53.7			34.7	14.7	
Effective Green, g (s)	48.1			34.7	14.7	
Actuated g/C Ratio	0.60			0.43	0.18	
Clearance Time (s)				6.0		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	954			688	261	
v/s Ratio Prot	c0.31			c0.38	c0.01	
v/s Ratio Perm						
v/c Ratio	0.51			0.88	0.03	
Uniform Delay, d1	9.2			20.8	26.8	
Progression Factor	0.19			1.04	1.58	
Incremental Delay, d2	0.3			11.6	0.0	
Delay (s)	2.0			33.1	42.4	
Level of Service	A			C	D	
Approach Delay (s)	2.0			33.1	42.4	
Approach LOS	A			C	D	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	459	0	0	271	9	11	10	15	0	0	0
Future Volume (vph)	0	459	0	0	271	9	11	10	15	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.98				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			1.00			0.94				
Flt Protected		1.00			1.00			0.99				
Satd. Flow (prot)		1588			1579			1445				
Flt Permitted		1.00			1.00			0.99				
Satd. Flow (perm)		1588			1579			1445				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	478	0	0	282	9	11	10	16	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	14	0	0	0	0
Lane Group Flow (vph)	0	478	0	0	290	0	0	23	0	0	0	0
Confl. Peds. (#/hr)	10		10			10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		58.7			44.2			9.3				
Effective Green, g (s)		58.7			44.2			9.3				
Actuated g/C Ratio		0.73			0.55			0.12				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1165			872			167				
v/s Ratio Prot		c0.30			0.18			c0.02				
v/s Ratio Perm												
v/c Ratio		0.41			0.33			0.14				
Uniform Delay, d1		4.1			9.8			31.7				
Progression Factor		0.06			0.51			1.04				
Incremental Delay, d2		0.1			1.0			0.1				
Delay (s)		0.3			6.0			33.2				
Level of Service		A			A			C				
Approach Delay (s)		0.3			6.0			33.2			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	3.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	348	0	0	397	26	11	3	11	0	0	0
Future Volume (vph)	0	348	0	0	397	26	11	3	11	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.99			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1558			1444				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1558			1444				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	362	0	0	414	27	11	3	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	363	0	0	438	0	0	16	0	0	0	0
Confl. Peds. (#/hr)	59		21			59			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		55.4			37.1			13.0				
Effective Green, g (s)		55.4			37.1			13.0				
Actuated g/C Ratio		0.69			0.46			0.16				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1099			722			234				
v/s Ratio Prot		c0.23			c0.28			c0.01				
v/s Ratio Perm												
v/c Ratio		0.33			0.61			0.07				
Uniform Delay, d1		4.9			16.0			28.4				
Progression Factor		0.21			0.77			1.00				
Incremental Delay, d2		0.2			3.5			0.1				
Delay (s)		1.2			15.8			28.5				
Level of Service		A			B			C				
Approach Delay (s)		1.2			15.8			28.5			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	13.9	42.4	0.16	13.4	C
Tamalpais	IV	25	16.0	31.3	47.3	0.06	4.6	F
Tamalpais	IV	25	3.1	4.3	7.4	0.01	5.7	F
Hetherton	IV	25	8.7	9.6	18.3	0.03	6.5	F
Irwin	IV	25	18.9	14.0	32.9	0.07	7.8	E
Total	IV		75.2	73.1	148.3	0.33	8.1	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	27.0	48.6	0.10	7.3	E
101 SB Off Hetherton	IV	25	18.9	23.2	42.1	0.07	6.1	F
Tamalpais	IV	25	8.7	64.3	73.0	0.03	1.6	F
Tamalpais	IV	25	3.1	3.5	6.6	0.01	6.4	F
Lincoln	IV	25	16.0	55.9	71.9	0.06	3.0	F
Total	IV		68.3	173.9	242.2	0.27	4.1	F

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	29	24.0	35.7	59.7	0.16	9.6	D
5th	IV	25	16.3	3.1	19.4	0.06	11.4	D
4th	IV	25	14.6	5.9	20.5	0.05	9.6	D
3rd	IV	25	17.7	14.9	32.6	0.07	7.4	E
2nd	IV	25	15.6	67.6	83.2	0.06	2.5	F
Total	IV		88.2	127.2	215.4	0.40	6.7	F

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	30	25.2	25.9	51.1	0.17	11.8	D
3rd St	IV	25	14.8	15.1	29.9	0.06	6.7	F
4th	IV	25	18.3	14.9	33.2	0.07	7.5	E
5th	IV	25	14.6	7.6	22.2	0.06	8.9	E
Mission	IV	25	15.7	5.6	21.3	0.06	10.0	D
Total	IV		88.6	69.1	157.7	0.41	9.3	D

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	23.6	41.7	0.07	5.9	F
C	IV	25	18.9	9.5	28.4	0.07	9.1	D
B	IV	25	17.9	25.8	43.7	0.07	5.6	F
A	IV	25	18.5	9.5	28.0	0.07	9.0	E
Lindaro	IV	25	25.3	10.8	36.1	0.14	14.0	C
Lincoln	IV	25	21.4	38.0	59.4	0.10	5.9	F
Francisco W.	IV	25	12.2	26.6	38.8	0.05	4.3	F
101 SBOn 2nd	IV	25	14.2	8.7	22.9	0.05	8.4	E
Total	IV		146.5	152.5	299.0	0.61	7.4	E

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	11.6	30.6	0.07	8.4	E
Tamalpais	IV	25	14.4	7.1	21.5	0.05	9.1	D
Lincoln	IV	25	13.2	4.3	17.5	0.05	10.3	D
Lindaro	IV	25	21.4	3.1	24.5	0.10	14.3	C
A	IV	25	25.3	15.7	41.0	0.14	12.3	D
B	IV	25	17.9	8.1	26.0	0.07	9.3	D
C	IV	25	19.0	4.2	23.2	0.07	11.1	D
D	IV	25	18.7	2.4	21.1	0.07	12.0	D
Total	IV		148.9	56.5	205.4	0.62	10.9	D

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	16.7	34.8	0.07	7.1	E
C	IV	25	18.9	12.6	31.5	0.07	8.2	E
B	IV	25	17.9	10.1	28.0	0.07	8.7	E
A	IV	25	18.5	10.3	28.8	0.07	8.7	E
Lindaro	IV	25	25.3	9.2	34.5	0.14	14.6	C
Lincoln	IV	25	21.4	23.0	44.4	0.10	7.9	E
Francisco W.	IV	25	12.2	12.9	25.1	0.05	6.6	F
101 SBOn Hetherton	IV	25	14.2	18.3	32.5	0.05	5.9	F
Total	IV		146.5	113.1	259.6	0.61	8.5	E

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	9.4	28.4	0.07	9.1	D
Tamalpais	IV	25	14.4	8.1	22.5	0.05	8.7	E
Lincoln	IV	25	13.2	7.0	20.2	0.05	8.9	E
Lindaro	IV	25	21.4	4.4	25.8	0.10	13.6	C
A	IV	25	25.3	5.6	30.9	0.14	16.4	C
B	IV	25	17.9	5.9	23.8	0.07	10.2	D
C	IV	25	19.0	3.9	22.9	0.07	11.3	D
D	IV	25	18.7	2.5	21.2	0.07	12.0	D
Total	IV		148.9	46.8	195.7	0.62	11.5	D

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	35	22.2	29.0	51.2	0.16	11.2	D
5th	IV	25	16.3	6.1	22.4	0.06	9.9	D
4th	IV	25	14.6	7.2	21.8	0.05	9.1	D
3rd	IV	25	17.7	25.0	42.7	0.07	5.6	F
2nd	IV	25	15.6	24.2	39.8	0.06	5.3	F
Total	IV		86.4	91.5	177.9	0.40	8.1	E

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	38	19.3	29.2	48.5	0.17	12.5	D
3rd St	IV	25	14.8	16.9	31.7	0.06	6.3	F
4th	IV	25	18.9	3.6	22.5	0.07	11.4	D
5th	IV	25	14.0	11.3	25.3	0.05	7.5	E
Mission	IV	25	15.7	2.9	18.6	0.06	11.5	D
Total	IV		82.7	63.9	146.6	0.41	10.0	D

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	11.3	39.8	0.16	14.3	C
Tamalpais	IV	25	16.1	14.9	31.0	0.06	7.1	E
Tamalpais	IV	25	4.3	1.9	6.2	0.02	9.5	D
Hetherton	IV	25	7.5	7.1	14.6	0.03	7.0	F
Irwin	IV	25	18.9	13.5	32.4	0.07	7.9	E
Total	IV		75.3	48.7	124.0	0.33	9.7	D

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	29.8	51.4	0.10	6.9	F
Hetherton	IV	25	18.9	7.3	26.2	0.07	9.8	D
Tamalpais	IV	25	7.5	29.7	37.2	0.03	2.7	F
Tamalpais	IV	25	4.3	2.2	6.5	0.02	9.0	D
Lincoln	IV	25	16.1	23.6	39.7	0.06	5.5	F
Total	IV		68.4	92.6	161.0	0.27	6.1	F

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5469	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1554
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	25.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3780	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1385
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.60
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	23.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	718	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	820
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	13.7
Speed 2 (S_3), mi/h	1.4	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	Fehr & Peers	Date	3/18/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 NB I-580 to Second Street Weave Segment		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Short Length (L_s), ft	2900	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Volume (V_i), veh/h	2058	1722	823	985
Peak Hour Factor (PHF)	0.99	0.93	0.93	0.95
Total Trucks, %	4.40	4.40	4.09	4.09
Heavy Vehicle Adjustment Factor (f_{HV})	0.958	0.958	0.961	0.961
Flow Rate (v_i), pc/h	2170	1933	921	1079

Weaving Flow Rate (v_W), pc/h	3012	Freeway Max Capacity (c_{IFL}), pc/h/ln	2300
Non-Weaving Flow Rate (v_{NW}), pc/h	3091	Density-Based Capacity (c_{IWL}), pc/h/ln	1928
Total Flow Rate (v), pc/h	6103	Demand Flow-Based Capacity (c_{IW}), pc/h	4858
Volume Ratio (VR)	0.494	Weaving Segment Capacity (c_W), veh/h	4654
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{wa}), veh/h	4654
Maximum Weaving Length (L_{MAX}), ft	7756	Volume-to-Capacity Ratio (v/c)	1.26

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	-	Average Weaving Speed (S_W), mi/h	-
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	-	Average Non-Weaving Speed (S_{NW}), mi/h	-
Weaving Lane Change Rate (LC_W), lc/h	-	Average Speed (S), mi/h	-
Total Lane Change Rate (LC_{All}), lc/h	-	Density (D), pc/mi/ln	-
Weaving Intensity Factor (W)	-	Level of Service (LOS)	F

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Level
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1062	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1191
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.72
Passenger Car Equivalent (E_T)	2.000		

Managed Lane Speed and Density

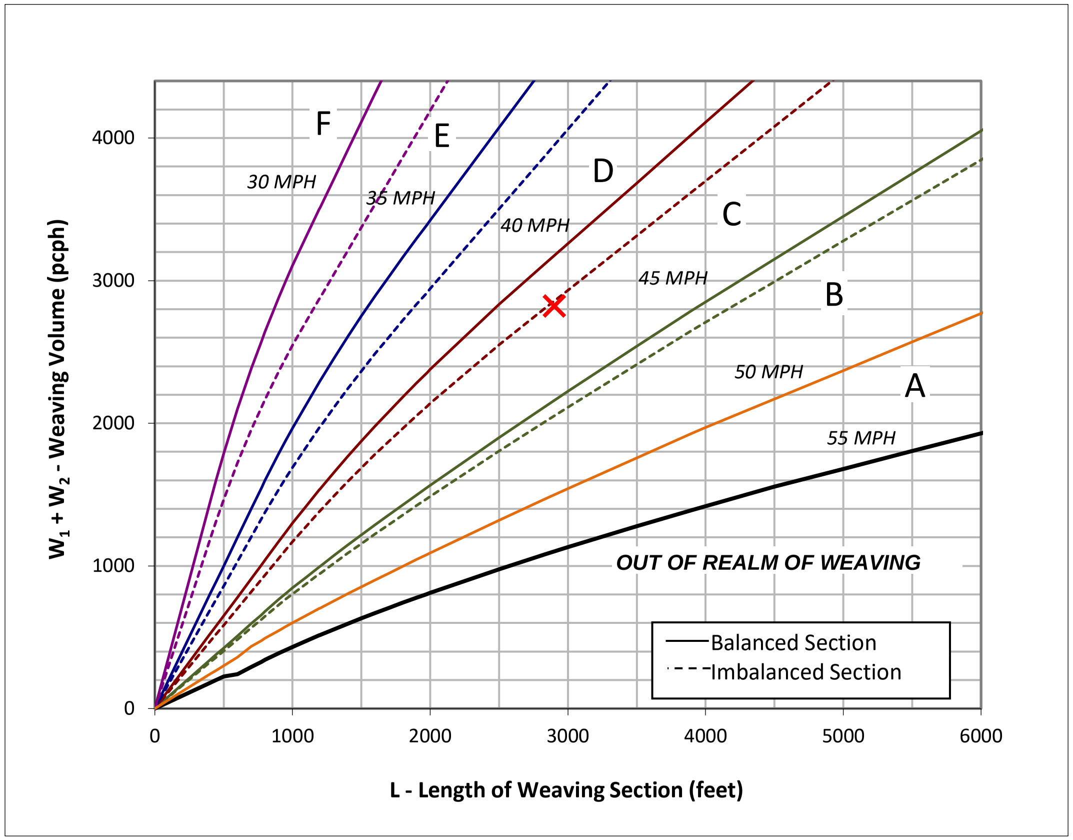
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	52.0
Speed 2 (S_2), mi/h	1.4	Density (D_{ML}), pc/mi/ln	22.9
Speed 2 (S_3), mi/h	6.6	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

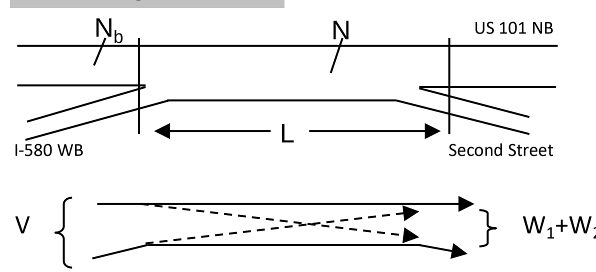
Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

Project Information	
Project	BioMarin
Scenario	Existing AM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,588	Volume (vph)*	1,722	Volume (vph)*	985
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	4%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,834	Volume (pcph)	1,798	Volume (pcph)	1,025



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? — **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? — **40 MPH** and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 40.2
4. Weaving Intensity Factor (k) — 2.51
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ — 1,477
6. Level of Service (LOS) — D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4284	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1602
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.70
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	26.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	998	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1104
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.0
Speed 2 (S_2), mi/h	1.0	Density (D_{ML}), pc/mi/ln	18.7
Speed 2 (S_3), mi/h	5.0	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5655	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	2043
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.89
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	56.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	36.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	3/17/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5655	1371
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	4.40	3.72
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.958
Flow Rate (v_i), pc/h	6130	1556
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.89	0.74

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	60532.1	Density in Ramp Influence Area (D_R), pc/mi/ln	37.1
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	0.373
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2127
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	53.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.535	Outer Lanes Freeway Speed (S_O), mi/h	61.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	4003	Ramp Junction Speed (S), mi/h	55.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	36.6
Level of Service (LOS)	E		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0

Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

Leisch Method for Weaving Analysis

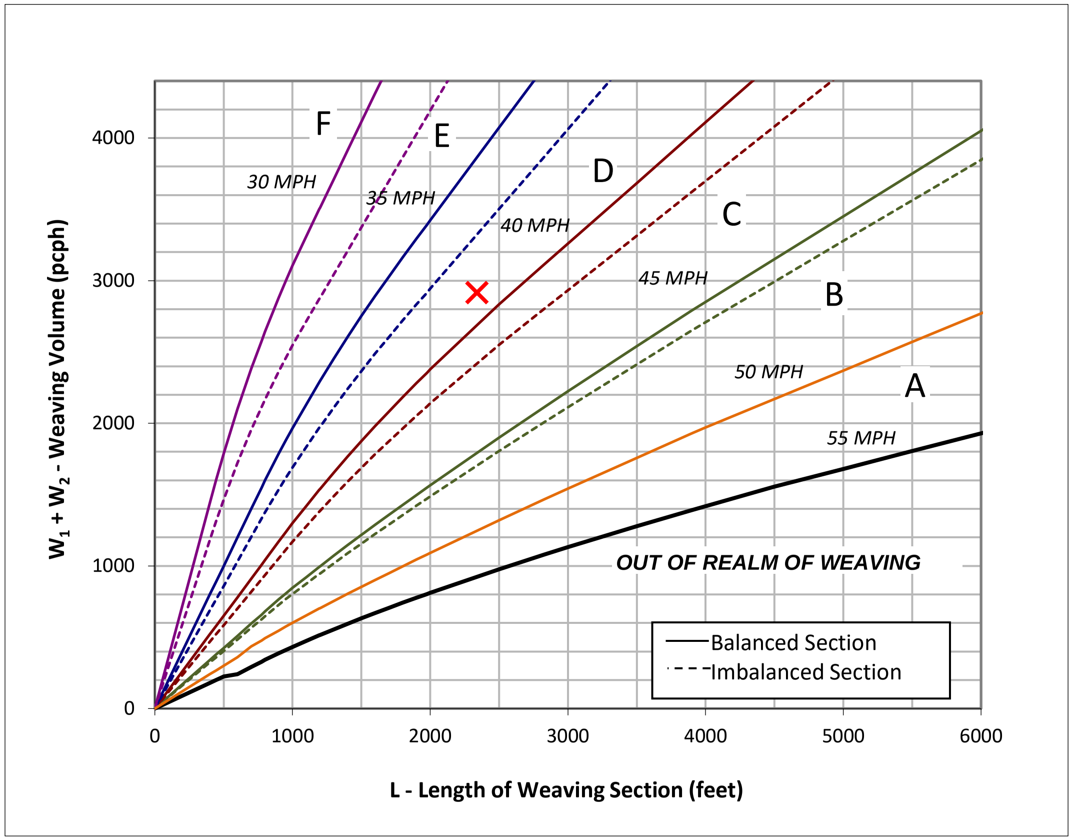
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

Project Information

Project	BioMarin
Scenario	Existing AM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,538	Volume (vph)*	1,646	Volume (vph)*	1,156
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	2%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	6,826	Volume (pcph)	1,690	Volume (pcph)	1,225

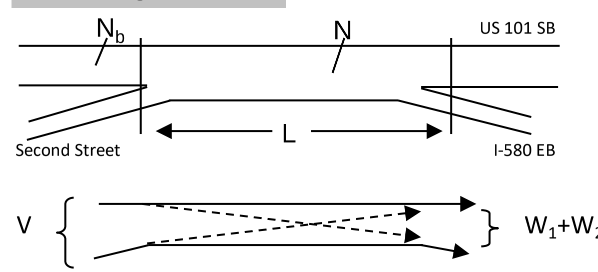


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? — Y

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? — **35 MPH** and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 39.0
4. Weaving Intensity Factor (k) — 2.59
5. Service Volume (SV, pcph) — 2,192

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$

6. Level of Service (LOS) — F

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6782	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1946
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	33.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1217	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	1342
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	57.7
Speed 2 (S_2), mi/h	2.3	Density (D_{ML}), pc/mi/ln	23.3
Speed 2 (S_3), mi/h	9.8	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4725	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1749
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	29.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	848	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	890
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.7
Speed 2 (S_2), mi/h	0.3	Density (D_{ML}), pc/mi/ln	14.9
Speed 2 (S_3), mi/h	2.1	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	Fehr & Peers	Date	3/18/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 NB I-580 to Second Street Weave Segment		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Short Length (L_s), ft	2900	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Volume (V_i), veh/h	3207	1518	598	1262
Peak Hour Factor (PHF)	0.98	0.96	0.96	0.96
Total Trucks, %	4.40	4.40	2.63	2.63
Heavy Vehicle Adjustment Factor (f_{HV})	0.958	0.958	0.974	0.974
Flow Rate (v_i), pc/h	3416	1651	640	1350

Weaving Flow Rate (v_W), pc/h	3001	Freeway Max Capacity (c_{IFL}), pc/h/ln	2300
Non-Weaving Flow Rate (v_{NW}), pc/h	4056	Density-Based Capacity (c_{IWL}), pc/h/ln	1989
Total Flow Rate (v), pc/h	7057	Demand Flow-Based Capacity (c_{IW}), pc/h	5647
Volume Ratio (VR)	0.425	Weaving Segment Capacity (c_W), veh/h	5410
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{wa}), veh/h	5410
Maximum Weaving Length (L_{MAX}), ft	6963	Volume-to-Capacity Ratio (v/c)	1.25

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	-	Average Weaving Speed (S_W), mi/h	-
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	-	Average Non-Weaving Speed (S_{NW}), mi/h	-
Weaving Lane Change Rate (LC_W), lc/h	-	Average Speed (S), mi/h	-
Total Lane Change Rate (LC_{All}), lc/h	-	Density (D), pc/mi/ln	-
Weaving Intensity Factor (W)	-	Level of Service (LOS)	F

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Level
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1182	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	1218
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	2.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	51.4
Speed 2 (S_2), mi/h	1.5	Density (D_{ML}), pc/mi/ln	23.7
Speed 2 (S_3), mi/h	7.1	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

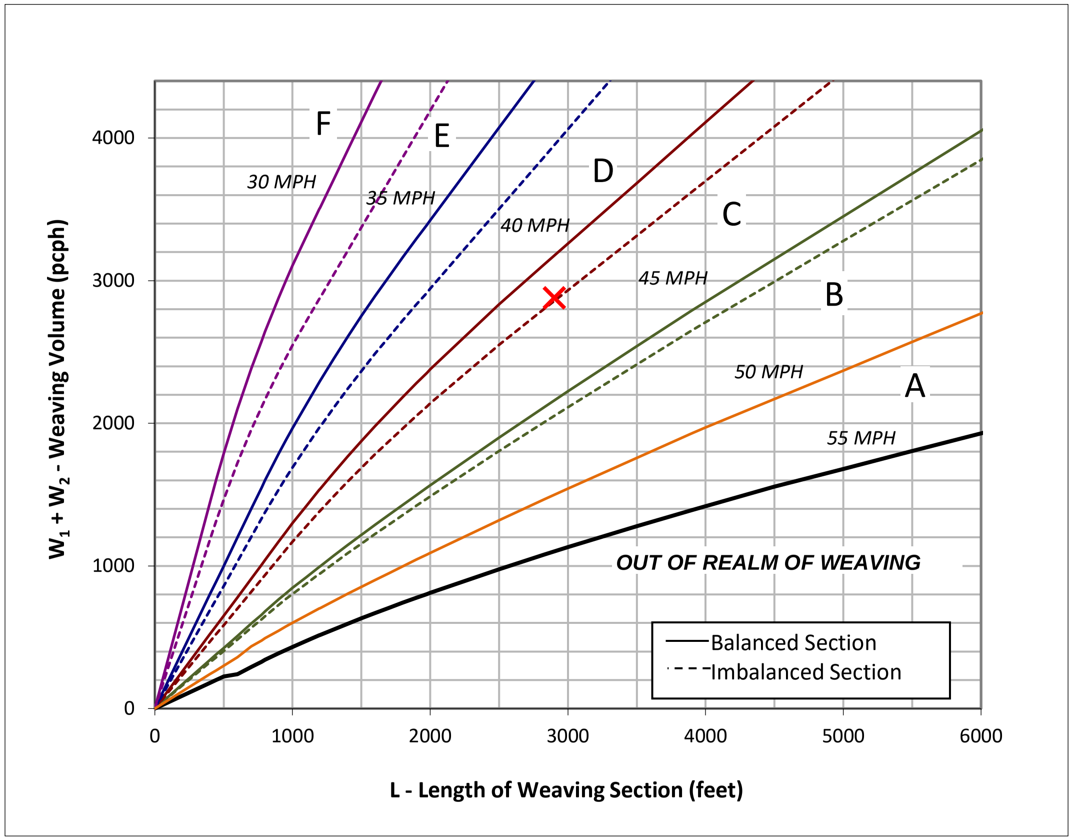
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

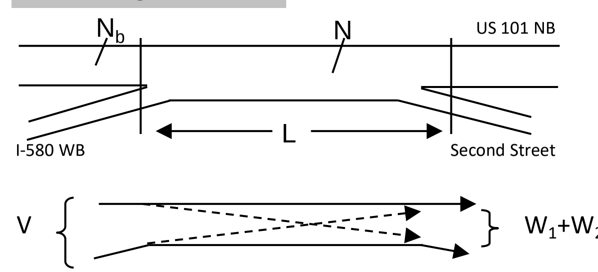
Project Information

Project	BioMarin
Scenario	Existing PM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,585	Volume (vph)*	1,518	Volume (vph)*	1,262
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	6,875	Volume (pcph)	1,585	Volume (pcph)	1,295



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? **35 MPH** and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 39.9
4. Weaving Intensity Factor (k) 2.53
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 1,771
6. Level of Service (LOS) E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	6/28/18
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3297	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1233
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	20.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	918	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1049
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.2
Speed 2 (S_2), mi/h	0.8	Density (D_{ML}), pc/mi/ln	17.7
Speed 2 (S_3), mi/h	4.2	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4943	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1786
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	30.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1377	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1555
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	56.0
Speed 2 (S_2), mi/h	4.0	Density (D_{ML}), pc/mi/ln	27.8
Speed 2 (S_3), mi/h	15.4	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	6/28/18
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	4943	1646
Peak Hour Factor (PHF)	0.97	0.96
Total Trucks, %	4.40	2.00
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.973
Flow Rate (v_i), pc/h	5358	1762
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.78	0.84

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	94060.4	Density in Ramp Influence Area (D_R), pc/mi/ln	34.7
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	0.392
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1636
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	52.9
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.545	Outer Lanes Freeway Speed (S_O), mi/h	63.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	3722	Ramp Junction Speed (S), mi/h	55.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	32.1
Level of Service (LOS)	D		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0

Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1380	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1559
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	55.9
Speed 2 (S_2), mi/h	4.1	Density (D_{ML}), pc/mi/ln	27.9
Speed 2 (S_3), mi/h	15.5	Level of Service (LOS)	D

Leisch Method for Weaving Analysis

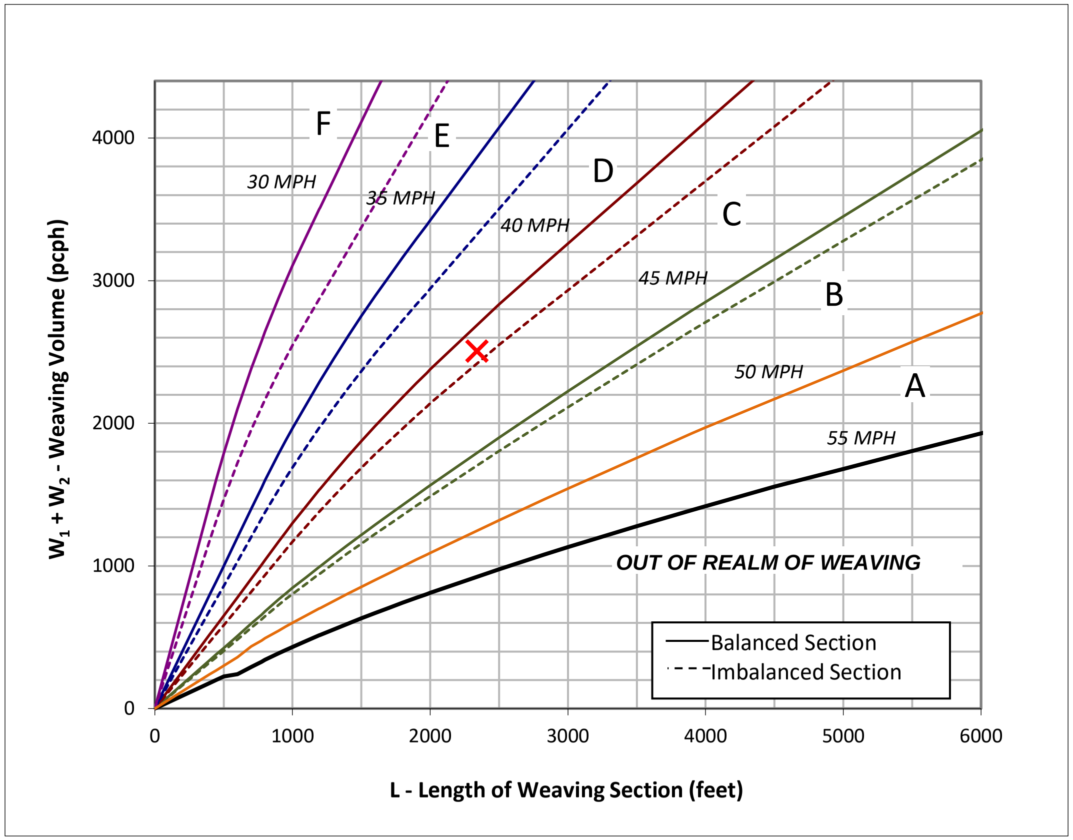
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

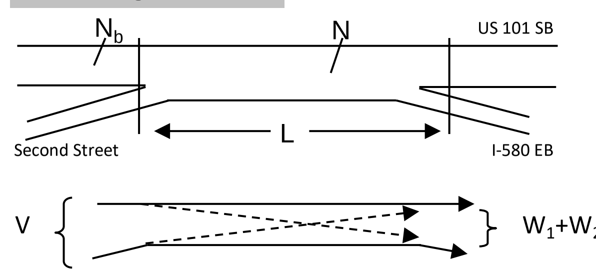
Project Information

Project	BioMarin
Scenario	Existing PM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,954	Volume (vph)*	961	Volume (vph)*	1,386
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	5,172	Volume (pcph)	985	Volume (pcph)	1,520



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? — **Y**

If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? — **40 MPH** and **45 MPH**

If left of the 30 MPH curve, LOS is F. Select "-".

If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 41.0
4. Weaving Intensity Factor (k) — 2.44
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] — 1,647
6. Level of Service (LOS) — E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Appendix B:
Baseline Conditions –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

April 5, 2019

FEHR PEERS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	460	20	70	570	50	20	210	40	60	385	360
Future Volume (veh/h)	110	460	20	70	570	50	20	210	40	60	385	360
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	0.99		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1710	1660	1660	1710	1800	1678	1728	1800	1748	1728
Adj Flow Rate, veh/h	120	500	20	76	620	50	22	228	34	65	418	178
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	148	865	35	372	625	50	73	509	72	146	846	347
Arrive On Green	0.09	0.55	0.55	0.55	0.55	0.55	0.85	0.85	0.85	0.43	0.43	0.43
Sat Flow, veh/h	1581	1582	63	817	1512	122	49	1192	169	208	1983	813
Grp Volume(v), veh/h	120	0	520	76	0	670	284	0	0	358	0	303
Grp Sat Flow(s),veh/h/ln	1581	0	1646	817	0	1634	1410	0	0	1619	0	1385
Q Serve(g_s), s	5.6	0.0	15.7	4.4	0.0	30.5	0.0	0.0	0.0	2.8	0.0	12.1
Cycle Q Clear(g_c), s	5.6	0.0	15.7	10.1	0.0	30.5	3.5	0.0	0.0	11.4	0.0	12.1
Prop In Lane	1.00		0.04	1.00		0.07	0.08		0.12	0.18		0.59
Lane Grp Cap(c), veh/h	148	0	900	372	0	675	654	0	0	747	0	591
V/C Ratio(X)	0.81	0.00	0.58	0.20	0.00	0.99	0.43	0.00	0.00	0.48	0.00	0.51
Avail Cap(c_a), veh/h	148	0	900	372	0	675	654	0	0	747	0	591
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.72	0.00	0.72	0.87	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.4	0.0	11.3	14.0	0.0	16.8	3.4	0.0	0.0	15.5	0.0	15.8
Incr Delay (d2), s/veh	36.9	0.0	2.7	0.9	0.0	27.5	1.8	0.0	0.0	2.2	0.0	3.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	7.8	1.1	0.0	18.6	1.5	0.0	0.0	5.8	0.0	5.1
LnGrp Delay(d),s/veh	70.3	0.0	14.0	14.9	0.0	44.2	5.2	0.0	0.0	17.7	0.0	18.9
LnGrp LOS	E		B	B		D	A			B		B
Approach Vol, veh/h		640			746			284			661	
Approach Delay, s/veh		24.5			41.2			5.2			18.3	
Approach LOS		C			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		45.2		36.8	10.0	35.2		36.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 41		25.4	7.0	* 31		25.4
Max Q Clear Time (g_c+I1), s		17.7		5.5	7.6	32.5		14.1
Green Ext Time (p_c), s		5.1		2.4	0.0	0.0		4.5

Intersection Summary	
HCM 2010 Ctrl Delay	25.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	80	40	220	0	0	0	0	220	970	465
Future Volume (vph)	0	490	80	40	220	0	0	0	0	220	970	465
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.97
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2715			1766						2961	1302
Flt Permitted		1.00			0.86						0.99	1.00
Satd. Flow (perm)		2715			1534						2961	1302
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	533	87	43	239	0	0	0	0	239	1054	505
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	603	0	0	282	0	0	0	0	0	1293	505
Confl. Peds. (#/hr)	15		22	22		15			16			1
Confl. Bikes (#/hr)			3			2			1			3
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1187			670						1318	458
v/s Ratio Prot		c0.22									c0.44	
v/s Ratio Perm					0.18							c0.39
v/c Ratio		0.51			0.42						0.98	1.10
Uniform Delay, d1		15.3			14.6						20.5	24.3
Progression Factor		0.60			1.45						1.00	1.00
Incremental Delay, d2		1.3			1.6						20.7	72.9
Delay (s)		10.5			22.6						41.1	97.2
Level of Service		B			C						D	F
Approach Delay (s)		10.5			22.6			0.0			56.9	
Approach LOS		B			C			A			E	

Intersection Summary			
HCM 2000 Control Delay	42.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	380	20	310	160	320	5	110	1065	130	40
Future Volume (vph)	380	20	310	160	320	5	110	1065	130	40
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1494	1794	1615	1471			3428	1295	
Flt Permitted		0.60	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		938	1794	1615	1471			3428	1295	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	413	22	337	174	348	5	120	1158	141	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	44	0
Lane Group Flow (vph)	0	435	337	174	353	0	0	1278	140	0
Confl. Peds. (#/hr)							13			6
Confl. Bikes (#/hr)					2	2				2
Parking (#/hr)				0				2		
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Effective Green, g (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Actuated g/C Ratio		0.45	0.45	0.25	0.25			0.44	0.44	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		502	808	404	368			1499	566	
v/s Ratio Prot		c0.12	0.19	0.11	c0.24					
v/s Ratio Perm		0.27						0.37	0.11	
v/c Ratio		0.87	0.42	0.43	0.96			0.85	0.25	
Uniform Delay, d1		19.1	13.9	23.6	27.7			18.9	13.3	
Progression Factor		0.98	0.94	1.00	1.00			0.75	0.67	
Incremental Delay, d2		14.1	1.2	3.3	37.7			3.0	0.5	
Delay (s)		32.9	14.3	26.9	65.4			17.2	9.4	
Level of Service		C	B	C	E			B	A	
Approach Delay (s)			24.8	52.7				16.2		
Approach LOS			C	D				B		

Intersection Summary			
HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	300	40	70	280	30	10	220	45	40	395	40
Future Volume (veh/h)	30	300	40	70	280	30	10	220	45	40	395	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1398	1545	1530	1398	1485	1530	1440	1485	1469	1440	1485	1469
Adj Flow Rate, veh/h	33	326	36	76	304	28	11	239	39	43	429	39
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	243	534	59	257	524	48	58	523	83	83	533	47
Arrive On Green	0.39	0.39	0.39	0.13	0.13	0.13	0.97	0.97	0.97	0.97	0.97	0.97
Sat Flow, veh/h	825	1361	150	802	1336	123	16	1077	171	63	1098	96
Grp Volume(v), veh/h	33	0	362	76	0	332	289	0	0	511	0	0
Grp Sat Flow(s),veh/h/ln	825	0	1511	802	0	1459	1264	0	0	1257	0	0
Q Serve(g_s), s	2.6	0.0	14.4	6.9	0.0	16.1	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	18.6	0.0	14.4	21.2	0.0	16.1	0.9	0.0	0.0	4.1	0.0	0.0
Prop In Lane	1.00		0.10	1.00		0.08	0.04		0.13	0.08		0.08
Lane Grp Cap(c), veh/h	243	0	592	257	0	572	663	0	0	662	0	0
V/C Ratio(X)	0.14	0.00	0.61	0.30	0.00	0.58	0.44	0.00	0.00	0.77	0.00	0.00
Avail Cap(c_a), veh/h	243	0	592	257	0	572	663	0	0	662	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.94	0.00	0.94	0.85	0.00	0.00	0.52	0.00	0.00
Uniform Delay (d), s/veh	26.4	0.0	18.2	36.0	0.0	26.8	0.6	0.0	0.0	0.6	0.0	0.0
Incr Delay (d2), s/veh	1.2	0.0	4.6	2.8	0.0	4.0	1.8	0.0	0.0	4.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	6.7	1.7	0.0	7.1	0.6	0.0	0.0	1.3	0.0	0.0
LnGrp Delay(d),s/veh	27.6	0.0	22.9	38.8	0.0	30.9	2.3	0.0	0.0	5.2	0.0	0.0
LnGrp LOS	C		C	D		C	A			A		
Approach Vol, veh/h		395			408			289			511	
Approach Delay, s/veh		23.3			32.3			2.3			5.2	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		34.0		41.0		34.0		41.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		29.4		36.4		29.4		36.4
Max Q Clear Time (g_c+I1), s		20.6		2.9		23.2		6.1
Green Ext Time (p_c), s		1.2		1.3		1.0		2.5

Intersection Summary			
HCM 2010 Ctrl Delay			16.0
HCM 2010 LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	240	165	40	245	0	0	0	0	50	925	115
Future Volume (vph)	0	240	165	40	245	0	0	0	0	50	925	115
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1665			1769						4117	1127
Flt Permitted		1.00			0.91						1.00	1.00
Satd. Flow (perm)		1665			1612						4117	1127
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	261	179	43	266	0	0	0	0	54	1005	125
RTOR Reduction (vph)	0	28	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	412	0	0	309	0	0	0	0	0	1059	125
Confl. Peds. (#/hr)			15	15		14			22	22		10
Confl. Bikes (#/hr)			4			2			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		728			704						1833	396
v/s Ratio Prot		c0.25										
v/s Ratio Perm					0.19						0.26	0.11
v/c Ratio		0.57			0.44						0.58	0.32
Uniform Delay, d1		15.8			14.7						15.5	17.7
Progression Factor		0.43			1.25						0.18	0.26
Incremental Delay, d2		3.1			1.2						0.5	0.8
Delay (s)		9.8			19.5						3.3	5.3
Level of Service		A			B						A	A
Approach Delay (s)		9.8			19.5			0.0			3.5	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	100	0	0	155	120	155	1115	10	0	0	0
Future Volume (veh/h)	140	100	0	0	155	120	155	1115	10	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	0.89	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1620	1573	1620			
Adj Flow Rate, veh/h	152	109	0	0	168	90	168	1212	10			
Adj No. of Lanes	1	1	0	0	1	0	0	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	0	3	0			
Cap, veh/h	237	491	0	0	265	142	181	1378	12			
Arrive On Green	0.10	0.10	0.00	0.00	0.31	0.31	0.19	0.19	0.19			
Sat Flow, veh/h	993	1573	0	0	849	455	321	2438	21			
Grp Volume(v), veh/h	152	109	0	0	0	258	725	0	665			
Grp Sat Flow(s),veh/h/ln	993	1573	0	0	0	1304	1384	0	1396			
Q Serve(g_s), s	10.7	4.8	0.0	0.0	0.0	12.7	38.7	0.0	34.5			
Cycle Q Clear(g_c), s	23.4	4.8	0.0	0.0	0.0	12.7	38.7	0.0	34.5			
Prop In Lane	1.00		0.00	0.00		0.35	0.23		0.02			
Lane Grp Cap(c), veh/h	237	491	0	0	0	407	782	0	789			
V/C Ratio(X)	0.64	0.22	0.00	0.00	0.00	0.63	0.93	0.00	0.84			
Avail Cap(c_a), veh/h	237	491	0	0	0	407	782	0	789			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	40.4	25.3	0.0	0.0	0.0	22.1	29.0	0.0	27.3			
Incr Delay (d2), s/veh	12.5	1.0	0.0	0.0	0.0	7.3	18.7	0.0	10.6			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	2.2	0.0	0.0	0.0	5.4	18.9	0.0	15.6			
LnGrp Delay(d),s/veh	52.9	26.3	0.0	0.0	0.0	29.5	47.6	0.0	37.9			
LnGrp LOS	D	C				C	D		D			
Approach Vol, veh/h		261			258			1390				
Approach Delay, s/veh		41.8			29.5			43.0				
Approach LOS		D			C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		28.0		47.0		28.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		23.4		42.4		23.4		
Max Q Clear Time (g_c+I1), s		25.4		40.7		14.7		
Green Ext Time (p_c), s		0.0		1.2		0.7		

Intersection Summary	
HCM 2010 Ctrl Delay	41.0
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	260	20	70	310	30	20	225	65	65	365	80
Future Volume (veh/h)	30	260	20	70	310	30	20	225	65	65	365	80
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.92	0.98		0.92	0.97		0.91	0.99		0.91
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1573	1510	1620	1573	1573	1620	1620	1573	1555	1620	1573	1555
Adj Flow Rate, veh/h	33	283	18	76	337	28	22	245	57	71	397	77
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	238	536	34	309	546	45	71	517	115	113	494	91
Arrive On Green	0.38	0.38	0.38	0.13	0.13	0.13	0.17	0.17	0.17	1.00	1.00	1.00
Sat Flow, veh/h	894	1396	89	937	1422	118	40	1027	228	117	980	181
Grp Volume(v), veh/h	33	0	301	76	0	365	324	0	0	545	0	0
Grp Sat Flow(s),veh/h/ln	894	0	1485	937	0	1540	1294	0	0	1278	0	0
Q Serve(g_s), s	2.4	0.0	11.7	5.8	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	19.3	0.0	11.7	17.5	0.0	16.8	16.5	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.06	1.00		0.08	0.07		0.18	0.13		0.14
Lane Grp Cap(c), veh/h	238	0	570	309	0	591	703	0	0	698	0	0
V/C Ratio(X)	0.14	0.00	0.53	0.25	0.00	0.62	0.46	0.00	0.00	0.78	0.00	0.00
Avail Cap(c_a), veh/h	238	0	570	309	0	591	703	0	0	698	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.50	0.00	0.00	0.47	0.00	0.00
Uniform Delay (d), s/veh	27.5	0.0	17.8	33.4	0.0	27.5	22.4	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	1.2	0.0	3.5	1.7	0.0	4.4	1.1	0.0	0.0	4.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	5.3	1.6	0.0	7.9	6.3	0.0	0.0	0.8	0.0	0.0
LnGrp Delay(d),s/veh	28.7	0.0	21.3	35.2	0.0	31.9	23.5	0.0	0.0	4.2	0.0	0.0
LnGrp LOS	C		C	D		C	C			A		
Approach Vol, veh/h		334			441			324			545	
Approach Delay, s/veh		22.1			32.5			23.5			4.2	
Approach LOS		C			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0		42.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 29		* 38		* 29		* 38
Max Q Clear Time (g_c+I1), s		21.3		18.5		19.5		2.0
Green Ext Time (p_c), s		1.6		2.8		2.6		6.6

Intersection Summary		
HCM 2010 Ctrl Delay		19.2
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	410	380	35	0	35
Future Volume (vph)	0	410	380	35	0	35
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6	5.6			5.2
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.99			0.87
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.99			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1573	1540			1188
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1573	1540			1188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	413	38	0	38
RTOR Reduction (vph)	0	0	4	0	0	32
Lane Group Flow (vph)	0	446	447	0	0	6
Confl. Peds. (#/hr)				39		46
Confl. Bikes (#/hr)				4		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		50.7	51.8			12.4
Effective Green, g (s)		50.7	51.8			12.4
Actuated g/C Ratio		0.68	0.69			0.17
Clearance Time (s)						5.2
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1063	1063			196
v/s Ratio Prot		c0.28	c0.29			
v/s Ratio Perm						0.01
v/c Ratio		0.42	0.42			0.03
Uniform Delay, d1		5.5	5.1			26.3
Progression Factor		1.63	0.49			1.00
Incremental Delay, d2		0.2	0.2			0.1
Delay (s)		9.2	2.6			26.3
Level of Service		A	A			C
Approach Delay (s)		9.2	2.6		26.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	6.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	285	130	185	285	0	0	0	0	105	825	200
Future Volume (vph)	0	285	130	185	285	0	0	0	0	105	825	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00						1.00	0.89
Flpb, ped/bikes		1.00	1.00	0.98	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1625	1180	1606	1520						4262	1185
Flt Permitted		1.00	1.00	0.49	1.00						0.99	1.00
Satd. Flow (perm)		1625	1180	832	1520						4262	1185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	310	141	201	310	0	0	0	0	114	897	217
RTOR Reduction (vph)	0	0	35	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	310	106	201	310	0	0	0	0	0	1011	217
Confl. Peds. (#/hr)			40	40		22			9	9		30
Confl. Bikes (#/hr)			8			4						2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		32.8	32.8	32.8	32.8						33.4	26.4
Effective Green, g (s)		32.8	32.8	32.8	32.8						33.4	26.4
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.45	0.35
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		710	516	363	664						1898	417
v/s Ratio Prot		0.19			0.20							
v/s Ratio Perm			0.09	c0.24							0.24	0.18
v/c Ratio		0.44	0.21	0.55	0.47						0.53	0.52
Uniform Delay, d1		14.7	13.0	15.7	14.9						15.1	19.3
Progression Factor		0.40	0.23	1.01	1.03						0.35	0.45
Incremental Delay, d2		1.8	0.8	4.4	1.7						0.9	3.8
Delay (s)		7.6	3.8	20.3	17.2						6.2	12.4
Level of Service		A	A	C	B						A	B
Approach Delay (s)		6.4			18.4			0.0			7.3	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	230	0	0	345	70	130	1080	50	0	0	0
Future Volume (veh/h)	160	230	0	0	345	70	130	1080	50	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1510	1573	1620			
Adj Flow Rate, veh/h	174	250	0	0	375	65	141	1174	50			
Adj No. of Lanes	1	1	0	0	1	0	1	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	152	604	0	0	443	77	725	1389	59			
Arrive On Green	0.77	0.77	0.00	0.00	0.13	0.13	0.17	0.17	0.17			
Sat Flow, veh/h	842	1573	0	0	1153	200	1438	2755	117			
Grp Volume(v), veh/h	174	250	0	0	0	440	141	636	588			
Grp Sat Flow(s),veh/h/ln	842	1573	0	0	0	1353	1438	1494	1378			
Q Serve(g_s), s	4.9	4.1	0.0	0.0	0.0	23.9	6.3	31.0	31.0			
Cycle Q Clear(g_c), s	28.8	4.1	0.0	0.0	0.0	23.9	6.3	31.0	31.0			
Prop In Lane	1.00		0.00	0.00		0.15	1.00		0.09			
Lane Grp Cap(c), veh/h	152	604	0	0	0	520	725	753	695			
V/C Ratio(X)	1.15	0.41	0.00	0.00	0.00	0.85	0.19	0.85	0.85			
Avail Cap(c_a), veh/h	152	604	0	0	0	520	725	753	695			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.90	0.90	0.00	0.00	0.00	1.00	0.36	0.36	0.36			
Uniform Delay (d), s/veh	22.2	5.8	0.0	0.0	0.0	30.6	18.1	28.4	28.4			
Incr Delay (d2), s/veh	114.7	1.9	0.0	0.0	0.0	15.6	0.2	4.4	4.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	7.9	1.9	0.0	0.0	0.0	11.2	2.6	13.8	12.8			
LnGrp Delay(d),s/veh	136.9	7.7	0.0	0.0	0.0	46.2	18.4	32.8	33.2			
LnGrp LOS	F	A				D	B	C	C			
Approach Vol, veh/h		424			440			1365				
Approach Delay, s/veh		60.7			46.2			31.5				
Approach LOS		E			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 29		* 38		* 29		
Max Q Clear Time (g_c+I1), s		30.8		33.0		25.9		
Green Ext Time (p_c), s		0.0		2.8		0.6		

Intersection Summary		
HCM 2010 Ctrl Delay		39.9
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	295	1135	0	0	0	0	0	230	30
Future Volume (veh/h)	0	0	0	295	1135	0	0	0	0	0	230	30
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.99
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1530	1485	0				0	1485	1530
Adj Flow Rate, veh/h				321	1234	0				0	250	18
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				502	1718	0				0	786	56
Arrive On Green				0.19	0.19	0.00				0.00	0.31	0.31
Sat Flow, veh/h				747	3133	0				0	2593	180
Grp Volume(v), veh/h				558	997	0				0	139	129
Grp Sat Flow(s),veh/h/ln				1299	1230	0				0	1411	1288
Q Serve(g_s), s				30.5	28.5	0.0				0.0	5.6	5.7
Cycle Q Clear(g_c), s				30.5	28.5	0.0				0.0	5.6	5.7
Prop In Lane				0.58		0.00				0.00		0.14
Lane Grp Cap(c), veh/h				817	1404	0				0	440	402
V/C Ratio(X)				0.68	0.71	0.00				0.00	0.32	0.32
Avail Cap(c_a), veh/h				817	1404	0				0	440	402
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				25.4	24.6	0.0				0.0	19.7	19.7
Incr Delay (d2), s/veh				4.6	3.1	0.0				0.0	1.9	2.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.0	10.3	0.0				0.0	2.4	2.3
LnGrp Delay(d),s/veh				30.0	27.7	0.0				0.0	21.6	21.8
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1555						268	
Approach Delay, s/veh					28.5						21.7	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		47.0		28.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 43		23.4				
Max Q Clear Time (g_c+I1), s		32.5		7.7				
Green Ext Time (p_c), s		5.7		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	27.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1315	110	100	235	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1315	110	100	235	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1398	1398	1440	1398	0			
Adj Flow Rate, veh/h				0	1429	82	109	255	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	2229	679	266	553	0			
Arrive On Green				0.00	0.19	0.19	0.10	0.10	0.00			
Sat Flow, veh/h				0	3943	1163	630	1883	0			
Grp Volume(v), veh/h				0	1429	82	197	167	0			
Grp Sat Flow(s),veh/h/ln				0	1272	1163	1241	1209	0			
Q Serve(g_s), s				0.0	25.9	4.4	9.6	9.7	0.0			
Cycle Q Clear(g_c), s				0.0	25.9	4.4	11.2	9.7	0.0			
Prop In Lane				0.00		1.00	0.55		0.00			
Lane Grp Cap(c), veh/h				0	2229	679	452	367	0			
V/C Ratio(X)				0.00	0.64	0.12	0.44	0.45	0.00			
Avail Cap(c_a), veh/h				0	2229	679	452	367	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	23.0	14.4	28.4	27.9	0.0			
Incr Delay (d2), s/veh				0.0	1.4	0.4	3.1	4.0	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	9.4	1.5	4.3	3.7	0.0			
LnGrp Delay(d),s/veh				0.0	24.5	14.7	31.5	31.9	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1511			364				
Approach Delay, s/veh					23.9			31.7				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		48.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 44		* 23				
Max Q Clear Time (g_c+I1), s		27.9		13.2				
Green Ext Time (p_c), s		7.6		1.0				

Intersection Summary			
HCM 2010 Ctrl Delay			25.4
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	90	1370	0	0	0	0	0	190	50
Future Volume (veh/h)	0	0	0	90	1370	0	0	0	0	0	190	50
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.87
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1398	0				0	1398	1440
Adj Flow Rate, veh/h				98	1489	0				0	207	25
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				167	2129	0				0	616	72
Arrive On Green				0.20	0.20	0.00				0.00	0.28	0.28
Sat Flow, veh/h				182	3601	0				0	2290	261
Grp Volume(v), veh/h				589	998	0				0	122	110
Grp Sat Flow(s),veh/h/ln				1353	1158	0				0	1328	1153
Q Serve(g_s), s				21.8	30.1	0.0				0.0	5.5	5.7
Cycle Q Clear(g_c), s				30.3	30.1	0.0				0.0	5.5	5.7
Prop In Lane				0.17		0.00				0.00		0.23
Lane Grp Cap(c), veh/h				882	1414	0				0	368	320
V/C Ratio(X)				0.67	0.71	0.00				0.00	0.33	0.34
Avail Cap(c_a), veh/h				882	1414	0				0	368	320
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.7	23.7	0.0				0.0	21.6	21.7
Incr Delay (d2), s/veh				4.0	3.0	0.0				0.0	2.4	2.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.4	10.2	0.0				0.0	2.2	2.1
LnGrp Delay(d),s/veh				27.7	26.6	0.0				0.0	24.0	24.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1587						232	
Approach Delay, s/veh					27.0						24.3	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		50.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 46		* 21				
Max Q Clear Time (g_c+I1), s		32.3		7.7				
Green Ext Time (p_c), s		6.9		0.7				

Intersection Summary	
HCM 2010 Ctrl Delay	26.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	1225	80	195	120	0	0	130	30
Future Volume (veh/h)	0	0	0	40	1225	80	195	120	0	0	130	30
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.97		1.00	1.00		0.93
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				43	1332	77	212	130	0	0	141	21
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				72	2356	141	371	685	0	0	358	53
Arrive On Green				0.17	0.17	0.17	0.02	0.12	0.00	0.00	0.26	0.26
Sat Flow, veh/h				140	4590	275	1748	1835	0	0	1375	205
Grp Volume(v), veh/h				537	446	469	212	130	0	0	0	162
Grp Sat Flow(s),veh/h/ln				1741	1590	1674	1748	1835	0	0	0	1580
Q Serve(g_s), s				21.4	19.3	19.3	0.0	4.8	0.0	0.0	0.0	6.3
Cycle Q Clear(g_c), s				21.4	19.3	19.3	0.0	4.8	0.0	0.0	0.0	6.3
Prop In Lane				0.08		0.16	1.00		0.00	0.00		0.13
Lane Grp Cap(c), veh/h				894	816	859	371	685	0	0	0	411
V/C Ratio(X)				0.60	0.55	0.55	0.57	0.19	0.00	0.00	0.00	0.39
Avail Cap(c_a), veh/h				894	816	859	371	685	0	0	0	411
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				24.0	23.2	23.2	30.1	22.7	0.0	0.0	0.0	22.9
Incr Delay (d2), s/veh				3.0	2.6	2.5	6.2	0.6	0.0	0.0	0.0	2.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.0	9.1	9.5	5.0	2.5	0.0	0.0	0.0	3.1
LnGrp Delay(d),s/veh				27.0	25.8	25.6	36.3	23.3	0.0	0.0	0.0	25.7
LnGrp LOS				C	C	C	D	C				C
Approach Vol, veh/h					1452			342			162	
Approach Delay, s/veh					26.2			31.4			25.7	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.0	24.0		43.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			4.0	19.5		38.5		28.0
Max Q Clear Time (g_c+I1), s			2.0	8.3		23.4		6.8
Green Ext Time (p_c), s			0.3	0.8		10.6		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	27.1
HCM 2010 LOS	C

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **Baseline Conditions**
Volume and Delay by Movement **AM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	20	17	82.8%	14.4	4.8	B
	Through						
	Right Turn						
	Subtotal	20	17	82.8%	14.4	4.8	B
SB	Left Turn						
	Through						
	Right Turn	5	5	95.7%	18.1	15.5	C
	Subtotal	5	5	95.7%	18.1	15.5	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	30	26	87.1%	1.8	0.7	A
	Through	1,320	1,283	97.2%	1.7	0.3	A
	Right Turn	5	4	81.0%	0.7	1.1	A
	Subtotal	1,355	1,313	96.9%	1.7	0.3	A
Total		1,380	1,335	96.7%	1.9	0.3	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	80	62	77.3%	15.1	5.2	B
	Through	10	9	92.0%	8.9	9.4	A
	Right Turn						
	Subtotal	90	71	78.9%	14.4	5.1	B
SB	Left Turn						
	Through	40	40	99.4%	20.9	12.0	C
	Right Turn	10	7	69.9%	8.6	12.7	A
	Subtotal	50	47	93.5%	19.1	10.7	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	315	302	95.8%	6.8	0.7	A
	Through	1,280	1,262	98.6%	4.8	0.5	A
	Right Turn	30	36	121.4%	4.6	1.1	A
	Subtotal	1,625	1,600	98.5%	5.1	0.4	A
Total		1,765	1,718	97.3%	5.9	0.7	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	160	1515	55	30	195	0	0	280	160
Future Volume (veh/h)	0	0	0	160	1515	55	30	195	0	0	280	160
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.92	1.00		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1620	1573	1620	1620	1573	0	0	1510	1555
Adj Flow Rate, veh/h				174	1647	56	33	212	0	0	304	164
Adj No. of Lanes				0	3	0	0	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				218	2205	77	54	219	0	0	257	139
Arrive On Green				0.18	0.18	0.18	0.11	0.11	0.00	0.00	0.11	0.11
Sat Flow, veh/h				394	3985	139	0	669	0	0	786	424
Grp Volume(v), veh/h				686	574	617	245	0	0	0	0	468
Grp Sat Flow(s),veh/h/ln				1553	1431	1534	669	0	0	0	0	1210
Q Serve(g_s), s				31.7	28.4	28.4	0.0	0.0	0.0	0.0	0.0	24.5
Cycle Q Clear(g_c), s				31.7	28.4	28.4	24.5	0.0	0.0	0.0	0.0	24.5
Prop In Lane				0.25		0.09	0.13		0.00	0.00		0.35
Lane Grp Cap(c), veh/h				859	792	849	273	0	0	0	0	395
V/C Ratio(X)				0.80	0.73	0.73	0.90	0.00	0.00	0.00	0.00	1.18
Avail Cap(c_a), veh/h				859	792	849	273	0	0	0	0	395
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				26.6	25.3	25.3	28.5	0.0	0.0	0.0	0.0	33.5
Incr Delay (d2), s/veh				7.6	5.7	5.4	33.5	0.0	0.0	0.0	0.0	105.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.5	12.5	13.3	7.6	0.0	0.0	0.0	0.0	19.8
LnGrp Delay(d),s/veh				34.3	31.0	30.7	62.0	0.0	0.0	0.0	0.0	139.1
LnGrp LOS				C	C	C	E					F
Approach Vol, veh/h					1877			245			468	
Approach Delay, s/veh					32.1			62.0			139.1	
Approach LOS					C			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				29.0		46.0		29.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				24.5		41.5		24.5
Max Q Clear Time (g_c+I1), s				26.5		33.7		26.5
Green Ext Time (p_c), s				0.0		5.2		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	54.3
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	235	1655	20	50	50	0	0	50	10
Future Volume (vph)	0	0	0	235	1655	20	50	50	0	0	50	10
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6			7.6	
Lane Util. Factor					0.91		1.00	1.00			1.00	
Frpb, ped/bikes					1.00		1.00	1.00			0.99	
Flpb, ped/bikes					0.98		0.93	1.00			1.00	
Frt					1.00		1.00	1.00			0.98	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3707		1060	1237			1191	
Flt Permitted					0.99		0.71	1.00			1.00	
Satd. Flow (perm)					3707		797	1237			1191	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	255	1799	22	54	54	0	0	54	11
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	0	0	0	2075	0	54	54	0	0	57	0
Confl. Peds. (#/hr)			73	73		38	49		63			49
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			4			8	
Permitted Phases				6			4					
Actuated Green, G (s)					51.5		19.3	19.3			19.3	
Effective Green, g (s)					51.5		19.3	19.3			19.3	
Actuated g/C Ratio					0.57		0.21	0.21			0.21	
Clearance Time (s)					11.6		7.6	7.6			7.6	
Lane Grp Cap (vph)					2121		170	265			255	
v/s Ratio Prot								0.04			0.05	
v/s Ratio Perm					0.56		c0.07					
v/c Ratio					0.98		0.32	0.20			0.22	
Uniform Delay, d1					18.7		29.8	29.0			29.2	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					15.0		4.9	1.7			2.0	
Delay (s)					33.7		34.7	30.8			31.2	
Level of Service					C		C	C			C	
Approach Delay (s)		0.0			33.7			32.7			31.2	
Approach LOS		A			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	33.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	141.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	420	1465	0	0	0	0	0	750	390
Future Volume (veh/h)	0	0	0	420	1465	0	0	0	0	0	750	390
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1545	1573	0				0	1573	1485
Adj Flow Rate, veh/h				457	1592	0				0	815	414
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				763	2139	0				0	1832	446
Arrive On Green				0.15	0.15	0.00				0.00	0.14	0.14
Sat Flow, veh/h				1471	4718	0				0	4435	1045
Grp Volume(v), veh/h				457	1592	0				0	815	414
Grp Sat Flow(s),veh/h/ln				1471	1573	0				0	1431	1045
Q Serve(g_s), s				22.1	24.2	0.0				0.0	13.0	29.4
Cycle Q Clear(g_c), s				22.1	24.2	0.0				0.0	13.0	29.4
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				763	2139	0				0	1832	446
V/C Ratio(X)				0.60	0.74	0.00				0.00	0.44	0.93
Avail Cap(c_a), veh/h				763	2139	0				0	1832	446
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				26.8	27.7	0.0				0.0	24.1	31.1
Incr Delay (d2), s/veh				3.5	2.4	0.0				0.0	0.8	28.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				9.7	11.0	0.0				0.0	5.3	12.0
LnGrp Delay(d),s/veh				30.3	30.1	0.0				0.0	24.9	59.1
LnGrp LOS				C	C						C	E
Approach Vol, veh/h					2049						1229	
Approach Delay, s/veh					30.2						36.4	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						38.0		37.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						34.0		32.0
Max Q Clear Time (g_c+I1), s						26.2		31.4
Green Ext Time (p_c), s						5.8		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	32.5
HCM 2010 LOS	C

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1020	120	875	1145	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1020	120	875	1145	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1485	1485	1398	1398	0			
Adj Flow Rate, veh/h				0	1109	98	960	1232	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	1379	403	1438	1510	0			
Arrive On Green				0.00	0.34	0.34	0.18	0.18	0.00			
Sat Flow, veh/h				0	4189	1186	2663	2796	0			
Grp Volume(v), veh/h				0	1109	98	960	1232	0			
Grp Sat Flow(s),veh/h/ln				0	1352	1186	1331	1398	0			
Q Serve(g_s), s				0.0	18.6	4.5	25.2	31.8	0.0			
Cycle Q Clear(g_c), s				0.0	18.6	4.5	25.2	31.8	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1379	403	1438	1510	0			
V/C Ratio(X)				0.00	0.80	0.24	0.67	0.82	0.00			
Avail Cap(c_a), veh/h				0	1379	403	1438	1510	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.5	17.8	24.5	27.2	0.0			
Incr Delay (d2), s/veh				0.0	5.1	1.4	2.5	5.0	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	7.5	1.6	9.8	13.4	0.0			
LnGrp Delay(d),s/veh				0.0	27.6	19.2	27.0	32.2	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1207			2192				
Approach Delay, s/veh					26.9			29.9				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				45.0		30.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				40.5		25.5		
Max Q Clear Time (g_c+I1), s				33.8		20.6		
Green Ext Time (p_c), s				5.3		2.7		

Intersection Summary	
HCM 2010 Ctrl Delay	28.9
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1920	80	0	0	0	0	0	255	70	450	0
Future Volume (veh/h)	0	1920	80	0	0	0	0	0	255	70	450	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.99	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1660	1710				0	1573	1620	1748	1748	0
Adj Flow Rate, veh/h	0	2087	80				0	0	261	76	489	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1126	1125	1488	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1323	1095	1748	0
Grp Volume(v), veh/h		0.0					0	0	261	76	489	0
Grp Sat Flow(s),veh/h/ln							0	0	1323	1095	1748	0
Q Serve(g_s), s							0.0	0.0	1.1	1.6	6.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	1.1	2.7	6.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1126	1125	1488	0
V/C Ratio(X)							0.00	0.00	0.23	0.07	0.33	0.00
Avail Cap(c_a), veh/h							0	0	1126	1125	1488	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	3.1	4.1	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.5	0.1	0.6	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.5	0.5	3.6	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.9	3.2	4.7	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								261			565	
Approach Delay, s/veh								0.9			4.5	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				31.0				31.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				26.4				26.4
Max Q Clear Time (g_c+I1), s				8.9				3.1
Green Ext Time (p_c), s				1.4				0.7

Intersection Summary	
HCM 2010 Ctrl Delay	3.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2135	0	0	0	0	0	200	90	0	0	0
Future Volume (veh/h)	110	2135	0	0	0	0	0	200	90	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1485	0				0	1485	1440			
Adj Flow Rate, veh/h	120	2321	0				0	217	94			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	159	2405	0				0	549	228			
Arrive On Green	0.20	0.20	0.00				0.00	0.28	0.28			
Sat Flow, veh/h	172	3974	0				0	1978	823			
Grp Volume(v), veh/h	861	1580	0				0	161	150			
Grp Sat Flow(s),veh/h/ln	1442	1352	0				0	1485	1315			
Q Serve(g_s), s	38.3	43.4	0.0				0.0	6.6	7.0			
Cycle Q Clear(g_c), s	44.6	43.4	0.0				0.0	6.6	7.0			
Prop In Lane	0.14		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	928	1637	0				0	412	365			
V/C Ratio(X)	0.93	0.97	0.00				0.00	0.39	0.41			
Avail Cap(c_a), veh/h	928	1637	0				0	412	365			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	29.6	29.2	0.0				0.0	22.0	22.1			
Incr Delay (d2), s/veh	16.6	15.4	0.0				0.0	2.8	3.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	22.1	19.7	0.0				0.0	3.0	2.9			
LnGrp Delay(d),s/veh	46.2	44.6	0.0				0.0	24.7	25.5			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2441						311				
Approach Delay, s/veh		45.2						25.1				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				25.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		45.4		
Max Q Clear Time (g_c+I1), s				9.0		46.6		
Green Ext Time (p_c), s				1.9		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	42.9
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2150	70	0	0	0	0	0	160	70	220	0
Future Volume (veh/h)	0	2150	70	0	0	0	0	0	160	70	220	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1382				0	1573	1591	1545	1485	0
Adj Flow Rate, veh/h	0	2337	71				0	0	157	76	239	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1077	1127	1238	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.83	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1292	1061	1485	0
Grp Volume(v), veh/h		0.0					0	0	157	76	239	0
Grp Sat Flow(s),veh/h/ln							0	0	1292	1061	1485	0
Q Serve(g_s), s							0.0	0.0	0.6	1.5	3.3	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.6	2.1	3.3	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1077	1127	1238	0
V/C Ratio(X)							0.00	0.00	0.15	0.07	0.19	0.00
Avail Cap(c_a), veh/h							0	0	1077	1127	1238	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	2.6	2.8	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.3	0.1	0.3	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.3	0.5	1.5	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.7	2.7	3.2	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								157			315	
Approach Delay, s/veh								0.7			3.1	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				27.0				27.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				22.5				22.5
Max Q Clear Time (g_c+I1), s				5.3				2.6
Green Ext Time (p_c), s				0.7				0.4

Intersection Summary			
HCM 2010 Ctrl Delay			2.3
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	2085	195	0	0	0	0	240	20	50	115	0
Future Volume (veh/h)	90	2085	195	0	0	0	0	240	20	50	115	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.96	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	98	2266	197				0	261	12	54	125	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	102	2492	220				0	685	31	285	530	0
Arrive On Green	0.19	0.19	0.19				0.00	0.22	0.22	0.01	0.11	0.00
Sat Flow, veh/h	181	4419	390				0	3149	140	1581	1660	0
Grp Volume(v), veh/h	941	781	839				0	134	139	54	125	0
Grp Sat Flow(s),veh/h/ln	1739	1590	1662				0	1577	1629	1581	1660	0
Q Serve(g_s), s	40.3	35.9	37.1				0.0	5.4	5.5	0.0	5.2	0.0
Cycle Q Clear(g_c), s	40.3	35.9	37.1				0.0	5.4	5.5	0.0	5.2	0.0
Prop In Lane	0.10		0.23				0.00		0.09	1.00		0.00
Lane Grp Cap(c), veh/h	980	897	937				0	352	364	285	530	0
V/C Ratio(X)	0.96	0.87	0.90				0.00	0.38	0.38	0.19	0.24	0.00
Avail Cap(c_a), veh/h	980	897	937				0	352	364	285	530	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	29.8	27.9	28.4				0.0	24.8	24.8	28.6	25.2	0.0
Incr Delay (d2), s/veh	20.5	11.3	13.0				0.0	3.1	3.0	1.5	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.0	18.6	20.4				0.0	2.6	2.7	1.1	2.5	0.0
LnGrp Delay(d),s/veh	50.3	39.3	41.4				0.0	27.9	27.8	30.0	26.3	0.0
LnGrp LOS	D	D	D					C	C	C	C	
Approach Vol, veh/h		2561						273			179	
Approach Delay, s/veh		44.0						27.8			27.4	
Approach LOS		D						C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4			7	8				
Phs Duration (G+Y+Rc), s		47.0		28.2			7.2	21.0				
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2				
Max Green Setting (Gmax), s		42.4		* 24			* 3	* 17				
Max Q Clear Time (g_c+I1), s		42.3		7.2			2.0	7.5				
Green Ext Time (p_c), s		0.1		0.7			0.0	1.4				
Intersection Summary												
HCM 2010 Ctrl Delay			41.6									
HCM 2010 LOS			D									
Notes												

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Baseline Conditions**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	30	27	89.5%	12.9	4.5	B
	Through						
	Right Turn						
	Subtotal	30	27	89.5%	12.9	4.5	B
EB	Left Turn	20	17	82.8%	3.3	0.5	A
	Through	2,140	2,071	96.8%	2.6	0.2	A
	Right Turn						
	Subtotal	2,160	2,088	96.7%	2.6	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,190	2,115	96.6%	2.8	0.2	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	50	43	86.1%	15.2	3.4	B
	Right Turn	250	239	95.5%	16.4	3.6	B
	Subtotal	300	282	94.0%	16.2	3.4	B
SB	Left Turn	60	66	110.4%	30.1	2.9	C
	Through	295	277	94.1%	24.9	2.4	C
	Right Turn						
	Subtotal	355	344	96.8%	26.0	1.9	C
EB	Left Turn	40	28	69.9%	9.7	3.9	A
	Through	2,120	2,055	96.9%	11.6	0.9	B
	Right Turn	50	53	105.2%	10.4	2.6	B
	Subtotal	2,210	2,136	96.6%	11.6	0.9	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,865	2,761	96.4%	13.9	0.8	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	135	2255	40	0	0	0	0	105	50	130	255	0
Future Volume (veh/h)	135	2255	40	0	0	0	0	105	50	130	255	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1398	1382	1342	0
Adj Flow Rate, veh/h	147	2451	22				0	114	42	141	277	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	140	2509	598				0	500	411	284	541	0
Arrive On Green	0.18	0.18	0.18				0.00	0.36	0.36	0.12	0.12	0.00
Sat Flow, veh/h	264	4728	1126				0	1398	1151	573	1576	0
Grp Volume(v), veh/h	771	1827	22				0	114	42	215	203	0
Grp Sat Flow(s),veh/h/ln	1385	1202	1126				0	1398	1151	927	1160	0
Q Serve(g_s), s	39.8	37.6	1.2				0.0	4.3	1.8	13.5	12.3	0.0
Cycle Q Clear(g_c), s	39.8	37.6	1.2				0.0	4.3	1.8	17.8	12.3	0.0
Prop In Lane	0.19		1.00				0.00		1.00	0.65		0.00
Lane Grp Cap(c), veh/h	735	1914	598				0	500	411	411	415	0
V/C Ratio(X)	1.05	0.95	0.04				0.00	0.23	0.10	0.52	0.49	0.00
Avail Cap(c_a), veh/h	735	1914	598				0	500	411	411	415	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.9	30.0	15.0				0.0	16.9	16.1	30.3	26.7	0.0
Incr Delay (d2), s/veh	47.0	12.3	0.1				0.0	1.1	0.5	4.7	4.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	24.8	14.7	0.4				0.0	1.8	0.6	4.8	4.4	0.0
LnGrp Delay(d),s/veh	78.0	42.3	15.1				0.0	17.9	16.6	35.0	30.7	0.0
LnGrp LOS	F	D	B					B	B	C	C	
Approach Vol, veh/h		2620						156			418	
Approach Delay, s/veh		52.6						17.6			32.9	
Approach LOS		D						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		44.0		31.0				31.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 40		* 27				* 27
Max Q Clear Time (g_c+I1), s		41.8		6.3				19.8
Green Ext Time (p_c), s		0.0		0.5				1.1

Intersection Summary			
HCM 2010 Ctrl Delay			48.3
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	2310	60	0	0	0	0	50	250	110	180	0
Future Volume (veh/h)	50	2310	60	0	0	0	0	50	250	110	180	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1454	1398	1398	0
Adj Flow Rate, veh/h	54	2511	39				0	54	233	120	196	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	59	2939	651				0	317	273	265	317	0
Arrive On Green	0.20	0.20	0.20				0.00	0.23	0.23	0.07	0.07	0.00
Sat Flow, veh/h	98	4902	1086				0	1398	1203	862	1398	0
Grp Volume(v), veh/h	764	1801	39				0	54	233	120	196	0
Grp Sat Flow(s),veh/h/ln	1393	1202	1086				0	1398	1203	862	1398	0
Q Serve(g_s), s	40.3	36.0	2.2				0.0	2.3	13.9	10.2	10.2	0.0
Cycle Q Clear(g_c), s	40.3	36.0	2.2				0.0	2.3	13.9	12.6	10.2	0.0
Prop In Lane	0.07		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	835	2163	651				0	317	273	265	317	0
V/C Ratio(X)	0.92	0.83	0.06				0.00	0.17	0.85	0.45	0.62	0.00
Avail Cap(c_a), veh/h	835	2163	651				0	569	489	420	569	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	28.2	26.5	12.9				0.0	23.3	27.8	33.8	31.5	0.0
Incr Delay (d2), s/veh	2.0	0.4	0.0				0.0	0.3	7.4	1.2	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.1	12.0	0.7				0.0	0.9	5.2	2.5	4.1	0.0
LnGrp Delay(d),s/veh	30.2	26.8	12.9				0.0	23.6	35.2	34.9	33.4	0.0
LnGrp LOS	C	C	B					C	D	C	C	
Approach Vol, veh/h		2604						287			316	
Approach Delay, s/veh		27.6						33.0			34.0	
Approach LOS		C						C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		51.5		23.5				23.5				
Change Period (Y+Rc), s		6.5		6.5				6.5				
Max Green Setting (Gmax), s		31.5		30.5				30.5				
Max Q Clear Time (g_c+I1), s		42.3		15.9				14.6				
Green Ext Time (p_c), s		0.0		1.1				1.4				
Intersection Summary												
HCM 2010 Ctrl Delay			28.7									
HCM 2010 LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1165	1345	0	0	0	0	0	0	195	975	0
Future Volume (veh/h)	0	1165	1345	0	0	0	0	0	0	195	975	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1485							1485	1485	0
Adj Flow Rate, veh/h	0	1266	1437							212	1060	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.92	0.92	0.92							0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3							3	3	0
Cap, veh/h	0	2050	1162							519	1089	0
Arrive On Green	0.00	0.15	0.15							0.12	0.12	0.00
Sat Flow, veh/h	0	4456	2525							1415	2971	0
Grp Volume(v), veh/h	0	1266	1437							212	1060	0
Grp Sat Flow(s),veh/h/ln	0	1485	1263							1415	1485	0
Q Serve(g_s), s	0.0	19.9	34.5							10.4	26.7	0.0
Cycle Q Clear(g_c), s	0.0	19.9	34.5							10.4	26.7	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2050	1162							519	1089	0
V/C Ratio(X)	0.00	0.62	1.24							0.41	0.97	0.00
Avail Cap(c_a), veh/h	0	2050	1162							519	1089	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.14	0.14							0.79	0.79	0.00
Uniform Delay (d), s/veh	0.0	25.6	31.8							25.4	32.6	0.0
Incr Delay (d2), s/veh	0.0	0.2	107.8							0.4	18.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.2	29.4							4.1	13.7	0.0
LnGrp Delay(d),s/veh	0.0	25.8	139.6							25.9	50.7	0.0
LnGrp LOS		C	F							C	D	
Approach Vol, veh/h		2703									1272	
Approach Delay, s/veh		86.3									46.6	
Approach LOS		F									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		43.0		32.0				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		34.5		27.5				
Max Q Clear Time (g_c+I1), s		36.5		28.7				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary	
HCM 2010 Ctrl Delay	73.6
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	715	815	0	0	0	0	0	1315	460	0	0	0
Future Volume (veh/h)	715	815	0	0	0	0	0	1315	460	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1454	1485	0				0	1398	1398			
Adj Flow Rate, veh/h	777	886	0				0	1429	461			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	1329	1220	0				0	1946	551			
Arrive On Green	0.14	0.14	0.00				0.00	0.46	0.46			
Sat Flow, veh/h	2769	2971	0				0	4194	1188			
Grp Volume(v), veh/h	777	886	0				0	1429	461			
Grp Sat Flow(s),veh/h/ln	1385	1485	0				0	1398	1188			
Q Serve(g_s), s	20.0	21.4	0.0				0.0	20.8	25.5			
Cycle Q Clear(g_c), s	20.0	21.4	0.0				0.0	20.8	25.5			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1329	1220	0				0	1946	551			
V/C Ratio(X)	0.58	0.73	0.00				0.00	0.73	0.84			
Avail Cap(c_a), veh/h	1329	1220	0				0	1946	551			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	27.8	28.4	0.0				0.0	16.3	17.6			
Incr Delay (d2), s/veh	1.9	3.8	0.0				0.0	2.5	14.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.1	9.5	0.0				0.0	8.4	10.5			
LnGrp Delay(d),s/veh	29.7	32.2	0.0				0.0	18.8	31.6			
LnGrp LOS	C	C						B	C			
Approach Vol, veh/h		1663						1890				
Approach Delay, s/veh		31.0						22.0				
Approach LOS		C						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		35.0		40.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 31		* 35				
Max Q Clear Time (g_c+I1), s		23.4		27.5				
Green Ext Time (p_c), s		6.3		6.6				

Intersection Summary	
HCM 2010 Ctrl Delay	26.2
HCM 2010 LOS	C

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	20	310	50	5	80	210	50	50	270	150	60	200
Future Volume (veh/h)	20	310	50	5	80	210	50	50	270	150	60	200
Number	5	2	12		1	6	16	3	8	18	7	4
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94		1.00		0.97	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2019	2019	2000		1942	1942	2000	1845	1845	1900	1845	1845
Adj Flow Rate, veh/h	22	337	46		87	228	44	54	293	138	65	217
Adj No. of Lanes	1	1	0		1	1	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3		3	3	3	3	3	3	3	3
Cap, veh/h	58	421	57		159	471	91	152	361	170	169	529
Arrive On Green	0.03	0.24	0.24		0.09	0.30	0.30	0.09	0.31	0.31	0.10	0.32
Sat Flow, veh/h	1923	1726	236		1849	1574	304	1757	1173	553	1757	1667
Grp Volume(v), veh/h	22	0	383		87	0	272	54	0	431	65	0
Grp Sat Flow(s),veh/h/ln	1923	0	1961		1849	0	1878	1757	0	1726	1757	0
Q Serve(g_s), s	0.7	0.0	11.8		2.9	0.0	7.6	1.9	0.0	14.8	2.2	0.0
Cycle Q Clear(g_c), s	0.7	0.0	11.8		2.9	0.0	7.6	1.9	0.0	14.8	2.2	0.0
Prop In Lane	1.00		0.12		1.00		0.16	1.00		0.32	1.00	
Lane Grp Cap(c), veh/h	58	0	478		159	0	562	152	0	531	169	0
V/C Ratio(X)	0.38	0.00	0.80		0.55	0.00	0.48	0.35	0.00	0.81	0.38	0.00
Avail Cap(c_a), veh/h	240	0	675		288	0	704	246	0	720	246	0
HCM Platoon Ratio	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00		1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.6	0.0	22.8		28.2	0.0	18.4	27.6	0.0	20.5	27.2	0.0
Incr Delay (d2), s/veh	1.5	0.0	4.6		1.1	0.0	0.6	0.5	0.0	5.1	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	7.0		1.5	0.0	4.0	0.9	0.0	7.7	1.1	0.0
LnGrp Delay(d),s/veh	32.0	0.0	27.5		29.3	0.0	19.1	28.2	0.0	25.6	27.8	0.0
LnGrp LOS	C		C		C		B	C		C	C	
Approach Vol, veh/h		405				359			485			300
Approach Delay, s/veh		27.7				21.6			25.9			19.9
Approach LOS		C				C			C			B

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.5	20.6	9.6	24.6	5.9	24.1	10.2	24.0
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	22.1	9.0	* 27	8.0	24.1	9.0	* 27
Max Q Clear Time (g_c+I1), s	4.9	13.8	3.9	8.6	2.7	9.6	4.2	16.8
Green Ext Time (p_c), s	0.1	1.1	0.0	0.8	0.0	0.9	0.0	1.4

Intersection Summary		
HCM 2010 Ctrl Delay		24.2
HCM 2010 LOS		C

Notes

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	20
Future Volume (veh/h)	20
Number	14
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.91
Parking Bus, Adj	1.00
Adj Sat Flow, veh/h/ln	1900
Adj Flow Rate, veh/h	18
Adj No. of Lanes	0
Peak Hour Factor	0.92
Percent Heavy Veh, %	3
Cap, veh/h	44
Arrive On Green	0.32
Sat Flow, veh/h	138
Grp Volume(v), veh/h	235
Grp Sat Flow(s),veh/h/ln	1805
Q Serve(g_s), s	6.6
Cycle Q Clear(g_c), s	6.6
Prop In Lane	0.08
Lane Grp Cap(c), veh/h	573
V/C Ratio(X)	0.41
Avail Cap(c_a), veh/h	753
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	17.2
Incr Delay (d2), s/veh	0.5
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	3.3
LnGrp Delay(d),s/veh	17.7
LnGrp LOS	B
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	545	25	0	690	25	5
Future Volume (vph)	545	25	0	690	25	5
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			3.0	5.2	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	0.98	
Frt	0.99			1.00	0.98	
Flt Protected	1.00			1.00	0.96	
Satd. Flow (prot)	1560			1573	1441	
Flt Permitted	1.00			1.00	0.96	
Satd. Flow (perm)	1560			1573	1441	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	592	27	0	750	27	5
RTOR Reduction (vph)	2	0	0	0	4	0
Lane Group Flow (vph)	617	0	0	750	28	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA	Perm	
Protected Phases	2			3 4 6		
Permitted Phases					8	
Actuated Green, G (s)	30.1			51.2	13.4	
Effective Green, g (s)	30.1			45.6	13.4	
Actuated g/C Ratio	0.40			0.61	0.18	
Clearance Time (s)	5.6				5.2	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	626			956	257	
v/s Ratio Prot	c0.40			c0.48		
v/s Ratio Perm					c0.02	
v/c Ratio	0.98			0.78	0.11	
Uniform Delay, d1	22.2			11.0	25.8	
Progression Factor	0.78			0.68	1.05	
Incremental Delay, d2	28.6			0.4	0.2	
Delay (s)	46.0			7.9	27.3	
Level of Service	D			A	C	
Approach Delay (s)	46.0			7.9	27.3	
Approach LOS	D			A	C	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	365	20	0	330	50	10	10	10	5	25	20
Future Volume (vph)	0	365	20	0	330	50	10	10	10	5	25	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6			5.6	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			1.00			0.98	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		0.99			0.98			0.95			0.94	
Flt Protected		1.00			1.00			0.98			1.00	
Satd. Flow (prot)		1558			1536			1466			1452	
Flt Permitted		1.00			1.00			0.87			0.97	
Satd. Flow (perm)		1558			1536			1293			1409	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	397	22	0	359	54	11	11	11	5	27	22
RTOR Reduction (vph)	0	2	0	0	5	0	0	10	0	0	20	0
Lane Group Flow (vph)	0	417	0	0	408	0	0	23	0	0	34	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			4 6			8			8	
Permitted Phases							8			8		
Actuated Green, G (s)		39.8			56.0			7.8			7.8	
Effective Green, g (s)		39.8			56.0			7.8			7.8	
Actuated g/C Ratio		0.53			0.75			0.10			0.10	
Clearance Time (s)		5.6						5.6			5.6	
Vehicle Extension (s)		3.0						1.5			1.5	
Lane Grp Cap (vph)		826			1146			134			146	
v/s Ratio Prot		c0.27			c0.27							
v/s Ratio Perm								0.02			c0.02	
v/c Ratio		0.50			0.36			0.17			0.23	
Uniform Delay, d1		11.3			3.3			30.7			30.9	
Progression Factor		0.72			0.06			0.63			0.83	
Incremental Delay, d2		1.7			0.1			0.2			0.3	
Delay (s)		9.8			0.3			19.5			25.8	
Level of Service		A			A			B			C	
Approach Delay (s)		9.8			0.3			19.5			25.8	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	550	0	0	685	5	20
Future Volume (vph)	550	0	0	685	5	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			5.6	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.89	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1573			1573	1387	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1573			1573	1387	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	598	0	0	745	5	22
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	598	0	0	745	10	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	48.7			30.1	15.5	
Effective Green, g (s)	43.5			30.1	15.5	
Actuated g/C Ratio	0.58			0.40	0.21	
Clearance Time (s)				5.6		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	912			631	286	
v/s Ratio Prot	c0.38			c0.47	c0.01	
v/s Ratio Perm						
v/c Ratio	0.66			1.18	0.03	
Uniform Delay, d1	10.7			22.4	23.8	
Progression Factor	0.61			1.15	0.82	
Incremental Delay, d2	0.5			88.9	0.0	
Delay (s)	7.0			114.6	19.4	
Level of Service	A			F	B	
Approach Delay (s)	7.0			114.6	19.4	
Approach LOS	A			F	B	

Intersection Summary			
HCM 2000 Control Delay	65.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	380	0	0	340	20	40	5	25	0	0	0
Future Volume (vph)	0	380	0	0	340	20	40	5	25	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.98				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.97				
Satd. Flow (prot)		1573			1557			1431				
Flt Permitted		1.00			1.00			0.97				
Satd. Flow (perm)		1573			1557			1431				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	413	0	0	370	22	43	5	27	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	23	0	0	0	0
Lane Group Flow (vph)	0	413	0	0	390	0	0	52	0	0	0	0
Confl. Peds. (#/hr)	10					10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		53.2			39.8			10.6				
Effective Green, g (s)		53.2			39.8			10.6				
Actuated g/C Ratio		0.71			0.53			0.14				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1115			826			202				
v/s Ratio Prot		c0.26			c0.25			c0.04				
v/s Ratio Perm												
v/c Ratio		0.37			0.47			0.26				
Uniform Delay, d1		4.3			11.0			28.7				
Progression Factor		0.01			0.51			1.27				
Incremental Delay, d2		0.1			1.8			0.2				
Delay (s)		0.1			7.4			36.5				
Level of Service		A			A			D				
Approach Delay (s)		0.1			7.4			36.5			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	410	0	0	405	75	10	5	10	0	0	0
Future Volume (vph)	0	410	0	0	405	75	10	5	10	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1512			1441				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1512			1441				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	0	0	440	82	11	5	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	446	0	0	514	0	0	18	0	0	0	0
Confl. Peds. (#/hr)	39		22			39			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		50.7			32.7			13.5				
Effective Green, g (s)		50.7			32.7			13.5				
Actuated g/C Ratio		0.68			0.44			0.18				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1063			659			259				
v/s Ratio Prot		c0.28			c0.34			c0.01				
v/s Ratio Perm												
v/c Ratio		0.42			0.78			0.07				
Uniform Delay, d1		5.5			18.1			25.5				
Progression Factor		0.06			0.94			1.00				
Incremental Delay, d2		0.3			7.9			0.1				
Delay (s)		0.6			25.0			25.7				
Level of Service		A			C			C				
Approach Delay (s)		0.6			25.0			25.7			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	465	20	50	530	70	10	485	50	0	360	300
Future Volume (veh/h)	260	465	20	50	530	70	10	485	50	0	360	300
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1676	1676	1710	1676	1676	1710	1800	1694	1728	0	1765	1728
Adj Flow Rate, veh/h	271	484	19	52	552	67	10	505	42	0	375	116
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	2	2
Cap, veh/h	180	941	37	435	640	78	53	1124	92	0	968	294
Arrive On Green	0.11	0.59	0.59	0.87	0.87	0.87	0.77	0.77	0.77	0.00	0.39	0.39
Sat Flow, veh/h	1597	1601	63	844	1463	178	18	2901	238	0	2586	759
Grp Volume(v), veh/h	271	0	503	52	0	619	295	0	262	0	250	241
Grp Sat Flow(s),veh/h/ln	1597	0	1664	844	0	1640	1677	0	1480	0	1676	1580
Q Serve(g_s), s	9.0	0.0	14.3	1.0	0.0	15.4	0.0	0.0	4.9	0.0	8.6	8.8
Cycle Q Clear(g_c), s	9.0	0.0	14.3	3.3	0.0	15.4	4.8	0.0	4.9	0.0	8.6	8.8
Prop In Lane	1.00		0.04	1.00		0.11	0.03		0.16	0.00		0.48
Lane Grp Cap(c), veh/h	180	0	978	435	0	718	696	0	573	0	650	612
V/C Ratio(X)	1.51	0.00	0.51	0.12	0.00	0.86	0.42	0.00	0.46	0.00	0.38	0.39
Avail Cap(c_a), veh/h	180	0	978	435	0	718	696	0	573	0	650	612
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.81	0.00	0.81	0.82	0.00	0.82	0.00	1.00	1.00
Uniform Delay (d), s/veh	35.5	0.0	9.8	3.3	0.0	3.8	6.1	0.0	6.1	0.0	17.6	17.7
Incr Delay (d2), s/veh	255.5	0.0	1.9	0.5	0.0	10.9	1.6	0.0	2.1	0.0	1.7	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.7	0.0	7.1	0.3	0.0	8.0	2.4	0.0	2.2	0.0	4.3	4.1
LnGrp Delay(d),s/veh	291.0	0.0	11.7	3.7	0.0	14.6	7.6	0.0	8.2	0.0	19.3	19.6
LnGrp LOS	F		B	A		B	A		A		B	B
Approach Vol, veh/h		774			671			557			491	
Approach Delay, s/veh		109.5			13.8			7.9			19.5	
Approach LOS		F			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		51.2		35.8	12.0	39.2		35.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 47		24.4	9.0	* 35		24.4
Max Q Clear Time (g_c+I1), s		16.3		6.9	11.0	17.4		10.8
Green Ext Time (p_c), s		5.4		4.6	0.0	6.3		3.5

Intersection Summary			
HCM 2010 Ctrl Delay			43.3
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	50	40	175	0	0	0	0	230	1160	450
Future Volume (vph)	0	490	50	40	175	0	0	0	0	230	1160	450
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.98
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.99			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2769			1781						2993	1321
Flt Permitted		1.00			0.85						0.99	1.00
Satd. Flow (perm)		2769			1520						2993	1321
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	510	52	42	182	0	0	0	0	240	1208	469
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	224	0	0	0	0	0	1448	469
Confl. Peds. (#/hr)			15	15		4			11			
Confl. Bikes (#/hr)			3			3			3			2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.8			30.8						40.4	33.4
Effective Green, g (s)		30.8			30.8						40.4	33.4
Actuated g/C Ratio		0.39			0.39						0.50	0.42
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1066			585						1511	551
v/s Ratio Prot		c0.20									c0.48	
v/s Ratio Perm					0.15							0.36
v/c Ratio		0.52			0.38						0.96	0.85
Uniform Delay, d1		18.9			17.7						19.0	21.1
Progression Factor		0.34			0.36						1.00	1.00
Incremental Delay, d2		1.6			1.6						15.1	15.2
Delay (s)		8.1			8.1						34.1	36.3
Level of Service		A			A						C	D
Approach Delay (s)		8.1			8.1			0.0			34.7	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	26.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	395	20	305	135	300	20	75	1465	190	50
Future Volume (vph)	395	20	305	135	300	20	75	1465	190	50
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1509	1812	1812	1485			3677	1316	
Flt Permitted		0.63	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		1000	1812	1812	1485			3677	1316	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	411	21	318	141	312	21	78	1526	198	52
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	38	0
Lane Group Flow (vph)	0	432	318	141	334	0	0	1604	212	0
Confl. Peds. (#/hr)							8			3
Confl. Bikes (#/hr)					4	4				
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Effective Green, g (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Actuated g/C Ratio		0.41	0.41	0.21	0.21			0.48	0.48	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		485	742	380	311			1783	638	
v/s Ratio Prot		c0.13	0.18	0.08	c0.22					
v/s Ratio Perm		0.23						0.44	0.16	
v/c Ratio		0.89	0.43	0.37	1.07			0.90	0.33	
Uniform Delay, d1		21.7	16.9	27.1	31.6			18.8	12.6	
Progression Factor		0.73	0.75	1.00	1.00			0.46	0.24	
Incremental Delay, d2		16.8	1.3	2.8	72.1			5.0	0.9	
Delay (s)		32.5	14.0	29.8	103.7			13.7	3.9	
Level of Service		C	B	C	F			B	A	
Approach Delay (s)			24.7	81.8				12.4		
Approach LOS			C	F				B		

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	80	370	40	30	250	50	40	415	50	60	330	40
Future Volume (veh/h)	80	370	40	30	250	50	40	415	50	60	330	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	1.00		0.98	0.98		0.92	0.98		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1412	1560	1530	1412	1500	1530	1440	1500	1469	1440	1500	1469
Adj Flow Rate, veh/h	83	385	37	31	260	43	42	432	41	62	344	32
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	520	706	68	333	632	104	105	887	82	160	780	73
Arrive On Green	0.50	0.50	0.50	1.00	1.00	1.00	0.76	0.76	0.76	0.76	0.76	0.76
Sat Flow, veh/h	852	1398	134	768	1251	207	140	2335	217	269	2052	192
Grp Volume(v), veh/h	83	0	422	31	0	303	268	0	247	219	0	219
Grp Sat Flow(s),veh/h/ln	852	0	1532	768	0	1457	1387	0	1305	1201	0	1312
Q Serve(g_s), s	4.3	0.0	15.1	1.3	0.0	0.0	0.0	0.0	5.8	0.5	0.0	4.8
Cycle Q Clear(g_c), s	4.3	0.0	15.1	16.4	0.0	0.0	5.3	0.0	5.8	6.3	0.0	4.8
Prop In Lane	1.00		0.09	1.00		0.14	0.16		0.17	0.28		0.15
Lane Grp Cap(c), veh/h	520	0	774	333	0	736	579	0	496	514	0	499
V/C Ratio(X)	0.16	0.00	0.55	0.09	0.00	0.41	0.46	0.00	0.50	0.43	0.00	0.44
Avail Cap(c_a), veh/h	520	0	774	333	0	736	579	0	496	514	0	499
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.97	0.00	0.97	0.85	0.00	0.85	0.75	0.00	0.75
Uniform Delay (d), s/veh	10.9	0.0	13.5	3.0	0.0	0.0	6.6	0.0	6.7	6.4	0.0	6.5
Incr Delay (d2), s/veh	0.7	0.0	2.8	0.5	0.0	1.7	2.3	0.0	3.0	1.9	0.0	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	6.9	0.3	0.0	0.3	2.4	0.0	2.3	1.9	0.0	1.9
LnGrp Delay(d),s/veh	11.5	0.0	16.3	3.6	0.0	1.7	8.8	0.0	9.7	8.4	0.0	8.6
LnGrp LOS	B		B	A		A	A		A	A		A
Approach Vol, veh/h		505			334			515			438	
Approach Delay, s/veh		15.5			1.8			9.2			8.5	
Approach LOS		B			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		40.4		30.4		40.4		30.4
Max Q Clear Time (g_c+I1), s		17.1		7.8		18.4		8.3
Green Ext Time (p_c), s		2.5		2.2		1.5		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	9.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	325	180	60	170	0	0	0	0	50	1070	130
Future Volume (vph)	0	325	180	60	170	0	0	0	0	50	1070	130
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.96
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1697			1775						4163	1148
Flt Permitted		1.00			0.67						1.00	1.00
Satd. Flow (perm)		1697			1213						4163	1148
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	339	188	62	177	0	0	0	0	52	1115	135
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	508	0	0	240	0	0	0	0	0	1167	135
Confl. Peds. (#/hr)	12		12	12		12			12	12		7
Confl. Bikes (#/hr)			6			4			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		35.8			35.8						35.4	28.4
Effective Green, g (s)		35.8			35.8						35.4	28.4
Actuated g/C Ratio		0.45			0.45						0.44	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		759			542						1842	407
v/s Ratio Prot		c0.30										
v/s Ratio Perm					0.20						0.28	0.12
v/c Ratio		0.67			0.44						0.63	0.33
Uniform Delay, d1		17.4			15.2						17.3	18.9
Progression Factor		0.32			1.02						0.35	0.43
Incremental Delay, d2		4.4			2.1						0.6	0.8
Delay (s)		10.0			17.6						6.7	8.9
Level of Service		B			B						A	A
Approach Delay (s)		10.0			17.6			0.0			6.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	245	150	0	0	130	110	90	1410	20	0	0	0
Future Volume (veh/h)	245	150	0	0	130	110	90	1410	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.96			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1620	1588	1620			
Adj Flow Rate, veh/h	255	156	0	0	135	105	94	1469	19			
Adj No. of Lanes	1	1	0	0	1	0	0	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	0	2	0			
Cap, veh/h	360	643	0	0	287	224	123	2056	27			
Arrive On Green	0.68	0.68	0.00	0.00	0.41	0.41	0.16	0.16	0.16			
Sat Flow, veh/h	1017	1588	0	0	710	552	257	4282	57			
Grp Volume(v), veh/h	255	156	0	0	0	240	576	481	525			
Grp Sat Flow(s),veh/h/ln	1017	1588	0	0	0	1262	1575	1445	1576			
Q Serve(g_s), s	19.2	3.0	0.0	0.0	0.0	11.2	28.0	25.2	25.2			
Cycle Q Clear(g_c), s	30.4	3.0	0.0	0.0	0.0	11.2	28.0	25.2	25.2			
Prop In Lane	1.00		0.00	0.00		0.44	0.16		0.04			
Lane Grp Cap(c), veh/h	360	643	0	0	0	511	756	694	756			
V/C Ratio(X)	0.71	0.24	0.00	0.00	0.00	0.47	0.76	0.69	0.69			
Avail Cap(c_a), veh/h	360	643	0	0	0	511	756	694	756			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00			
Uniform Delay (d), s/veh	18.0	8.2	0.0	0.0	0.0	17.5	29.3	28.1	28.1			
Incr Delay (d2), s/veh	11.2	0.9	0.0	0.0	0.0	3.1	7.1	5.6	5.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.4	1.5	0.0	0.0	0.0	4.3	13.7	11.2	12.1			
LnGrp Delay(d),s/veh	29.2	9.1	0.0	0.0	0.0	20.6	36.4	33.7	33.3			
LnGrp LOS	C	A				C	D	C	C			
Approach Vol, veh/h		411			240			1582				
Approach Delay, s/veh		21.6			20.6			34.6				
Approach LOS		C			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		37.0		43.0		37.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		32.4		38.4		32.4		
Max Q Clear Time (g_c+I1), s		32.4		30.0		13.2		
Green Ext Time (p_c), s		0.0		4.7		0.9		

Intersection Summary	
HCM 2010 Ctrl Delay	30.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	230	40	105	250	70	30	395	85	45	290	65
Future Volume (veh/h)	55	230	40	105	250	70	30	395	85	45	290	65
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.91	0.97		0.91	0.92		0.83	0.96		0.83
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1588	1525	1620	1588	1588	1620	1620	1588	1555	1620	1588	1555
Adj Flow Rate, veh/h	57	240	34	109	260	59	31	411	67	47	302	47
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	390	657	93	472	626	142	86	899	141	122	721	119
Arrive On Green	0.51	0.51	0.51	0.17	0.17	0.17	0.13	0.13	0.13	0.77	0.77	0.77
Sat Flow, veh/h	937	1288	182	960	1227	278	94	2335	367	171	1873	310
Grp Volume(v), veh/h	57	0	274	109	0	319	274	0	235	196	0	200
Grp Sat Flow(s),veh/h/ln	937	0	1471	960	0	1505	1507	0	1289	1038	0	1316
Q Serve(g_s), s	3.5	0.0	9.0	8.2	0.0	15.2	0.0	0.0	13.6	3.2	0.0	4.0
Cycle Q Clear(g_c), s	18.7	0.0	9.0	17.2	0.0	15.2	12.8	0.0	13.6	16.8	0.0	4.0
Prop In Lane	1.00		0.12	1.00		0.18	0.11		0.28	0.24		0.24
Lane Grp Cap(c), veh/h	390	0	750	472	0	768	630	0	496	456	0	507
V/C Ratio(X)	0.15	0.00	0.37	0.23	0.00	0.42	0.43	0.00	0.47	0.43	0.00	0.39
Avail Cap(c_a), veh/h	390	0	750	472	0	768	630	0	496	456	0	507
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.88	0.00	0.88	0.85	0.00	0.85
Uniform Delay (d), s/veh	19.7	0.0	11.8	27.5	0.0	22.6	27.0	0.0	27.4	7.0	0.0	6.1
Incr Delay (d2), s/veh	0.8	0.0	1.4	1.1	0.0	1.5	1.9	0.0	2.8	2.5	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	3.9	2.3	0.0	6.7	5.9	0.0	5.2	1.5	0.0	1.6
LnGrp Delay(d),s/veh	20.5	0.0	13.2	28.5	0.0	24.1	29.0	0.0	30.2	9.5	0.0	8.1
LnGrp LOS	C		B	C		C	C		C	A		A
Approach Vol, veh/h		331			428			509			396	
Approach Delay, s/veh		14.4			25.3			29.5			8.8	
Approach LOS		B			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 41		* 31		* 41		* 31
Max Q Clear Time (g_c+I1), s		20.7		15.6		19.2		18.8
Green Ext Time (p_c), s		2.9		4.0		4.1		2.7

Intersection Summary			
HCM 2010 Ctrl Delay			20.5
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	370	380	65	0	55
Future Volume (vph)	0	370	380	65	0	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0	6.0			5.6
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.97			0.78
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.98			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1588	1516			1074
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1588	1516			1074
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	385	396	68	0	57
RTOR Reduction (vph)	0	0	7	0	0	48
Lane Group Flow (vph)	0	385	457	0	0	9
Confl. Peds. (#/hr)				59		78
Confl. Bikes (#/hr)				14		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		55.1	56.1			12.3
Effective Green, g (s)		55.1	56.1			12.3
Actuated g/C Ratio		0.69	0.70			0.15
Clearance Time (s)						5.6
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1093	1063			165
v/s Ratio Prot		c0.24	c0.30			
v/s Ratio Perm						0.01
v/c Ratio		0.35	0.43			0.05
Uniform Delay, d1		5.1	5.1			28.9
Progression Factor		0.95	0.17			1.00
Incremental Delay, d2		0.2	0.2			0.1
Delay (s)		5.0	1.1			29.0
Level of Service		A	A			C
Approach Delay (s)		5.0	1.1		29.0	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	4.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	270	110	80	240	0	0	0	0	125	955	230
Future Volume (vph)	0	270	110	80	240	0	0	0	0	125	955	230
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.93	1.00	1.00						1.00	0.92
Flpb, ped/bikes		1.00	1.00	0.97	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1173	1605	1535						4142	1102
Flt Permitted		1.00	1.00	0.52	1.00						0.99	1.00
Satd. Flow (perm)		1641	1173	874	1535						4142	1102
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	281	115	83	250	0	0	0	0	130	995	240
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	281	86	83	250	0	0	0	0	0	1125	240
Confl. Peds. (#/hr)			51	51		28			11	11		19
Confl. Bikes (#/hr)			10			16			1			1
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		34.8	34.8	34.8	34.8						36.4	29.4
Effective Green, g (s)		34.8	34.8	34.8	34.8						36.4	29.4
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.45	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		713	510	380	667						1884	404
v/s Ratio Prot		c0.17			0.16							
v/s Ratio Perm			0.07	0.10							0.27	0.22
v/c Ratio		0.39	0.17	0.22	0.37						0.60	0.59
Uniform Delay, d1		15.4	13.8	14.1	15.3						16.3	20.5
Progression Factor		0.52	0.38	0.88	0.92						0.38	0.49
Incremental Delay, d2		1.6	0.7	1.2	1.5						1.1	4.9
Delay (s)		9.6	5.9	13.7	15.5						7.4	14.9
Level of Service		A	A	B	B						A	B
Approach Delay (s)		8.5			15.0			0.0			8.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	210	0	0	195	90	125	1260	160	0	0	0
Future Volume (veh/h)	175	210	0	0	195	90	125	1260	160	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1525	1588	1620			
Adj Flow Rate, veh/h	182	219	0	0	203	72	130	1312	146			
Adj No. of Lanes	1	1	0	0	1	0	1	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	234	552	0	0	333	118	795	2166	241			
Arrive On Green	0.11	0.11	0.00	0.00	0.11	0.11	0.18	0.18	0.18			
Sat Flow, veh/h	985	1588	0	0	959	340	1452	3955	440			
Grp Volume(v), veh/h	182	219	0	0	0	275	130	959	499			
Grp Sat Flow(s),veh/h/ln	985	1588	0	0	0	1299	1452	1445	1505			
Q Serve(g_s), s	11.7	10.2	0.0	0.0	0.0	16.1	6.0	24.4	24.4			
Cycle Q Clear(g_c), s	27.8	10.2	0.0	0.0	0.0	16.1	6.0	24.4	24.4			
Prop In Lane	1.00		0.00	0.00		0.26	1.00		0.29			
Lane Grp Cap(c), veh/h	234	552	0	0	0	451	795	1583	824			
V/C Ratio(X)	0.78	0.40	0.00	0.00	0.00	0.61	0.16	0.61	0.61			
Avail Cap(c_a), veh/h	234	552	0	0	0	451	795	1583	824			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.92	0.92	0.00	0.00	0.00	1.00	0.35	0.35	0.35			
Uniform Delay (d), s/veh	44.7	27.6	0.0	0.0	0.0	30.2	17.3	24.8	24.8			
Incr Delay (d2), s/veh	20.7	2.0	0.0	0.0	0.0	6.0	0.2	0.6	1.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.4	4.8	0.0	0.0	0.0	6.6	2.5	9.9	10.4			
LnGrp Delay(d),s/veh	65.4	29.6	0.0	0.0	0.0	36.3	17.5	25.4	26.0			
LnGrp LOS	E	C				D	B	C	C			
Approach Vol, veh/h		401			275			1588				
Approach Delay, s/veh		45.9			36.3			25.0				
Approach LOS		D			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		32.0		48.0		32.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 28		* 44		* 28		
Max Q Clear Time (g_c+I1), s		29.8		26.4		18.1		
Green Ext Time (p_c), s		0.0		7.8		0.8		

Intersection Summary	
HCM 2010 Ctrl Delay	30.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	300	1485	0	0	0	0	0	280	50
Future Volume (veh/h)	0	0	0	300	1485	0	0	0	0	0	280	50
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.95
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.82
Adj Sat Flow, veh/h/ln				1530	1500	0				0	1500	1530
Adj Flow Rate, veh/h				312	1547	0				0	292	33
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				455	1994	0				0	626	70
Arrive On Green				0.21	0.21	0.00				0.00	0.27	0.27
Sat Flow, veh/h				625	3326	0				0	2415	261
Grp Volume(v), veh/h				671	1188	0				0	176	149
Grp Sat Flow(s),veh/h/ln				1344	1242	0				0	1425	1176
Q Serve(g_s), s				38.0	36.1	0.0				0.0	8.3	8.5
Cycle Q Clear(g_c), s				38.0	36.1	0.0				0.0	8.3	8.5
Prop In Lane				0.46		0.00				0.00		0.22
Lane Grp Cap(c), veh/h				902	1546	0				0	381	315
V/C Ratio(X)				0.74	0.77	0.00				0.00	0.46	0.47
Avail Cap(c_a), veh/h				902	1546	0				0	381	315
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				27.1	26.3	0.0				0.0	24.5	24.6
Incr Delay (d2), s/veh				5.5	3.7	0.0				0.0	4.0	5.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.6	13.2	0.0				0.0	3.7	3.2
LnGrp Delay(d),s/veh				32.6	30.1	0.0				0.0	28.5	29.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1859						325	
Approach Delay, s/veh					31.0						29.0	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.0		26.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 50		21.4				
Max Q Clear Time (g_c+I1), s		40.0		10.5				
Green Ext Time (p_c), s		6.4		1.0				

Intersection Summary	
HCM 2010 Ctrl Delay	30.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1655	150	140	310	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1655	150	140	310	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1412	1412	1440	1412	0			
Adj Flow Rate, veh/h				0	1724	120	146	323	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	2	2	0			
Cap, veh/h				0	2351	717	266	507	0			
Arrive On Green				0.00	0.20	0.20	0.09	0.09	0.00			
Sat Flow, veh/h				0	3981	1175	683	1842	0			
Grp Volume(v), veh/h				0	1724	120	253	216	0			
Grp Sat Flow(s),veh/h/ln				0	1285	1175	1241	1220	0			
Q Serve(g_s), s				0.0	33.5	6.8	14.8	13.6	0.0			
Cycle Q Clear(g_c), s				0.0	33.5	6.8	15.8	13.6	0.0			
Prop In Lane				0.00		1.00	0.58		0.00			
Lane Grp Cap(c), veh/h				0	2351	717	425	348	0			
V/C Ratio(X)				0.00	0.73	0.17	0.60	0.62	0.00			
Avail Cap(c_a), veh/h				0	2351	717	425	348	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	25.9	15.2	33.0	32.1	0.0			
Incr Delay (d2), s/veh				0.0	2.1	0.5	6.0	8.1	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	12.4	2.3	6.1	5.4	0.0			
LnGrp Delay(d),s/veh				0.0	27.9	15.7	39.0	40.2	0.0			
LnGrp LOS					C	B	D	D				
Approach Vol, veh/h					1844			469				
Approach Delay, s/veh					27.1			39.6				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		53.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 49		* 23				
Max Q Clear Time (g_c+I1), s		35.5		17.8				
Green Ext Time (p_c), s		8.2		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	29.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	180	1720	0	0	0	0	0	275	90
Future Volume (veh/h)	0	0	0	180	1720	0	0	0	0	0	275	90
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1412	0				0	1412	1440
Adj Flow Rate, veh/h				188	1792	0				0	286	77
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				264	2122	0				0	499	129
Arrive On Green				0.21	0.21	0.00				0.00	0.26	0.26
Sat Flow, veh/h				326	3458	0				0	1988	496
Grp Volume(v), veh/h				729	1251	0				0	196	167
Grp Sat Flow(s),veh/h/ln				1330	1169	0				0	1341	1072
Q Serve(g_s), s				39.9	41.1	0.0				0.0	10.2	10.9
Cycle Q Clear(g_c), s				42.3	41.1	0.0				0.0	10.2	10.9
Prop In Lane				0.26		0.00				0.00		0.46
Lane Grp Cap(c), veh/h				901	1485	0				0	349	279
V/C Ratio(X)				0.81	0.84	0.00				0.00	0.56	0.60
Avail Cap(c_a), veh/h				901	1485	0				0	349	279
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				28.2	27.8	0.0				0.0	25.7	25.9
Incr Delay (d2), s/veh				7.8	6.0	0.0				0.0	6.4	9.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.5	14.6	0.0				0.0	4.4	3.9
LnGrp Delay(d),s/veh				35.9	33.8	0.0				0.0	32.1	35.1
LnGrp LOS				D	C						C	D
Approach Vol, veh/h					1980						363	
Approach Delay, s/veh					34.6						33.5	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		55.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 51		* 21				
Max Q Clear Time (g_c+I1), s		44.3		12.9				
Green Ext Time (p_c), s		4.9		1.0				

Intersection Summary	
HCM 2010 Ctrl Delay	34.4
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	70	1570	90	240	155	0	0	170	50
Future Volume (veh/h)	0	0	0	70	1570	90	240	155	0	0	170	50
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				73	1635	87	250	161	0	0	177	38
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				105	2505	138	299	649	0	0	299	64
Arrive On Green				0.18	0.18	0.18	0.10	0.58	0.00	0.00	0.23	0.23
Sat Flow, veh/h				194	4606	253	1765	1853	0	0	1294	278
Grp Volume(v), veh/h				662	551	582	250	161	0	0	0	215
Grp Sat Flow(s),veh/h/ln				1755	1606	1692	1765	1853	0	0	0	1571
Q Serve(g_s), s				28.3	25.4	25.5	2.1	3.4	0.0	0.0	0.0	9.7
Cycle Q Clear(g_c), s				28.3	25.4	25.5	2.1	3.4	0.0	0.0	0.0	9.7
Prop In Lane				0.11		0.15	1.00		0.00	0.00		0.18
Lane Grp Cap(c), veh/h				954	873	920	299	649	0	0	0	363
V/C Ratio(X)				0.69	0.63	0.63	0.84	0.25	0.00	0.00	0.00	0.59
Avail Cap(c_a), veh/h				954	873	920	299	649	0	0	0	363
HCM Platoon Ratio				0.33	0.33	0.33	1.67	1.67	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				26.6	25.4	25.4	32.4	11.5	0.0	0.0	0.0	27.4
Incr Delay (d2), s/veh				4.1	3.5	3.3	23.3	0.9	0.0	0.0	0.0	6.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				14.8	12.1	12.8	7.0	1.9	0.0	0.0	0.0	4.9
LnGrp Delay(d),s/veh				30.7	28.9	28.7	55.7	12.4	0.0	0.0	0.0	34.3
LnGrp LOS				C	C	C	E	B				C
Approach Vol, veh/h					1795			411			215	
Approach Delay, s/veh					29.5			38.7			34.3	
Approach LOS					C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			9.0	23.0		48.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			5.0	18.5		43.5		28.0
Max Q Clear Time (g_c+I1), s			4.1	11.7		30.3		5.4
Green Ext Time (p_c), s			0.2	0.8		11.0		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	31.5
HCM 2010 LOS	C

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Baseline Conditions**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	40	39	97.5%	11.5	4.2	B
	Through	5	4	73.6%	7.4	8.0	A
	Right Turn						
	Subtotal	45	43	94.9%	11.4	3.8	B
SB	Left Turn						
	Through	10	10	99.4%	21.4	11.4	C
	Right Turn	5	6	117.8%	10.1	10.9	B
	Subtotal	15	16	105.5%	21.6	6.8	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	65	65	99.6%	2.4	0.4	A
	Through	1,690	1,619	95.8%	1.6	0.4	A
	Right Turn	5	2	44.2%	0.5	0.9	A
	Subtotal	1,760	1,686	95.8%	1.6	0.4	A
Total		1,820	1,745	95.9%	2.0	0.5	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	110	109	99.0%	25.8	2.7	C
	Through	20	28	138.0%	23.5	6.2	C
	Right Turn						
	Subtotal	130	137	105.0%	25.2	2.5	C
SB	Left Turn						
	Through	50	43	86.1%	18.6	4.5	B
	Right Turn	10	10	95.7%	10.8	12.1	B
	Subtotal	60	53	87.7%	16.5	3.4	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	220	210	95.3%	11.7	2.7	B
	Through	1,725	1,614	93.5%	9.1	1.7	A
	Right Turn	40	37	92.9%	6.6	1.6	A
	Subtotal	1,985	1,861	93.7%	9.3	1.7	A
Total		2,175	2,050	94.2%	10.6	1.7	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	100	1685	130	40	325	0	0	265	150
Future Volume (veh/h)	0	0	0	100	1685	130	40	325	0	0	265	150
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.97		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1620	1588	1620	1620	1588	0	0	1525	1555
Adj Flow Rate, veh/h				104	1755	125	42	339	0	0	276	149
Adj No. of Lanes				0	3	0	0	2	0	0	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				127	2282	167	101	734	0	0	552	279
Arrive On Green				0.19	0.19	0.19	0.64	0.64	0.00	0.00	0.11	0.11
Sat Flow, veh/h				224	4013	294	144	2376	0	0	1807	874
Grp Volume(v), veh/h				733	610	641	190	191	0	0	228	197
Grp Sat Flow(s),veh/h/ln				1577	1445	1508	1075	1373	0	0	1448	1157
Q Serve(g_s), s				35.6	31.9	32.1	2.5	5.6	0.0	0.0	11.9	12.9
Cycle Q Clear(g_c), s				35.6	31.9	32.1	15.4	5.6	0.0	0.0	11.9	12.9
Prop In Lane				0.14		0.19	0.22		0.00	0.00		0.76
Lane Grp Cap(c), veh/h				897	822	858	398	438	0	0	462	369
V/C Ratio(X)				0.82	0.74	0.75	0.48	0.44	0.00	0.00	0.49	0.53
Avail Cap(c_a), veh/h				897	822	858	398	438	0	0	462	369
HCM Platoon Ratio				0.33	0.33	0.33	2.00	2.00	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				28.5	27.0	27.1	11.4	10.9	0.0	0.0	29.7	30.2
Incr Delay (d2), s/veh				8.1	6.0	5.9	4.1	3.1	0.0	0.0	3.7	5.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.6	14.2	14.8	2.4	2.4	0.0	0.0	5.3	4.7
LnGrp Delay(d),s/veh				36.6	33.0	33.0	15.5	14.0	0.0	0.0	33.4	35.6
LnGrp LOS				D	C	C	B	B			C	D
Approach Vol, veh/h					1984			381			425	
Approach Delay, s/veh					34.3			14.7			34.5	
Approach LOS					C			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				30.0		50.0		30.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				25.5		45.5		25.5
Max Q Clear Time (g_c+I1), s				17.4		37.6		14.9
Green Ext Time (p_c), s				1.0		5.5		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	31.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	300	1760	30	110	50	0	0	30	30
Future Volume (vph)	0	0	0	300	1760	30	110	50	0	0	30	30
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6			7.6	
Lane Util. Factor					0.91		1.00	1.00			1.00	
Frpb, ped/bikes					1.00		1.00	1.00			0.97	
Flpb, ped/bikes					0.97		0.96	1.00			1.00	
Frt					1.00		1.00	1.00			0.93	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3681		1100	1249			1128	
Flt Permitted					0.99		0.72	1.00			1.00	
Satd. Flow (perm)					3681		830	1249			1128	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	312	1833	31	115	52	0	0	31	31
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	9	0
Lane Group Flow (vph)	0	0	0	0	2175	0	115	52	0	0	53	0
Confl. Peds. (#/hr)			106	106		44	30		69			30
Confl. Bikes (#/hr)						2			3			8
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			4			8	
Permitted Phases				6			4					
Actuated Green, G (s)					51.4		19.4	19.4			19.4	
Effective Green, g (s)					51.4		19.4	19.4			19.4	
Actuated g/C Ratio					0.57		0.22	0.22			0.22	
Clearance Time (s)					11.6		7.6	7.6			7.6	
Lane Grp Cap (vph)					2102		178	269			243	
v/s Ratio Prot								0.04			0.05	
v/s Ratio Perm					0.59		c0.14					
v/c Ratio					1.03		0.65	0.19			0.22	
Uniform Delay, d1					19.3		32.2	28.9			29.1	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					29.3		16.7	1.6			2.1	
Delay (s)					48.6		48.9	30.5			31.1	
Level of Service					D		D	C			C	
Approach Delay (s)		0.0			48.6			43.2			31.1	
Approach LOS		A			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	47.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	154.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	480	1585	0	0	0	0	0	665	480
Future Volume (veh/h)	0	0	0	480	1585	0	0	0	0	0	665	480
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.85
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1560	1588	0				0	1588	1500
Adj Flow Rate, veh/h				500	1651	0				0	693	492
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				740	2085	0				0	1951	489
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1486	4765	0				0	4479	1088
Grp Volume(v), veh/h				500	1651	0				0	693	492
Grp Sat Flow(s),veh/h/ln				1486	1588	0				0	1445	1088
Q Serve(g_s), s				25.9	26.8	0.0				0.0	11.5	36.0
Cycle Q Clear(g_c), s				25.9	26.8	0.0				0.0	11.5	36.0
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				740	2085	0				0	1951	489
V/C Ratio(X)				0.68	0.79	0.00				0.00	0.36	1.01
Avail Cap(c_a), veh/h				740	2085	0				0	1951	489
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				30.3	30.7	0.0				0.0	23.6	34.1
Incr Delay (d2), s/veh				4.9	3.2	0.0				0.0	0.5	42.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.7	12.4	0.0				0.0	4.7	16.5
LnGrp Delay(d),s/veh				35.2	33.9	0.0				0.0	24.1	76.1
LnGrp LOS				D	C						C	F
Approach Vol, veh/h					2151						1185	
Approach Delay, s/veh					34.2						45.7	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						39.0		41.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						35.0		36.0
Max Q Clear Time (g_c+I1), s						28.8		38.0
Green Ext Time (p_c), s						4.9		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		38.3
HCM 2010 LOS		D

Notes
User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1150	195	910	1350	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1150	195	910	1350	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1500	1500	1398	1398	0			
Adj Flow Rate, veh/h				0	1198	187	1026	1297	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	3	3	0			
Cap, veh/h				0	1510	441	1381	1450	0			
Arrive On Green				0.00	0.37	0.37	0.17	0.17	0.00			
Sat Flow, veh/h				0	4230	1195	2663	2796	0			
Grp Volume(v), veh/h				0	1198	187	1026	1297	0			
Grp Sat Flow(s),veh/h/ln				0	1365	1195	1331	1398	0			
Q Serve(g_s), s				0.0	20.9	9.4	29.3	36.3	0.0			
Cycle Q Clear(g_c), s				0.0	20.9	9.4	29.3	36.3	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1510	441	1381	1450	0			
V/C Ratio(X)				0.00	0.79	0.42	0.74	0.89	0.00			
Avail Cap(c_a), veh/h				0	1510	441	1381	1450	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.5	18.9	28.1	31.0	0.0			
Incr Delay (d2), s/veh				0.0	4.4	3.0	3.6	8.8	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	8.4	3.4	11.5	15.8	0.0			
LnGrp Delay(d),s/veh				0.0	26.9	21.9	31.7	39.8	0.0			
LnGrp LOS					C	C	C	D				
Approach Vol, veh/h					1385			2323				
Approach Delay, s/veh					26.2			36.3				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				46.0		34.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				41.5		29.5		
Max Q Clear Time (g_c+I1), s				38.3		22.9		
Green Ext Time (p_c), s				2.8		3.8		

Intersection Summary	
HCM 2010 Ctrl Delay	32.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1525	100	0	0	0	0	0	400	170	430	0
Future Volume (veh/h)	0	1525	100	0	0	0	0	0	400	170	430	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1676	1710				0	1588	1620	1765	1765	0
Adj Flow Rate, veh/h	0	1589	95				0	0	402	177	448	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1145	992	1526	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.86	0.29	0.29	0.00
Sat Flow, veh/h		0					0	0	1324	969	1765	0
Grp Volume(v), veh/h		0.0					0	0	402	177	448	0
Grp Sat Flow(s),veh/h/ln							0	0	1324	969	1765	0
Q Serve(g_s), s							0.0	0.0	2.0	4.9	6.7	0.0
Cycle Q Clear(g_c), s							0.0	0.0	2.0	6.9	6.7	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1145	992	1526	0
V/C Ratio(X)							0.00	0.00	0.35	0.18	0.29	0.00
Avail Cap(c_a), veh/h							0	0	1145	992	1526	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.9	4.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.8	0.4	0.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.9	1.4	3.6	0.0
LnGrp Delay(d),s/veh							0.0	0.0	1.3	5.3	4.5	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								402			625	
Approach Delay, s/veh								1.3			4.7	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				34.0				34.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				29.4				29.4
Max Q Clear Time (g_c+I1), s				8.9				4.0
Green Ext Time (p_c), s				1.8				1.2

Intersection Summary		
HCM 2010 Ctrl Delay		3.4
HCM 2010 LOS		A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	1915	0	0	0	0	0	245	120	0	0	0
Future Volume (veh/h)	185	1915	0	0	0	0	0	245	120	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1500	0				0	1500	1440			
Adj Flow Rate, veh/h	193	1995	0				0	255	120			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	251	2157	0				0	626	284			
Arrive On Green	0.19	0.19	0.00				0.00	0.32	0.32			
Sat Flow, veh/h	344	3800	0				0	1940	881			
Grp Volume(v), veh/h	762	1426	0				0	195	180			
Grp Sat Flow(s),veh/h/ln	1414	1365	0				0	1500	1322			
Q Serve(g_s), s	40.9	41.0	0.0				0.0	8.1	8.5			
Cycle Q Clear(g_c), s	42.6	41.0	0.0				0.0	8.1	8.5			
Prop In Lane	0.25		0.00				0.00		0.67			
Lane Grp Cap(c), veh/h	859	1549	0				0	484	426			
V/C Ratio(X)	0.89	0.92	0.00				0.00	0.40	0.42			
Avail Cap(c_a), veh/h	859	1549	0				0	484	426			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	31.3	30.7	0.0				0.0	21.1	21.3			
Incr Delay (d2), s/veh	13.1	10.4	0.0				0.0	2.5	3.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	19.9	17.8	0.0				0.0	3.7	3.5			
LnGrp Delay(d),s/veh	44.5	41.1	0.0				0.0	23.6	24.3			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2188						375				
Approach Delay, s/veh		42.3						23.9				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				30.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 26		45.4		
Max Q Clear Time (g_c+I1), s				10.5		44.6		
Green Ext Time (p_c), s				2.8		0.8		

Intersection Summary	
HCM 2010 Ctrl Delay	39.6
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1960	80	0	0	0	0	0	230	200	270	0
Future Volume (veh/h)	0	1960	80	0	0	0	0	0	230	200	270	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1382				0	1588	1591	1560	1500	0
Adj Flow Rate, veh/h	0	2042	78				0	0	224	208	281	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1101	1057	1282	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1288	1001	1500	0
Grp Volume(v), veh/h		0.0					0	0	224	208	281	0
Grp Sat Flow(s),veh/h/ln							0	0	1288	1001	1500	0
Q Serve(g_s), s							0.0	0.0	0.9	5.0	4.4	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.9	6.0	4.4	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1101	1057	1282	0
V/C Ratio(X)							0.00	0.00	0.20	0.20	0.22	0.00
Avail Cap(c_a), veh/h							0	0	1101	1057	1282	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.1	3.2	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.4	0.4	0.4	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.4	1.5	2.0	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.8	4.5	3.6	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								224			489	
Approach Delay, s/veh								0.8			4.0	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				31.0				31.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				26.5				26.5
Max Q Clear Time (g_c+I1), s				8.0				2.9
Green Ext Time (p_c), s				1.4				0.6

Intersection Summary			
HCM 2010 Ctrl Delay			3.0
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	2115	175	0	0	0	0	305	30	110	130	0
Future Volume (veh/h)	100	2115	175	0	0	0	0	305	30	110	130	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.92	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	104	2203	171				0	318	22	115	135	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	116	2596	205				0	629	43	255	543	0
Arrive On Green	0.19	0.19	0.19				0.00	0.21	0.21	0.03	0.21	0.00
Sat Flow, veh/h	200	4488	355				0	3088	206	1597	1744	0
Grp Volume(v), veh/h	911	756	811				0	167	173	115	135	0
Grp Sat Flow(s),veh/h/ln	1755	1606	1682				0	1593	1618	1597	1744	0
Q Serve(g_s), s	40.6	36.2	37.2				0.0	7.4	7.6	0.0	5.2	0.0
Cycle Q Clear(g_c), s	40.6	36.2	37.2				0.0	7.4	7.6	0.0	5.2	0.0
Prop In Lane	0.11		0.21				0.00		0.13	1.00		0.00
Lane Grp Cap(c), veh/h	1015	929	973				0	334	339	255	543	0
V/C Ratio(X)	0.90	0.81	0.83				0.00	0.50	0.51	0.45	0.25	0.00
Avail Cap(c_a), veh/h	1015	929	973				0	334	339	255	543	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.67	0.67	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.1	28.3	28.7				0.0	28.0	28.1	34.1	23.9	0.0
Incr Delay (d2), s/veh	12.2	7.8	8.3				0.0	5.3	5.4	5.7	1.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	23.2	18.1	19.6				0.0	3.7	3.9	2.9	2.7	0.0
LnGrp Delay(d),s/veh	42.3	36.1	37.0				0.0	33.3	33.4	39.8	25.0	0.0
LnGrp LOS	D	D	D					C	C	D	C	
Approach Vol, veh/h		2478						340			250	
Approach Delay, s/veh		38.7						33.4			31.8	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		51.0		29.2			8.2	21.0
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		46.4		* 25			* 4	* 17
Max Q Clear Time (g_c+I1), s		42.6		7.2			2.0	9.6
Green Ext Time (p_c), s		3.7		0.9			0.1	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	37.5
HCM 2010 LOS	D

Notes

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	75	70	93.2%	26.0	4.8	D
	Through						
	Right Turn						
	Subtotal	75	70	93.2%	26.0	4.8	D
EB	Left Turn	45	43	96.5%	3.1	0.4	A
	Through	2,245	2,176	96.9%	2.6	0.2	A
	Right Turn						
	Subtotal	2,290	2,219	96.9%	2.6	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,365	2,289	96.8%	3.4	0.4	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	80	85	105.8%	18.2	2.3	B
	Right Turn	290	278	95.9%	18.1	3.6	B
	Subtotal	370	363	98.1%	18.2	2.6	B
SB	Left Turn	100	95	94.6%	22.4	4.9	C
	Through	170	153	90.1%	16.0	3.3	B
	Right Turn						
	Subtotal	270	248	91.7%	18.5	1.9	B
EB	Left Turn	50	49	97.2%	17.4	2.9	B
	Through	2,200	2,120	96.3%	15.1	0.9	B
	Right Turn	40	37	92.0%	7.8	4.2	A
	Subtotal	2,290	2,205	96.3%	15.0	0.9	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,930	2,816	96.1%	15.7	1.0	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	215	2265	50	0	0	0	0	200	130	130	180	0
Future Volume (veh/h)	215	2265	50	0	0	0	0	200	130	130	180	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1412	1382	1355	0
Adj Flow Rate, veh/h	224	2359	29				0	208	125	135	188	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	223	2533	642				0	491	404	257	439	0
Arrive On Green	0.18	0.18	0.18				0.00	0.35	0.35	0.69	0.69	0.00
Sat Flow, veh/h	408	4626	1172				0	1412	1162	496	1324	0
Grp Volume(v), veh/h	765	1818	29				0	208	125	156	167	0
Grp Sat Flow(s),veh/h/ln	1391	1214	1172				0	1412	1162	587	1172	0
Q Serve(g_s), s	43.8	39.2	1.6				0.0	9.0	6.3	11.6	4.9	0.0
Cycle Q Clear(g_c), s	43.8	39.2	1.6				0.0	9.0	6.3	20.6	4.9	0.0
Prop In Lane	0.29		1.00				0.00		1.00	0.87		0.00
Lane Grp Cap(c), veh/h	762	1994	642				0	491	404	288	407	0
V/C Ratio(X)	1.00	0.91	0.05				0.00	0.42	0.31	0.54	0.41	0.00
Avail Cap(c_a), veh/h	762	1994	642				0	491	404	288	407	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.8	30.9	15.5				0.0	20.0	19.1	14.3	8.7	0.0
Incr Delay (d2), s/veh	33.5	7.8	0.1				0.0	2.7	2.0	7.1	3.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	24.0	14.6	0.6				0.0	3.9	2.2	3.3	1.8	0.0
LnGrp Delay(d),s/veh	66.3	38.7	15.6				0.0	22.6	21.1	21.4	11.8	0.0
LnGrp LOS	F	D	B					C	C	C	B	
Approach Vol, veh/h		2612						333			323	
Approach Delay, s/veh		46.5						22.1			16.4	
Approach LOS		D						C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		48.0		32.0				32.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 44		* 28				* 28
Max Q Clear Time (g_c+I1), s		45.8		11.0				22.6
Green Ext Time (p_c), s		0.0		1.3				0.7

Intersection Summary			
HCM 2010 Ctrl Delay			41.0
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	2375	120	0	0	0	0	140	340	85	235	0
Future Volume (veh/h)	30	2375	120	0	0	0	0	140	340	85	235	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1468	1412	1412	0
Adj Flow Rate, veh/h	31	2474	76				0	146	319	89	245	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	32	2738	614				0	408	351	243	408	0
Arrive On Green	0.18	0.18	0.18				0.00	0.29	0.29	0.58	0.58	0.00
Sat Flow, veh/h	58	4993	1119				0	1412	1216	738	1412	0
Grp Volume(v), veh/h	747	1758	76				0	146	319	89	245	0
Grp Sat Flow(s),veh/h/ln	1409	1214	1119				0	1412	1216	738	1412	0
Q Serve(g_s), s	42.1	37.6	4.6				0.0	6.6	20.2	7.4	9.0	0.0
Cycle Q Clear(g_c), s	42.1	37.6	4.6				0.0	6.6	20.2	14.0	9.0	0.0
Prop In Lane	0.04		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	773	1998	614				0	408	351	243	408	0
V/C Ratio(X)	0.97	0.88	0.12				0.00	0.36	0.91	0.37	0.60	0.00
Avail Cap(c_a), veh/h	773	1998	614				0	468	403	274	468	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	32.0	30.2	16.7				0.0	22.6	27.4	17.5	13.9	0.0
Incr Delay (d2), s/veh	4.7	0.6	0.0				0.0	0.5	22.1	0.9	1.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.5	12.8	1.4				0.0	2.6	8.9	1.5	3.6	0.0
LnGrp Delay(d),s/veh	36.7	30.8	16.7				0.0	23.1	49.5	18.4	15.5	0.0
LnGrp LOS	D	C	B					C	D	B	B	
Approach Vol, veh/h		2581						465			334	
Approach Delay, s/veh		32.1						41.2			16.3	
Approach LOS		C						D			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		50.4		29.6				29.6
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		40.5		26.5				26.5
Max Q Clear Time (g_c+I1), s		44.1		22.2				16.0
Green Ext Time (p_c), s		0.0		0.9				1.2

Intersection Summary			
HCM 2010 Ctrl Delay			31.8
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1790	1005	0	0	0	0	0	0	365	780	0
Future Volume (veh/h)	0	1790	1005	0	0	0	0	0	0	365	780	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1500							1500	1500	0
Adj Flow Rate, veh/h	0	1808	1016							380	812	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.96	0.96	0.96							0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2							2	2	0
Cap, veh/h	0	2268	1285							476	1000	0
Arrive On Green	0.00	0.17	0.17							0.11	0.11	0.00
Sat Flow, veh/h	0	4500	2550							1429	3000	0
Grp Volume(v), veh/h	0	1808	1016							380	812	0
Grp Sat Flow(s),veh/h/ln	0	1500	1275							1429	1500	0
Q Serve(g_s), s	0.0	30.9	30.6							20.8	21.2	0.0
Cycle Q Clear(g_c), s	0.0	30.9	30.6							20.8	21.2	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2268	1285							476	1000	0
V/C Ratio(X)	0.00	0.80	0.79							0.80	0.81	0.00
Avail Cap(c_a), veh/h	0	2268	1285							545	1144	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.18	0.18							0.88	0.88	0.00
Uniform Delay (d), s/veh	0.0	29.4	29.3							33.0	33.1	0.0
Incr Delay (d2), s/veh	0.0	0.6	1.0							6.5	3.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	13.0	11.0							9.1	9.3	0.0
LnGrp Delay(d),s/veh	0.0	30.0	30.2							39.4	36.7	0.0
LnGrp LOS		C	C							D	D	
Approach Vol, veh/h		2824									1192	
Approach Delay, s/veh		30.1									37.6	
Approach LOS		C									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		48.8		31.2				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		36.5		30.5				
Max Q Clear Time (g_c+I1), s		32.9		23.2				
Green Ext Time (p_c), s		3.4		3.5				

Intersection Summary			
HCM 2010 Ctrl Delay			32.3
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	900	1305	0	0	0	0	0	1380	560	0	0	0
Future Volume (veh/h)	900	1305	0	0	0	0	0	1380	560	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1468	1500	0				0	1412	1412			
Adj Flow Rate, veh/h	1002	1270	0				0	1534	501			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	1466	1380	0				0	1789	495			
Arrive On Green	0.15	0.15	0.00				0.00	0.42	0.42			
Sat Flow, veh/h	2797	3000	0				0	4235	1172			
Grp Volume(v), veh/h	1002	1270	0				0	1534	501			
Grp Sat Flow(s),veh/h/ln	1398	1500	0				0	1412	1172			
Q Serve(g_s), s	27.6	33.4	0.0				0.0	26.2	33.8			
Cycle Q Clear(g_c), s	27.6	33.4	0.0				0.0	26.2	33.8			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1466	1380	0				0	1789	495			
V/C Ratio(X)	0.68	0.92	0.00				0.00	0.86	1.01			
Avail Cap(c_a), veh/h	1466	1380	0				0	1789	495			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	30.0	32.5	0.0				0.0	20.9	23.1			
Incr Delay (d2), s/veh	2.6	11.4	0.0				0.0	5.6	43.5			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	11.2	16.1	0.0				0.0	11.0	16.8			
LnGrp Delay(d),s/veh	32.6	43.9	0.0				0.0	26.5	66.6			
LnGrp LOS	C	D						C	F			
Approach Vol, veh/h		2272						2035				
Approach Delay, s/veh		38.9						36.4				
Approach LOS		D						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		41.0		39.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 37		* 34				
Max Q Clear Time (g_c+I1), s		35.4		35.8				
Green Ext Time (p_c), s		1.4		0.0				

Intersection Summary	
HCM 2010 Ctrl Delay	37.7
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	280	40	70	280	50	60	220	170	90	130	30
Future Volume (veh/h)	20	280	40	70	280	50	60	220	170	90	130	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		0.96	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2039	2039	2000	1961	1961	2000	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	21	292	35	73	292	45	62	229	145	94	135	22
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	58	389	47	155	449	69	271	302	191	213	395	64
Arrive On Green	0.03	0.22	0.22	0.08	0.27	0.27	0.15	0.29	0.29	0.12	0.26	0.26
Sat Flow, veh/h	1942	1778	213	1867	1650	254	1774	1047	663	1774	1543	251
Grp Volume(v), veh/h	21	0	327	73	0	337	62	0	374	94	0	157
Grp Sat Flow(s),veh/h/ln	1942	0	1991	1867	0	1904	1774	0	1711	1774	0	1795
Q Serve(g_s), s	0.6	0.0	9.1	2.2	0.0	9.2	1.8	0.0	11.7	2.9	0.0	4.2
Cycle Q Clear(g_c), s	0.6	0.0	9.1	2.2	0.0	9.2	1.8	0.0	11.7	2.9	0.0	4.2
Prop In Lane	1.00		0.11	1.00		0.13	1.00		0.39	1.00		0.14
Lane Grp Cap(c), veh/h	58	0	436	155	0	518	271	0	493	213	0	459
V/C Ratio(X)	0.37	0.00	0.75	0.47	0.00	0.65	0.23	0.00	0.76	0.44	0.00	0.34
Avail Cap(c_a), veh/h	263	0	841	317	0	868	301	0	667	301	0	700
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.1	0.0	21.5	25.8	0.0	19.0	21.9	0.0	19.1	24.1	0.0	17.9
Incr Delay (d2), s/veh	1.4	0.0	2.6	0.8	0.0	1.4	0.2	0.0	3.4	0.5	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	5.2	1.2	0.0	5.1	0.9	0.0	6.0	1.4	0.0	2.1
LnGrp Delay(d),s/veh	29.5	0.0	24.1	26.6	0.0	20.4	22.1	0.0	22.5	24.7	0.0	18.3
LnGrp LOS	C		C	C		C	C		C	C		B
Approach Vol, veh/h		348			410			436			251	
Approach Delay, s/veh		24.5			21.5			22.5			20.7	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.9	17.8	13.0	19.3	5.7	20.9	11.1	21.2
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	24.9	10.0	* 23	8.0	26.9	10.0	* 23
Max Q Clear Time (g_c+I1), s	4.2	11.1	3.8	6.2	2.6	11.2	4.9	13.7
Green Ext Time (p_c), s	0.0	1.1	0.0	0.5	0.0	1.2	0.1	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	22.4
HCM 2010 LOS	C

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	490	50	0	635	10	25
Future Volume (vph)	490	50	0	635	10	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			3.0	5.6	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	0.99	
Frt	0.99			1.00	0.90	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1561			1588	1401	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1561			1588	1401	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	510	52	0	661	10	26
RTOR Reduction (vph)	5	0	0	0	21	0
Lane Group Flow (vph)	557	0	0	661	15	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA	Perm	
Protected Phases	2			3 4 6		
Permitted Phases					8	
Actuated Green, G (s)	34.1			54.9	13.9	
Effective Green, g (s)	34.1			48.9	13.9	
Actuated g/C Ratio	0.43			0.61	0.17	
Clearance Time (s)	6.0				5.6	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	665			970	243	
v/s Ratio Prot	c0.36			c0.42		
v/s Ratio Perm					c0.01	
v/c Ratio	0.84			0.68	0.06	
Uniform Delay, d1	20.5			10.4	27.6	
Progression Factor	0.64			0.35	0.72	
Incremental Delay, d2	10.7			0.5	0.1	
Delay (s)	23.9			4.2	20.0	
Level of Service	C			A	C	
Approach Delay (s)	23.9			4.2	20.0	
Approach LOS	C			A	C	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	455	5	0	290	15	30	25	20	10	20	20
Future Volume (vph)	0	455	5	0	290	15	30	25	20	10	20	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			1.00			0.98	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		1.00			0.99			0.96			0.95	
Flt Protected		1.00			1.00			0.98			0.99	
Satd. Flow (prot)		1585			1574			1487			1461	
Flt Permitted		1.00			1.00			0.85			0.92	
Satd. Flow (perm)		1585			1574			1285			1356	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	474	5	0	302	16	31	26	21	10	21	21
RTOR Reduction (vph)	0	0	0	0	2	0	0	19	0	0	19	0
Lane Group Flow (vph)	0	479	0	0	316	0	0	59	0	0	33	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			4 6			8			8	
Permitted Phases							8			8		
Actuated Green, G (s)		43.0			58.8			9.2			9.2	
Effective Green, g (s)		43.0			58.8			9.2			9.2	
Actuated g/C Ratio		0.54			0.73			0.11			0.11	
Clearance Time (s)		6.0						6.0			6.0	
Vehicle Extension (s)		3.0						1.5			1.5	
Lane Grp Cap (vph)		851			1156			147			155	
v/s Ratio Prot		c0.30			c0.20							
v/s Ratio Perm								c0.05			0.02	
v/c Ratio		0.56			0.27			0.40			0.22	
Uniform Delay, d1		12.3			3.5			32.9			32.1	
Progression Factor		0.58			0.05			0.38			0.84	
Incremental Delay, d2		2.3			0.0			0.6			0.1	
Delay (s)		9.4			0.2			13.0			27.1	
Level of Service		A			A			B			C	
Approach Delay (s)		9.4			0.2			13.0			27.1	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	515	0	0	625	10	25
Future Volume (vph)	515	0	0	625	10	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			6.0	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.90	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1588			1588	1414	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1588			1588	1414	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	536	0	0	651	10	26
RTOR Reduction (vph)	0	0	0	0	21	0
Lane Group Flow (vph)	536	0	0	651	15	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	53.6			34.1	14.8	
Effective Green, g (s)	48.0			34.1	14.8	
Actuated g/C Ratio	0.60			0.43	0.19	
Clearance Time (s)				6.0		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	952			676	261	
v/s Ratio Prot	c0.34			c0.41	c0.01	
v/s Ratio Perm						
v/c Ratio	0.56			0.96	0.06	
Uniform Delay, d1	9.7			22.3	26.9	
Progression Factor	0.29			1.04	1.82	
Incremental Delay, d2	0.4			20.9	0.0	
Delay (s)	3.3			44.0	48.9	
Level of Service	A			D	D	
Approach Delay (s)	3.3			44.0	48.9	
Approach LOS	A			D	D	

Intersection Summary			
HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	485	0	0	285	15	20	20	20	0	0	0
Future Volume (vph)	0	485	0	0	285	15	20	20	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1573			1470				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1573			1470				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	505	0	0	297	16	21	21	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	505	0	0	311	0	0	45	0	0	0	0
Confl. Peds. (#/hr)	10		10			10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		58.2			43.0			9.8				
Effective Green, g (s)		58.2			43.0			9.8				
Actuated g/C Ratio		0.73			0.54			0.12				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1155			845			180				
v/s Ratio Prot		c0.32			0.20			c0.03				
v/s Ratio Perm												
v/c Ratio		0.44			0.37			0.25				
Uniform Delay, d1		4.4			10.7			31.8				
Progression Factor		0.09			0.52			1.01				
Incremental Delay, d2		0.1			1.2			0.2				
Delay (s)		0.5			6.7			32.3				
Level of Service		A			A			C				
Approach Delay (s)		0.5			6.7			32.3			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	370	0	0	425	50	20	5	20	0	0	0
Future Volume (vph)	0	370	0	0	425	50	20	5	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1537			1442				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1537			1442				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	385	0	0	443	52	21	5	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	385	0	0	490	0	0	29	0	0	0	0
Confl. Peds. (#/hr)	59		21			59			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		55.1			36.8			13.3				
Effective Green, g (s)		55.1			36.8			13.3				
Actuated g/C Ratio		0.69			0.46			0.17				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1093			707			239				
v/s Ratio Prot		c0.24			c0.32			c0.02				
v/s Ratio Perm												
v/c Ratio		0.35			0.69			0.12				
Uniform Delay, d1		5.1			17.1			28.4				
Progression Factor		0.21			0.78			1.01				
Incremental Delay, d2		0.2			5.0			0.2				
Delay (s)		1.3			18.4			28.9				
Level of Service		A			B			C				
Approach Delay (s)		1.3			18.4			28.9			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	28.1	46.2	0.07	5.3	F
C	IV	25	18.9	11.5	30.4	0.07	8.5	E
B	IV	25	17.9	43.2	61.1	0.07	4.0	F
A	IV	25	18.5	12.3	30.8	0.07	8.1	E
Lindaro	IV	25	25.3	18.1	43.4	0.14	11.6	D
Lincoln	IV	25	21.4	57.0	78.4	0.10	4.5	F
Francisco W.	IV	25	12.2	30.8	43.0	0.05	3.9	F
101 SBOn 2nd	IV	25	14.2	22.1	36.3	0.05	5.3	F
Total	IV		146.5	223.1	369.6	0.61	6.0	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	24.0	43.0	0.07	6.0	F
Tamalpais	IV	25	14.4	34.9	49.3	0.05	4.0	F
Lincoln	IV	25	13.2	17.0	30.2	0.05	6.0	F
Lindaro	IV	25	21.4	3.2	24.6	0.10	14.2	C
A	IV	25	25.3	15.5	40.8	0.14	12.4	D
B	IV	25	17.9	8.8	26.7	0.07	9.1	D
C	IV	25	19.0	4.5	23.5	0.07	11.0	D
D	IV	25	18.7	2.6	21.3	0.07	11.9	D
Total	IV		148.9	110.5	259.4	0.62	8.7	E

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	29	24.0	42.9	66.9	0.16	8.6	E
5th	IV	25	16.3	3.3	19.6	0.06	11.3	D
4th	IV	25	14.6	6.3	20.9	0.05	9.5	D
3rd	IV	25	17.7	10.2	27.9	0.07	8.6	E
2nd	IV	25	15.6	75.4	91.0	0.06	2.3	F
Total	IV		88.2	138.1	226.3	0.40	6.4	F

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	30	25.2	27.4	52.6	0.17	11.5	D
3rd St	IV	25	14.8	18.1	32.9	0.06	6.1	F
4th	IV	25	18.3	17.1	35.4	0.07	7.0	E
5th	IV	25	14.6	9.7	24.3	0.06	8.2	E
Mission	IV	25	15.7	5.9	21.6	0.06	9.9	D
Total	IV		88.6	78.2	166.8	0.41	8.8	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	14.6	43.1	0.16	13.2	C
Tamalpais	IV	25	16.0	49.8	65.8	0.06	3.3	F
Tamalpais	IV	25	3.1	5.7	8.8	0.01	4.8	F
Hetherton	IV	25	8.7	10.2	18.9	0.03	6.3	F
Irwin	IV	25	18.9	14.7	33.6	0.07	7.6	E
Total	IV		75.2	95.0	170.2	0.33	7.1	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	27.6	49.2	0.10	7.2	E
Hetherton	IV	25	18.9	23.4	42.3	0.07	6.1	F
Tamalpais	IV	25	8.7	115.6	124.3	0.03	1.0	F
Tamalpais	IV	25	3.1	4.7	7.8	0.01	5.4	F
Lincoln	IV	25	16.0	80.8	96.8	0.06	2.2	F
Total	IV		68.3	252.1	320.4	0.27	3.1	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	17.6	35.7	0.07	6.9	F
C	IV	25	18.9	13.8	32.7	0.07	7.9	E
B	IV	25	17.9	14.9	32.8	0.07	7.4	E
A	IV	25	18.5	12.1	30.6	0.07	8.2	E
Lindaro	IV	25	25.3	12.3	37.6	0.14	13.4	C
Lincoln	IV	25	21.4	36.4	57.8	0.10	6.1	F
Francisco W.	IV	25	12.2	19.0	31.2	0.05	5.3	F
101 SBOn Hetherton	IV	25	14.2	61.0	75.2	0.05	2.6	F
Total	IV		146.5	187.1	333.6	0.61	6.6	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	40.6	59.6	0.07	4.3	F
Tamalpais	IV	25	14.4	49.9	64.3	0.05	3.0	F
Lincoln	IV	25	13.2	17.8	31.0	0.05	5.8	F
Lindaro	IV	25	21.4	4.6	26.0	0.10	13.5	C
A	IV	25	25.3	6.1	31.4	0.14	16.1	C
B	IV	25	17.9	7.1	25.0	0.07	9.7	D
C	IV	25	19.0	4.3	23.3	0.07	11.1	D
D	IV	25	18.7	2.9	21.6	0.07	11.7	D
Total	IV		148.9	133.3	282.2	0.62	8.0	E

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	35	22.2	35.6	57.8	0.16	9.9	D
5th	IV	25	16.3	6.7	23.0	0.06	9.6	D
4th	IV	25	14.6	7.4	22.0	0.05	9.0	E
3rd	IV	25	17.7	22.8	40.5	0.07	5.9	F
2nd	IV	25	15.6	25.7	41.3	0.06	5.1	F
Total	IV		86.4	98.2	184.6	0.40	7.8	E

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	38	19.3	55.5	74.8	0.17	8.1	E
3rd St	IV	25	14.8	18.6	33.4	0.06	6.0	F
4th	IV	25	18.9	3.7	22.6	0.07	11.4	D
5th	IV	25	14.0	12.2	26.2	0.05	7.3	E
Mission	IV	25	15.7	3.2	18.9	0.06	11.3	D
Total	IV		82.7	93.2	175.9	0.41	8.3	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	12.1	40.6	0.16	14.0	C
Tamalpais	IV	25	16.1	25.9	42.0	0.06	5.2	F
Tamalpais	IV	25	4.3	3.1	7.4	0.02	7.9	E
Hetherton	IV	25	7.5	8.0	15.5	0.03	6.6	F
Irwin	IV	25	18.9	14.4	33.3	0.07	7.7	E
Total	IV		75.3	63.5	138.8	0.33	8.7	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	30.4	52.0	0.10	6.8	F
Hetherton	IV	25	18.9	8.3	27.2	0.07	9.4	D
Tamalpais	IV	25	7.5	46.6	54.1	0.03	1.9	F
Tamalpais	IV	25	4.3	2.7	7.0	0.02	8.4	E
Lincoln	IV	25	16.1	31.9	48.0	0.06	4.6	F
Total	IV		68.4	119.9	188.3	0.27	5.3	F

Leisch Method for Weaving Analysis

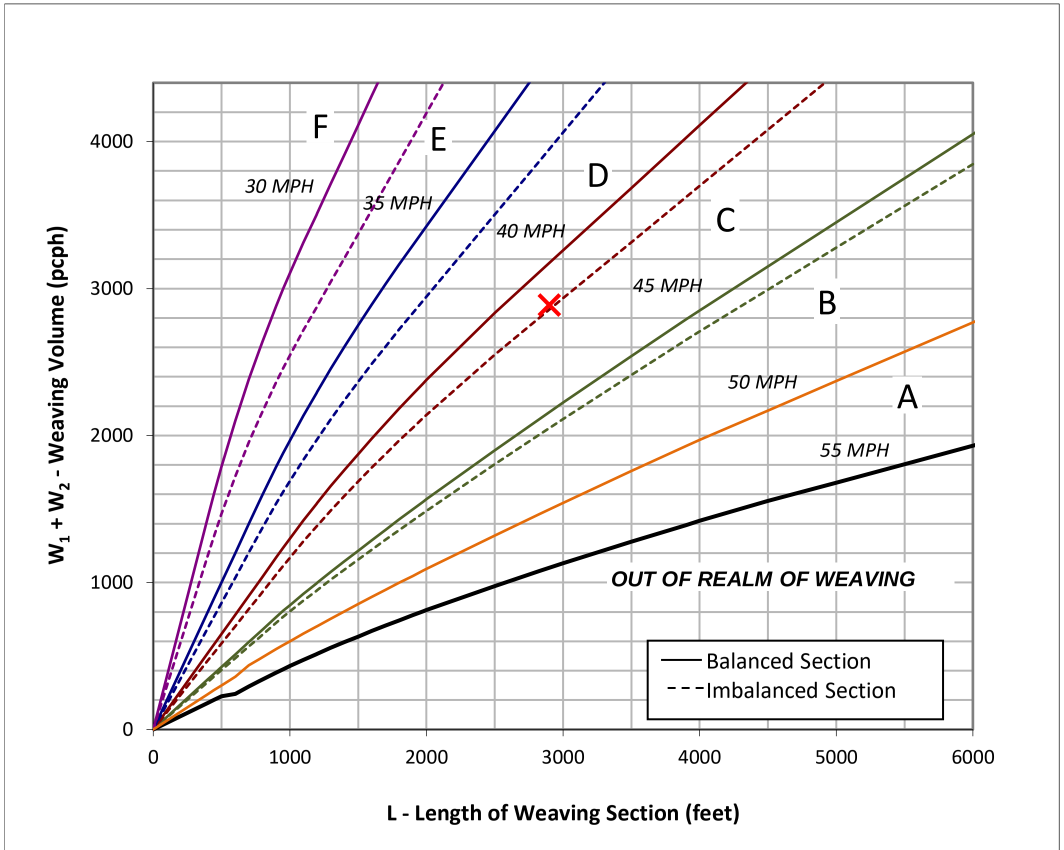
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

Project Information

Project	BioMarin
Scenario	Baseline AM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,707	Volume (vph)*	1,754	Volume (vph)*	1,016
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	4%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,958	Volume (pcph)	1,831	Volume (pcph)	1,058

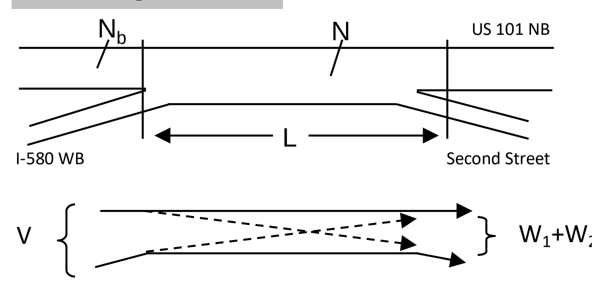


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? — N

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? — **40 MPH** and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 39.8
4. Weaving Intensity Factor (k) — 2.54
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] — 1,517

6. Level of Service (LOS) — D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3833	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1404
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	23.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	718	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	820
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	13.7
Speed 2 (S_3), mi/h	1.4	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5612	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1594
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	26.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5803	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	2097
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.91
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	55.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	37.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	3/17/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5803	1448
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	4.40	3.72
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.958
Flow Rate (v_i), pc/h	6291	1643
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.91	0.78

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	62470.8	Density in Ramp Influence Area (D_R), pc/mi/ln	37.9
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	0.381
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2199
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	53.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.527	Outer Lanes Freeway Speed (S_O), mi/h	61.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	4092	Ramp Junction Speed (S), mi/h	55.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	37.7
Level of Service (LOS)	E		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0

Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4355	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1628
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.71
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	27.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	998	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1104
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.0
Speed 2 (S_2), mi/h	1.0	Density (D_{ML}), pc/mi/ln	18.7
Speed 2 (S_3), mi/h	5.0	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

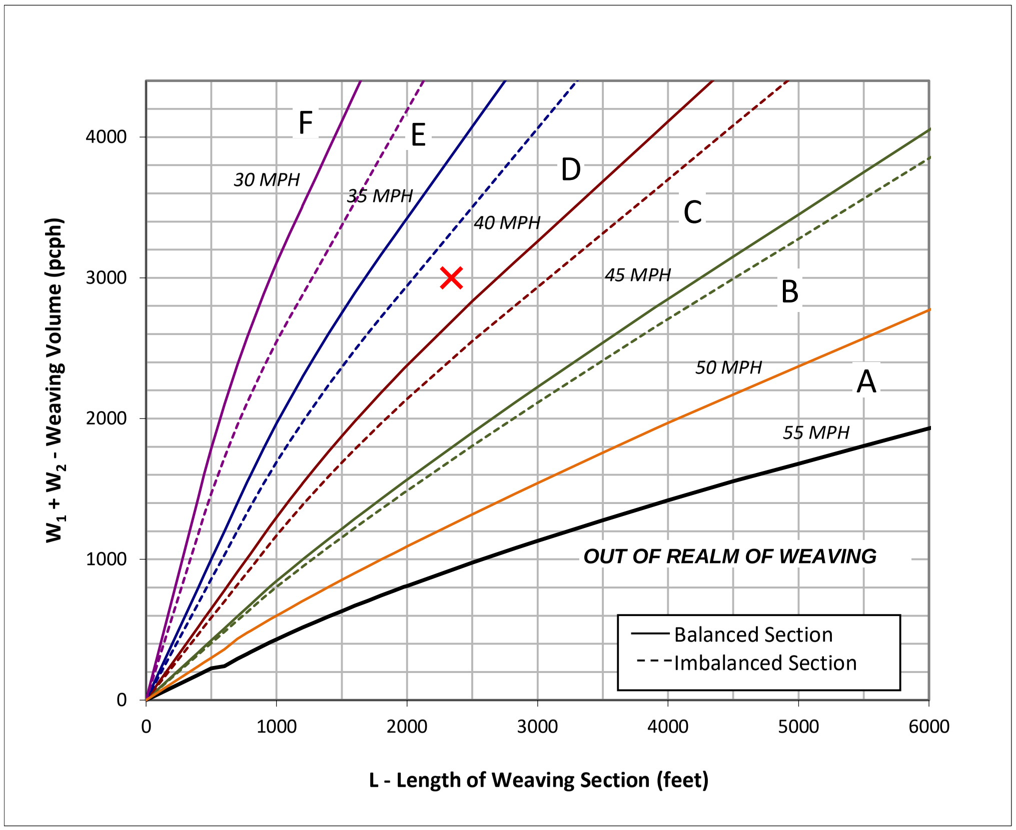
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

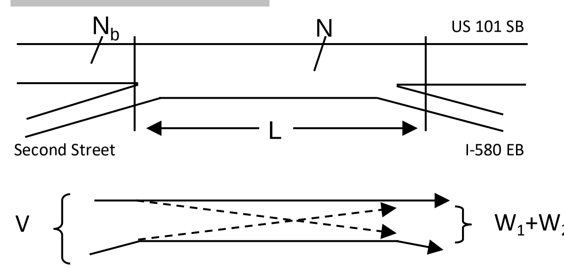
Project Information

Project	BioMarin
Scenario	Baseline AM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,697	Volume (vph)*	1,709	Volume (vph)*	1,177
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	2%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	6,992	Volume (pcph)	1,754	Volume (pcph)	1,247



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 38.7
4. Weaving Intensity Factor (k) — 2.60
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 2,248
6. Level of Service (LOS) — F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

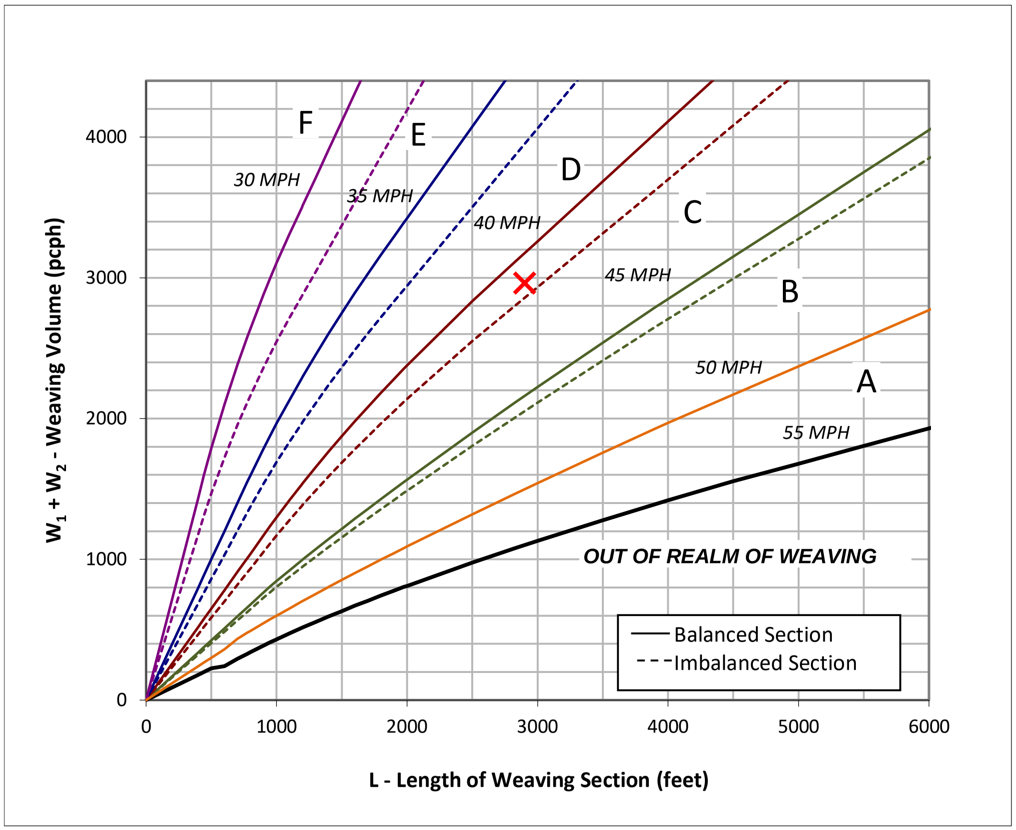
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

Project Information

Project	BioMarin
Scenario	Baseline PM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,739	Volume (vph)*	1,546	Volume (vph)*	1,315
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	7,036	Volume (pcph)	1,614	Volume (pcph)	1,350

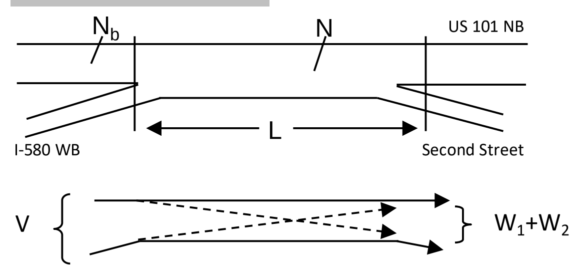


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 39.5
4. Weaving Intensity Factor (k) 2.55
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 1,827

6. Level of Service (LOS) E

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4799	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1776
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	29.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	848	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	890
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.7
Speed 2 (S_2), mi/h	0.3	Density (D_{ML}), pc/mi/ln	14.9
Speed 2 (S_3), mi/h	2.1	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6959	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1997
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	35.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1217	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	1342
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	57.7
Speed 2 (S_2), mi/h	2.3	Density (D_{ML}), pc/mi/ln	23.3
Speed 2 (S_3), mi/h	9.8	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5072	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1833
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	31.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1377	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1555
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	56.0
Speed 2 (S_2), mi/h	4.0	Density (D_{ML}), pc/mi/ln	27.8
Speed 2 (S_3), mi/h	15.4	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5072	1737
Peak Hour Factor (PHF)	0.97	0.96
Total Trucks, %	4.40	2.00
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.973
Flow Rate (v_i), pc/h	5498	1860
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.80	0.89

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	101150.1	Density in Ramp Influence Area (D_R), pc/mi/ln	35.5
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	0.400
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1684
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	52.8
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.537	Outer Lanes Freeway Speed (S_O), mi/h	63.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	3814	Ramp Junction Speed (S), mi/h	55.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	33.0
Level of Service (LOS)	E		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1380	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1559
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	55.9
Speed 2 (S_2), mi/h	4.1	Density (D_{ML}), pc/mi/ln	27.9
Speed 2 (S_3), mi/h	15.5	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3335	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1247
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	20.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	918	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1049
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.2
Speed 2 (S_2), mi/h	0.8	Density (D_{ML}), pc/mi/ln	17.7
Speed 2 (S_3), mi/h	4.2	Level of Service (LOS)	B

Leisch Method for Weaving Analysis

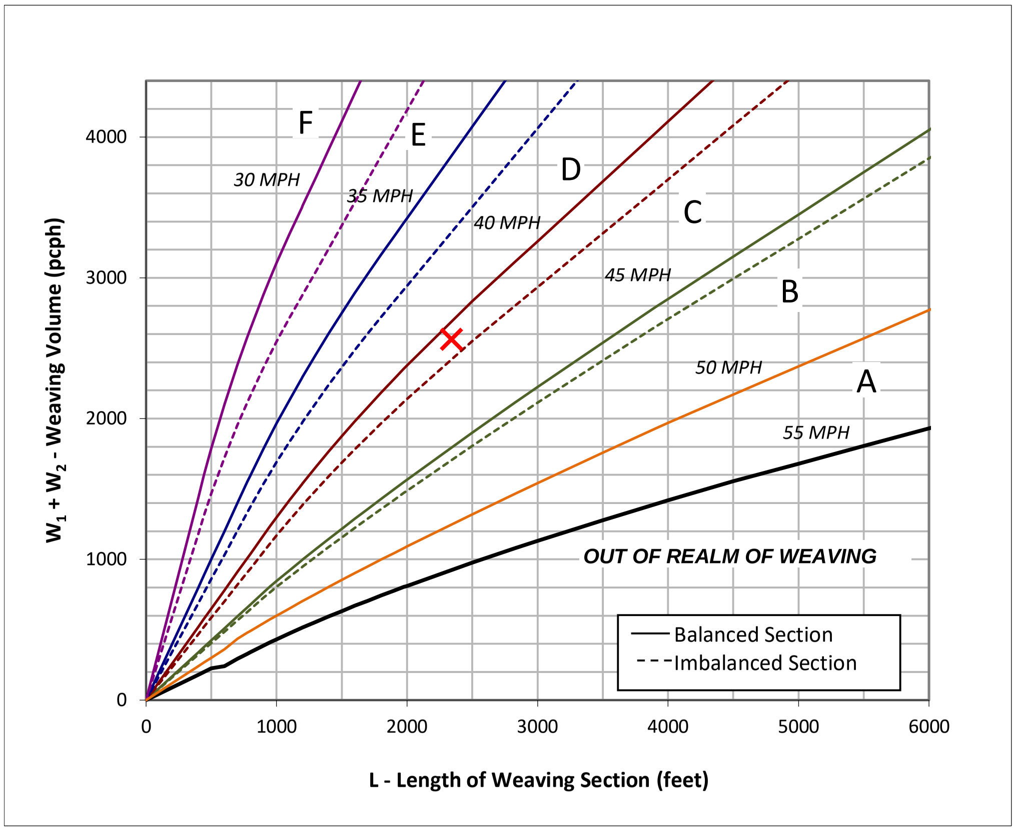
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

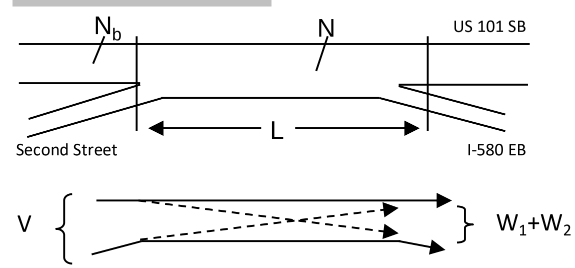
Project Information

Project	BioMarin
Scenario	Baseline PM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,056	Volume (vph)*	994	Volume (vph)*	1,409
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	5,278	Volume (pcph)	1,019	Volume (pcph)	1,545



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   40 MPH and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 40.7
4. Weaving Intensity Factor (k) 2.47
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 1,693
6. Level of Service (LOS) E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Appendix C:
Baseline Plus Project Conditions (R&D Only) –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

April 5, 2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	460	20	70	570	50	20	210	40	60	390	360
Future Volume (veh/h)	110	460	20	70	570	50	20	210	40	60	390	360
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	0.99		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1710	1660	1660	1710	1800	1678	1728	1800	1748	1728
Adj Flow Rate, veh/h	120	500	20	76	620	50	22	228	34	65	424	180
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	148	865	35	372	625	50	73	509	72	144	848	347
Arrive On Green	0.09	0.55	0.55	0.55	0.55	0.55	0.85	0.85	0.85	0.43	0.43	0.43
Sat Flow, veh/h	1581	1582	63	817	1512	122	49	1192	169	206	1988	813
Grp Volume(v), veh/h	120	0	520	76	0	670	284	0	0	362	0	307
Grp Sat Flow(s),veh/h/ln	1581	0	1646	817	0	1634	1410	0	0	1621	0	1385
Q Serve(g_s), s	5.6	0.0	15.7	4.4	0.0	30.5	0.0	0.0	0.0	2.9	0.0	12.2
Cycle Q Clear(g_c), s	5.6	0.0	15.7	10.1	0.0	30.5	3.5	0.0	0.0	11.6	0.0	12.2
Prop In Lane	1.00		0.04	1.00		0.07	0.08		0.12	0.18		0.59
Lane Grp Cap(c), veh/h	148	0	900	372	0	675	653	0	0	748	0	591
V/C Ratio(X)	0.81	0.00	0.58	0.20	0.00	0.99	0.43	0.00	0.00	0.48	0.00	0.52
Avail Cap(c_a), veh/h	148	0	900	372	0	675	653	0	0	748	0	591
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.72	0.00	0.72	0.87	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.4	0.0	11.3	14.0	0.0	16.8	3.4	0.0	0.0	15.6	0.0	15.8
Incr Delay (d2), s/veh	36.9	0.0	2.7	0.9	0.0	27.5	1.8	0.0	0.0	2.2	0.0	3.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	7.8	1.1	0.0	18.6	1.5	0.0	0.0	5.9	0.0	5.2
LnGrp Delay(d),s/veh	70.3	0.0	14.0	14.9	0.0	44.2	5.2	0.0	0.0	17.8	0.0	19.1
LnGrp LOS	E		B	B		D	A			B		B
Approach Vol, veh/h		640			746			284			669	
Approach Delay, s/veh		24.5			41.2			5.2			18.4	
Approach LOS		C			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		45.2		36.8	10.0	35.2		36.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 41		25.4	7.0	* 31		25.4
Max Q Clear Time (g_c+I1), s		17.7		5.5	7.6	32.5		14.2
Green Ext Time (p_c), s		5.1		2.4	0.0	0.0		4.5

Intersection Summary	
HCM 2010 Ctrl Delay	25.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	80	40	220	0	0	0	0	220	1026	465
Future Volume (vph)	0	490	80	40	220	0	0	0	0	220	1026	465
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.97
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2715			1766						2962	1302
Flt Permitted		1.00			0.86						0.99	1.00
Satd. Flow (perm)		2715			1534						2962	1302
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	533	87	43	239	0	0	0	0	239	1115	505
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	603	0	0	282	0	0	0	0	0	1354	505
Confl. Peds. (#/hr)	15		22	22		15			16			1
Confl. Bikes (#/hr)			3			2			1			3
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1187			670						1319	458
v/s Ratio Prot		c0.22									c0.46	
v/s Ratio Perm					0.18							0.39
v/c Ratio		0.51			0.42						1.03	1.10
Uniform Delay, d1		15.3			14.6						20.8	24.3
Progression Factor		0.61			1.45						1.00	1.00
Incremental Delay, d2		1.3			1.6						31.8	72.9
Delay (s)		10.5			22.6						52.6	97.2
Level of Service		B			C						D	F
Approach Delay (s)		10.5			22.6			0.0			64.7	
Approach LOS		B			C			A			E	

Intersection Summary			
HCM 2000 Control Delay	48.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	92.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	380	20	310	160	320	5	110	1071	130	40
Future Volume (vph)	380	20	310	160	320	5	110	1071	130	40
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1494	1794	1615	1471			3428	1295	
Flt Permitted		0.60	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		938	1794	1615	1471			3428	1295	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	413	22	337	174	348	5	120	1164	141	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	44	0
Lane Group Flow (vph)	0	435	337	174	353	0	0	1284	140	0
Confl. Peds. (#/hr)							13			6
Confl. Bikes (#/hr)					2	2				2
Parking (#/hr)				0				2		
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Effective Green, g (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Actuated g/C Ratio		0.45	0.45	0.25	0.25			0.44	0.44	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		502	808	404	368			1499	566	
v/s Ratio Prot		c0.12	0.19	0.11	c0.24					
v/s Ratio Perm		0.27						0.37	0.11	
v/c Ratio		0.87	0.42	0.43	0.96			0.86	0.25	
Uniform Delay, d1		19.1	13.9	23.6	27.7			19.0	13.3	
Progression Factor		0.99	0.95	1.00	1.00			0.74	0.66	
Incremental Delay, d2		13.8	1.2	3.3	37.7			3.1	0.5	
Delay (s)		32.8	14.3	26.9	65.4			17.2	9.3	
Level of Service		C	B	C	E			B	A	
Approach Delay (s)			24.8	52.7				16.2		
Approach LOS			C	D				B		

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	300	40	70	280	30	10	220	45	40	400	40
Future Volume (veh/h)	30	300	40	70	280	30	10	220	45	40	400	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1398	1545	1530	1398	1485	1530	1440	1485	1469	1440	1485	1469
Adj Flow Rate, veh/h	33	326	36	76	304	28	11	239	39	43	435	39
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	243	534	59	257	524	48	58	523	83	82	534	46
Arrive On Green	0.39	0.39	0.39	0.13	0.13	0.13	0.97	0.97	0.97	0.97	0.97	0.97
Sat Flow, veh/h	825	1361	150	802	1336	123	16	1077	171	62	1101	95
Grp Volume(v), veh/h	33	0	362	76	0	332	289	0	0	517	0	0
Grp Sat Flow(s),veh/h/ln	825	0	1511	802	0	1459	1264	0	0	1258	0	0
Q Serve(g_s), s	2.6	0.0	14.4	6.9	0.0	16.1	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	18.6	0.0	14.4	21.2	0.0	16.1	0.9	0.0	0.0	4.3	0.0	0.0
Prop In Lane	1.00		0.10	1.00		0.08	0.04		0.13	0.08		0.08
Lane Grp Cap(c), veh/h	243	0	592	257	0	572	663	0	0	662	0	0
V/C Ratio(X)	0.14	0.00	0.61	0.30	0.00	0.58	0.44	0.00	0.00	0.78	0.00	0.00
Avail Cap(c_a), veh/h	243	0	592	257	0	572	663	0	0	662	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.94	0.00	0.94	0.85	0.00	0.00	0.51	0.00	0.00
Uniform Delay (d), s/veh	26.4	0.0	18.2	36.0	0.0	26.8	0.6	0.0	0.0	0.6	0.0	0.0
Incr Delay (d2), s/veh	1.2	0.0	4.6	2.8	0.0	4.0	1.8	0.0	0.0	4.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	6.7	1.7	0.0	7.1	0.6	0.0	0.0	1.3	0.0	0.0
LnGrp Delay(d),s/veh	27.6	0.0	22.9	38.8	0.0	30.9	2.3	0.0	0.0	5.3	0.0	0.0
LnGrp LOS	C		C	D		C	A			A		
Approach Vol, veh/h		395			408			289			517	
Approach Delay, s/veh		23.3			32.3			2.3			5.3	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		34.0		41.0		34.0		41.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		29.4		36.4		29.4		36.4
Max Q Clear Time (g_c+I1), s		20.6		2.9		23.2		6.3
Green Ext Time (p_c), s		1.2		1.3		1.0		2.6

Intersection Summary	
HCM 2010 Ctrl Delay	16.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	240	165	40	245	0	0	0	0	50	981	115
Future Volume (vph)	0	240	165	40	245	0	0	0	0	50	981	115
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1665			1769						4118	1127
Flt Permitted		1.00			0.91						1.00	1.00
Satd. Flow (perm)		1665			1612						4118	1127
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	261	179	43	266	0	0	0	0	54	1066	125
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	417	0	0	309	0	0	0	0	0	1120	125
Confl. Peds. (#/hr)			15	15		14			22	22		10
Confl. Bikes (#/hr)			4			2			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		728			704						1833	396
v/s Ratio Prot		c0.25										
v/s Ratio Perm					0.19						0.27	0.11
v/c Ratio		0.57			0.44						0.61	0.32
Uniform Delay, d1		15.8			14.7						15.8	17.7
Progression Factor		0.44			1.25						0.17	0.25
Incremental Delay, d2		3.1			1.2						0.4	0.6
Delay (s)		10.1			19.5						3.1	5.0
Level of Service		B			B						A	A
Approach Delay (s)		10.1			19.5			0.0			3.3	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	100	0	0	155	120	155	1121	10	0	0	0
Future Volume (veh/h)	140	100	0	0	155	120	155	1121	10	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	0.89	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1620	1573	1620			
Adj Flow Rate, veh/h	152	109	0	0	168	90	168	1218	10			
Adj No. of Lanes	1	1	0	0	1	0	0	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	0	3	0			
Cap, veh/h	237	491	0	0	265	142	180	1379	12			
Arrive On Green	0.10	0.10	0.00	0.00	0.31	0.31	0.19	0.19	0.19			
Sat Flow, veh/h	993	1573	0	0	849	455	319	2440	21			
Grp Volume(v), veh/h	152	109	0	0	0	258	728	0	668			
Grp Sat Flow(s),veh/h/ln	993	1573	0	0	0	1304	1384	0	1396			
Q Serve(g_s), s	10.7	4.8	0.0	0.0	0.0	12.7	38.9	0.0	34.6			
Cycle Q Clear(g_c), s	23.4	4.8	0.0	0.0	0.0	12.7	38.9	0.0	34.6			
Prop In Lane	1.00		0.00	0.00		0.35	0.23		0.01			
Lane Grp Cap(c), veh/h	237	491	0	0	0	407	782	0	789			
V/C Ratio(X)	0.64	0.22	0.00	0.00	0.00	0.63	0.93	0.00	0.85			
Avail Cap(c_a), veh/h	237	491	0	0	0	407	782	0	789			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	40.4	25.3	0.0	0.0	0.0	22.1	29.1	0.0	27.3			
Incr Delay (d2), s/veh	12.5	1.0	0.0	0.0	0.0	7.3	19.2	0.0	10.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	2.2	0.0	0.0	0.0	5.4	19.1	0.0	15.8			
LnGrp Delay(d),s/veh	52.9	26.3	0.0	0.0	0.0	29.5	48.3	0.0	38.2			
LnGrp LOS	D	C				C	D		D			
Approach Vol, veh/h		261			258			1396				
Approach Delay, s/veh		41.8			29.5			43.4				
Approach LOS		D			C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		28.0		47.0		28.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		23.4		42.4		23.4		
Max Q Clear Time (g_c+I1), s		25.4		40.9		14.7		
Green Ext Time (p_c), s		0.0		1.1		0.7		

Intersection Summary			
HCM 2010 Ctrl Delay			41.3
HCM 2010 LOS			D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	260	20	70	310	30	20	225	65	65	370	80
Future Volume (veh/h)	30	260	20	70	310	30	20	225	65	65	370	80
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.92	0.98		0.92	0.97		0.91	0.99		0.91
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1573	1510	1620	1573	1573	1620	1620	1573	1555	1620	1573	1555
Adj Flow Rate, veh/h	33	283	18	76	337	28	22	245	57	71	402	77
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	238	536	34	309	546	45	71	517	115	113	496	90
Arrive On Green	0.38	0.38	0.38	0.13	0.13	0.13	0.17	0.17	0.17	1.00	1.00	1.00
Sat Flow, veh/h	894	1396	89	937	1422	118	40	1027	228	116	983	179
Grp Volume(v), veh/h	33	0	301	76	0	365	324	0	0	550	0	0
Grp Sat Flow(s),veh/h/ln	894	0	1485	937	0	1540	1294	0	0	1279	0	0
Q Serve(g_s), s	2.4	0.0	11.7	5.8	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	19.3	0.0	11.7	17.5	0.0	16.8	16.5	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.06	1.00		0.08	0.07		0.18	0.13		0.14
Lane Grp Cap(c), veh/h	238	0	570	309	0	591	703	0	0	699	0	0
V/C Ratio(X)	0.14	0.00	0.53	0.25	0.00	0.62	0.46	0.00	0.00	0.79	0.00	0.00
Avail Cap(c_a), veh/h	238	0	570	309	0	591	703	0	0	699	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.46	0.00	0.00	0.46	0.00	0.00
Uniform Delay (d), s/veh	27.5	0.0	17.8	33.4	0.0	27.5	22.4	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	1.2	0.0	3.5	1.7	0.0	4.4	1.0	0.0	0.0	4.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	5.3	1.6	0.0	7.9	6.3	0.0	0.0	0.8	0.0	0.0
LnGrp Delay(d),s/veh	28.7	0.0	21.3	35.2	0.0	31.9	23.4	0.0	0.0	4.2	0.0	0.0
LnGrp LOS	C		C	D		C	C			A		
Approach Vol, veh/h		334			441			324			550	
Approach Delay, s/veh		22.1			32.5			23.4			4.2	
Approach LOS		C			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0		42.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 29		* 38		* 29		* 38
Max Q Clear Time (g_c+I1), s		21.3		18.5		19.5		2.0
Green Ext Time (p_c), s		1.6		2.8		2.6		6.7

Intersection Summary	
HCM 2010 Ctrl Delay	19.1
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	410	380	35	0	35
Future Volume (vph)	0	410	380	35	0	35
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6	5.6			5.2
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.99			0.87
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.99			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1573	1540			1188
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1573	1540			1188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	413	38	0	38
RTOR Reduction (vph)	0	0	4	0	0	32
Lane Group Flow (vph)	0	446	447	0	0	6
Confl. Peds. (#/hr)				39		46
Confl. Bikes (#/hr)				4		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		50.7	51.8			12.4
Effective Green, g (s)		50.7	51.8			12.4
Actuated g/C Ratio		0.68	0.69			0.17
Clearance Time (s)						5.2
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1063	1063			196
v/s Ratio Prot		c0.28	c0.29			
v/s Ratio Perm						0.01
v/c Ratio		0.42	0.42			0.03
Uniform Delay, d1		5.5	5.1			26.3
Progression Factor		1.63	0.49			1.00
Incremental Delay, d2		0.2	0.2			0.1
Delay (s)		9.2	2.6			26.3
Level of Service		A	A			C
Approach Delay (s)		9.2	2.6		26.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	6.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	285	130	185	285	0	0	0	0	105	881	200
Future Volume (vph)	0	285	130	185	285	0	0	0	0	105	881	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00						1.00	0.89
Flpb, ped/bikes		1.00	1.00	0.98	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1625	1180	1606	1520						4263	1185
Flt Permitted		1.00	1.00	0.49	1.00						0.99	1.00
Satd. Flow (perm)		1625	1180	832	1520						4263	1185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	310	141	201	310	0	0	0	0	114	958	217
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	310	112	201	310	0	0	0	0	0	1072	217
Confl. Peds. (#/hr)			40	40		22			9	9		30
Confl. Bikes (#/hr)			8			4						2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		32.8	32.8	32.8	32.8						33.4	26.4
Effective Green, g (s)		32.8	32.8	32.8	32.8						33.4	26.4
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.45	0.35
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		710	516	363	664						1898	417
v/s Ratio Prot		0.19			0.20							
v/s Ratio Perm			0.09	c0.24							0.25	0.18
v/c Ratio		0.44	0.22	0.55	0.47						0.56	0.52
Uniform Delay, d1		14.7	13.1	15.7	14.9						15.4	19.3
Progression Factor		0.39	0.26	1.02	1.03						0.33	0.43
Incremental Delay, d2		1.8	0.9	4.4	1.7						1.0	3.7
Delay (s)		7.6	4.3	20.3	17.2						6.1	11.9
Level of Service		A	A	C	B						A	B
Approach Delay (s)		6.5			18.4			0.0			7.1	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	230	0	0	345	70	130	1086	50	0	0	0
Future Volume (veh/h)	160	230	0	0	345	70	130	1086	50	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1510	1573	1620			
Adj Flow Rate, veh/h	174	250	0	0	375	65	141	1180	50			
Adj No. of Lanes	1	1	0	0	1	0	1	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	152	604	0	0	443	77	725	1389	59			
Arrive On Green	0.77	0.77	0.00	0.00	0.13	0.13	0.17	0.17	0.17			
Sat Flow, veh/h	842	1573	0	0	1153	200	1438	2756	117			
Grp Volume(v), veh/h	174	250	0	0	0	440	141	639	591			
Grp Sat Flow(s),veh/h/ln	842	1573	0	0	0	1353	1438	1494	1378			
Q Serve(g_s), s	4.9	4.1	0.0	0.0	0.0	23.9	6.3	31.2	31.2			
Cycle Q Clear(g_c), s	28.8	4.1	0.0	0.0	0.0	23.9	6.3	31.2	31.2			
Prop In Lane	1.00		0.00	0.00		0.15	1.00		0.08			
Lane Grp Cap(c), veh/h	152	604	0	0	0	520	725	753	695			
V/C Ratio(X)	1.15	0.41	0.00	0.00	0.00	0.85	0.19	0.85	0.85			
Avail Cap(c_a), veh/h	152	604	0	0	0	520	725	753	695			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.90	0.90	0.00	0.00	0.00	1.00	0.30	0.30	0.30			
Uniform Delay (d), s/veh	22.2	5.8	0.0	0.0	0.0	30.6	18.1	28.5	28.5			
Incr Delay (d2), s/veh	114.7	1.9	0.0	0.0	0.0	15.6	0.2	3.9	4.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	7.9	1.9	0.0	0.0	0.0	11.2	2.6	13.7	12.7			
LnGrp Delay(d),s/veh	136.9	7.7	0.0	0.0	0.0	46.2	18.3	32.3	32.7			
LnGrp LOS	F	A				D	B	C	C			
Approach Vol, veh/h		424			440			1371				
Approach Delay, s/veh		60.7			46.2			31.1				
Approach LOS		E			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 29		* 38		* 29		
Max Q Clear Time (g_c+I1), s		30.8		33.2		25.9		
Green Ext Time (p_c), s		0.0		2.7		0.6		

Intersection Summary		
HCM 2010 Ctrl Delay		39.7
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	295	1136	0	0	0	0	0	230	30
Future Volume (veh/h)	0	0	0	295	1136	0	0	0	0	0	230	30
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.99
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1530	1485	0				0	1485	1530
Adj Flow Rate, veh/h				321	1235	0				0	250	18
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				502	1719	0				0	786	56
Arrive On Green				0.19	0.19	0.00				0.00	0.31	0.31
Sat Flow, veh/h				747	3133	0				0	2593	180
Grp Volume(v), veh/h				558	998	0				0	139	129
Grp Sat Flow(s),veh/h/ln				1299	1230	0				0	1411	1288
Q Serve(g_s), s				30.5	28.5	0.0				0.0	5.6	5.7
Cycle Q Clear(g_c), s				30.5	28.5	0.0				0.0	5.6	5.7
Prop In Lane				0.58		0.00				0.00		0.14
Lane Grp Cap(c), veh/h				817	1404	0				0	440	402
V/C Ratio(X)				0.68	0.71	0.00				0.00	0.32	0.32
Avail Cap(c_a), veh/h				817	1404	0				0	440	402
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				25.4	24.6	0.0				0.0	19.7	19.7
Incr Delay (d2), s/veh				4.6	3.1	0.0				0.0	1.9	2.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.0	10.3	0.0				0.0	2.4	2.3
LnGrp Delay(d),s/veh				30.0	27.7	0.0				0.0	21.6	21.8
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1556						268	
Approach Delay, s/veh					28.6						21.7	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		47.0		28.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 43		23.4				
Max Q Clear Time (g_c+I1), s		32.5		7.7				
Green Ext Time (p_c), s		5.7		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	27.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1316	110	100	235	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1316	110	100	235	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1398	1398	1440	1398	0			
Adj Flow Rate, veh/h				0	1430	82	109	255	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	2229	679	266	553	0			
Arrive On Green				0.00	0.19	0.19	0.10	0.10	0.00			
Sat Flow, veh/h				0	3943	1163	630	1883	0			
Grp Volume(v), veh/h				0	1430	82	197	167	0			
Grp Sat Flow(s),veh/h/ln				0	1272	1163	1241	1209	0			
Q Serve(g_s), s				0.0	25.9	4.4	9.6	9.7	0.0			
Cycle Q Clear(g_c), s				0.0	25.9	4.4	11.2	9.7	0.0			
Prop In Lane				0.00		1.00	0.55		0.00			
Lane Grp Cap(c), veh/h				0	2229	679	452	367	0			
V/C Ratio(X)				0.00	0.64	0.12	0.44	0.45	0.00			
Avail Cap(c_a), veh/h				0	2229	679	452	367	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	23.0	14.4	28.4	27.9	0.0			
Incr Delay (d2), s/veh				0.0	1.4	0.4	3.1	4.0	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	9.4	1.5	4.3	3.7	0.0			
LnGrp Delay(d),s/veh				0.0	24.5	14.7	31.5	31.9	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1512			364				
Approach Delay, s/veh					23.9			31.7				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		48.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 44		* 23				
Max Q Clear Time (g_c+I1), s		27.9		13.2				
Green Ext Time (p_c), s		7.6		1.0				

Intersection Summary		
HCM 2010 Ctrl Delay		25.4
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	90	1371	0	0	0	0	0	190	50
Future Volume (veh/h)	0	0	0	90	1371	0	0	0	0	0	190	50
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.87
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1398	0				0	1398	1440
Adj Flow Rate, veh/h				98	1490	0				0	207	25
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				167	2129	0				0	616	72
Arrive On Green				0.20	0.20	0.00				0.00	0.28	0.28
Sat Flow, veh/h				182	3601	0				0	2290	261
Grp Volume(v), veh/h				590	998	0				0	122	110
Grp Sat Flow(s),veh/h/ln				1353	1158	0				0	1328	1153
Q Serve(g_s), s				21.8	30.1	0.0				0.0	5.5	5.7
Cycle Q Clear(g_c), s				30.4	30.1	0.0				0.0	5.5	5.7
Prop In Lane				0.17		0.00				0.00		0.23
Lane Grp Cap(c), veh/h				882	1414	0				0	368	320
V/C Ratio(X)				0.67	0.71	0.00				0.00	0.33	0.34
Avail Cap(c_a), veh/h				882	1414	0				0	368	320
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.7	23.7	0.0				0.0	21.6	21.7
Incr Delay (d2), s/veh				4.0	3.0	0.0				0.0	2.4	2.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.4	10.3	0.0				0.0	2.2	2.1
LnGrp Delay(d),s/veh				27.7	26.7	0.0				0.0	24.0	24.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1588						232	
Approach Delay, s/veh					27.0						24.3	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		50.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 46		* 21				
Max Q Clear Time (g_c+I1), s		32.4		7.7				
Green Ext Time (p_c), s		6.8		0.7				

Intersection Summary	
HCM 2010 Ctrl Delay	26.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	1226	80	195	120	0	0	130	30
Future Volume (veh/h)	0	0	0	40	1226	80	195	120	0	0	130	30
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.97		1.00	1.00		0.93
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				43	1333	77	212	130	0	0	141	21
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				72	2357	141	371	685	0	0	358	53
Arrive On Green				0.17	0.17	0.17	0.02	0.12	0.00	0.00	0.26	0.26
Sat Flow, veh/h				139	4591	274	1748	1835	0	0	1375	205
Grp Volume(v), veh/h				537	446	470	212	130	0	0	0	162
Grp Sat Flow(s),veh/h/ln				1741	1590	1674	1748	1835	0	0	0	1580
Q Serve(g_s), s				21.4	19.3	19.3	0.0	4.8	0.0	0.0	0.0	6.3
Cycle Q Clear(g_c), s				21.4	19.3	19.3	0.0	4.8	0.0	0.0	0.0	6.3
Prop In Lane				0.08		0.16	1.00		0.00	0.00		0.13
Lane Grp Cap(c), veh/h				894	816	859	371	685	0	0	0	411
V/C Ratio(X)				0.60	0.55	0.55	0.57	0.19	0.00	0.00	0.00	0.39
Avail Cap(c_a), veh/h				894	816	859	371	685	0	0	0	411
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				24.0	23.2	23.2	30.1	22.7	0.0	0.0	0.0	22.9
Incr Delay (d2), s/veh				3.0	2.6	2.5	6.2	0.6	0.0	0.0	0.0	2.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.0	9.1	9.5	5.0	2.5	0.0	0.0	0.0	3.1
LnGrp Delay(d),s/veh				27.0	25.8	25.7	36.3	23.3	0.0	0.0	0.0	25.7
LnGrp LOS				C	C	C	D	C				C
Approach Vol, veh/h					1453			342			162	
Approach Delay, s/veh					26.2			31.4			25.7	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.0	24.0		43.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			4.0	19.5		38.5		28.0
Max Q Clear Time (g_c+I1), s			2.0	8.3		23.4		6.8
Green Ext Time (p_c), s			0.3	0.8		10.6		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	27.1
HCM 2010 LOS	C

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	20	19	95.7%	10.5	4.3	B
	Through	5	6	125.1%	24.4	17.8	C
	Right Turn						
	Subtotal	25	25	101.6%	14.5	5.5	B
SB	Left Turn						
	Through	5	3	51.5%	6.7	12.7	A
	Right Turn	5	7	139.8%	15.4	12.5	C
	Subtotal	10	10	95.7%	17.0	11.6	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	30	27	89.5%	2.5	0.3	A
	Through	1,321	1,301	98.5%	2.4	0.4	A
	Right Turn	5	5	103.0%	1.8	1.1	A
	Subtotal	1,356	1,333	98.3%	2.4	0.4	A
Total		1,391	1,368	98.3%	2.7	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	83	78	93.6%	15.5	2.7	B
	Through	10	9	92.0%	14.5	11.7	B
	Right Turn						
	Subtotal	93	87	93.4%	15.8	2.7	B
SB	Left Turn						
	Through	40	37	92.9%	36.0	9.2	D
	Right Turn	10	8	81.0%	18.6	9.2	B
	Subtotal	50	45	90.5%	32.5	8.8	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	452	433	95.8%	25.5	12.6	C
	Through	1,293	1,275	98.6%	8.4	2.8	A
	Right Turn	30	32	105.5%	6.5	2.6	A
	Subtotal	1,775	1,740	98.0%	12.7	5.1	B
Total		1,918	1,872	97.6%	13.3	4.8	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	160	1659	55	31	195	0	0	280	165
Future Volume (veh/h)	0	0	0	160	1659	55	31	195	0	0	280	165
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.92	1.00		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1620	1573	1620	1620	1573	0	0	1510	1555
Adj Flow Rate, veh/h				174	1803	56	34	212	0	0	304	172
Adj No. of Lanes				0	3	0	0	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				202	2230	71	55	215	0	0	252	142
Arrive On Green				0.18	0.18	0.18	0.11	0.11	0.00	0.00	0.11	0.11
Sat Flow, veh/h				364	4030	129	0	659	0	0	771	436
Grp Volume(v), veh/h				743	621	669	246	0	0	0	0	476
Grp Sat Flow(s),veh/h/ln				1555	1431	1537	659	0	0	0	0	1207
Q Serve(g_s), s				34.8	31.0	31.2	0.0	0.0	0.0	0.0	0.0	24.5
Cycle Q Clear(g_c), s				34.8	31.0	31.2	24.5	0.0	0.0	0.0	0.0	24.5
Prop In Lane				0.23		0.08	0.14		0.00	0.00		0.36
Lane Grp Cap(c), veh/h				860	792	850	270	0	0	0	0	394
V/C Ratio(X)				0.86	0.78	0.79	0.91	0.00	0.00	0.00	0.00	1.21
Avail Cap(c_a), veh/h				860	792	850	270	0	0	0	0	394
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				27.9	26.4	26.4	28.8	0.0	0.0	0.0	0.0	33.5
Incr Delay (d2), s/veh				11.2	7.7	7.3	36.1	0.0	0.0	0.0	0.0	115.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.7	14.0	15.0	7.8	0.0	0.0	0.0	0.0	20.8
LnGrp Delay(d),s/veh				39.1	34.0	33.7	64.9	0.0	0.0	0.0	0.0	148.5
LnGrp LOS				D	C	C	E					F
Approach Vol, veh/h					2033			246			476	
Approach Delay, s/veh					35.8			64.9			148.5	
Approach LOS					D			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				29.0		46.0		29.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				24.5		41.5		24.5
Max Q Clear Time (g_c+I1), s				26.5		36.8		26.5
Green Ext Time (p_c), s				0.0		3.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	57.8
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	235	1799	20	50	50	0	0	50	10
Future Volume (vph)	0	0	0	235	1799	20	50	50	0	0	50	10
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6			7.6	
Lane Util. Factor					0.91		1.00	1.00			1.00	
Frpb, ped/bikes					1.00		1.00	1.00			0.99	
Flpb, ped/bikes					0.98		0.93	1.00			1.00	
Frt					1.00		1.00	1.00			0.98	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3714		1060	1237			1191	
Flt Permitted					0.99		0.71	1.00			1.00	
Satd. Flow (perm)					3714		797	1237			1191	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	255	1955	22	54	54	0	0	54	11
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	6	0
Lane Group Flow (vph)	0	0	0	0	2231	0	54	54	0	0	59	0
Confl. Peds. (#/hr)			73	73		38	49		63			49
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			4			8	
Permitted Phases				6			4					
Actuated Green, G (s)					51.6		19.2	19.2			19.2	
Effective Green, g (s)					51.6		19.2	19.2			19.2	
Actuated g/C Ratio					0.57		0.21	0.21			0.21	
Clearance Time (s)					11.6		7.6	7.6			7.6	
Lane Grp Cap (vph)					2129		170	263			254	
v/s Ratio Prot								0.04			0.05	
v/s Ratio Perm					0.60		c0.07					
v/c Ratio					1.05		0.32	0.21			0.23	
Uniform Delay, d1					19.2		29.9	29.1			29.3	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					33.4		4.9	1.8			2.1	
Delay (s)					52.6		34.7	30.9			31.4	
Level of Service					D		C	C			C	
Approach Delay (s)		0.0			52.6			32.8			31.4	
Approach LOS		A			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	51.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	145.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	420	1553	0	0	0	0	0	750	446
Future Volume (veh/h)	0	0	0	420	1553	0	0	0	0	0	750	446
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1545	1573	0				0	1573	1485
Adj Flow Rate, veh/h				457	1688	0				0	815	475
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				763	2139	0				0	1832	446
Arrive On Green				0.15	0.15	0.00				0.00	0.14	0.14
Sat Flow, veh/h				1471	4718	0				0	4435	1045
Grp Volume(v), veh/h				457	1688	0				0	815	475
Grp Sat Flow(s),veh/h/ln				1471	1573	0				0	1431	1045
Q Serve(g_s), s				22.1	25.9	0.0				0.0	13.0	32.0
Cycle Q Clear(g_c), s				22.1	25.9	0.0				0.0	13.0	32.0
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				763	2139	0				0	1832	446
V/C Ratio(X)				0.60	0.79	0.00				0.00	0.44	1.07
Avail Cap(c_a), veh/h				763	2139	0				0	1832	446
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				26.8	28.4	0.0				0.0	24.1	32.2
Incr Delay (d2), s/veh				3.5	3.1	0.0				0.0	0.8	61.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				9.7	11.9	0.0				0.0	5.3	16.8
LnGrp Delay(d),s/veh				30.3	31.5	0.0				0.0	24.9	93.3
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2145						1290	
Approach Delay, s/veh					31.2						50.1	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						38.0		37.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						34.0		32.0
Max Q Clear Time (g_c+I1), s						27.9		34.0
Green Ext Time (p_c), s						4.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	38.3
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1025	120	958	1151	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1025	120	958	1151	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1485	1485	1398	1398	0			
Adj Flow Rate, veh/h				0	1114	98	1041	1251	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	1379	403	1438	1510	0			
Arrive On Green				0.00	0.34	0.34	0.18	0.18	0.00			
Sat Flow, veh/h				0	4189	1186	2663	2796	0			
Grp Volume(v), veh/h				0	1114	98	1041	1251	0			
Grp Sat Flow(s),veh/h/ln				0	1352	1186	1331	1398	0			
Q Serve(g_s), s				0.0	18.7	4.5	27.7	32.4	0.0			
Cycle Q Clear(g_c), s				0.0	18.7	4.5	27.7	32.4	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1379	403	1438	1510	0			
V/C Ratio(X)				0.00	0.81	0.24	0.72	0.83	0.00			
Avail Cap(c_a), veh/h				0	1379	403	1438	1510	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.5	17.8	25.5	27.5	0.0			
Incr Delay (d2), s/veh				0.0	5.2	1.4	3.2	5.4	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	7.6	1.6	10.9	13.6	0.0			
LnGrp Delay(d),s/veh				0.0	27.7	19.2	28.7	32.9	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1212			2292				
Approach Delay, s/veh					27.0			31.0				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				45.0		30.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				40.5		25.5		
Max Q Clear Time (g_c+I1), s				34.4		20.7		
Green Ext Time (p_c), s				5.1		2.7		

Intersection Summary	
HCM 2010 Ctrl Delay	29.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1931	80	0	0	0	0	0	255	70	450	0
Future Volume (veh/h)	0	1931	80	0	0	0	0	0	255	70	450	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.99	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1660	1710				0	1573	1620	1748	1748	0
Adj Flow Rate, veh/h	0	2099	80				0	0	261	76	489	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1126	1125	1488	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1323	1095	1748	0
Grp Volume(v), veh/h		0.0					0	0	261	76	489	0
Grp Sat Flow(s),veh/h/ln							0	0	1323	1095	1748	0
Q Serve(g_s), s							0.0	0.0	1.1	1.6	6.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	1.1	2.7	6.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1126	1125	1488	0
V/C Ratio(X)							0.00	0.00	0.23	0.07	0.33	0.00
Avail Cap(c_a), veh/h							0	0	1126	1125	1488	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	3.1	4.1	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.5	0.1	0.6	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.5	0.5	3.6	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.9	3.2	4.7	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								261			565	
Approach Delay, s/veh								0.9			4.5	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				31.0				31.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				26.4				26.4
Max Q Clear Time (g_c+I1), s				8.9				3.1
Green Ext Time (p_c), s				1.4				0.7

Intersection Summary			
HCM 2010 Ctrl Delay			3.4
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2146	0	0	0	0	0	200	90	0	0	0
Future Volume (veh/h)	110	2146	0	0	0	0	0	200	90	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1485	0				0	1485	1440			
Adj Flow Rate, veh/h	120	2333	0				0	217	94			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	158	2406	0				0	549	228			
Arrive On Green	0.20	0.20	0.00				0.00	0.28	0.28			
Sat Flow, veh/h	171	3975	0				0	1978	823			
Grp Volume(v), veh/h	866	1587	0				0	161	150			
Grp Sat Flow(s),veh/h/ln	1443	1352	0				0	1485	1315			
Q Serve(g_s), s	38.6	43.7	0.0				0.0	6.6	7.0			
Cycle Q Clear(g_c), s	44.9	43.7	0.0				0.0	6.6	7.0			
Prop In Lane	0.14		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	928	1637	0				0	412	365			
V/C Ratio(X)	0.93	0.97	0.00				0.00	0.39	0.41			
Avail Cap(c_a), veh/h	928	1637	0				0	412	365			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	29.7	29.3	0.0				0.0	22.0	22.1			
Incr Delay (d2), s/veh	17.2	16.2	0.0				0.0	2.8	3.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	22.4	20.1	0.0				0.0	3.0	2.9			
LnGrp Delay(d),s/veh	46.9	45.5	0.0				0.0	24.7	25.5			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2453						311				
Approach Delay, s/veh		46.0						25.1				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				25.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		45.4		
Max Q Clear Time (g_c+I1), s				9.0		46.9		
Green Ext Time (p_c), s				1.9		0.0		

Intersection Summary		
HCM 2010 Ctrl Delay		43.6
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2161	70	0	0	0	0	0	160	70	220	0
Future Volume (veh/h)	0	2161	70	0	0	0	0	0	160	70	220	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1382				0	1573	1591	1545	1485	0
Adj Flow Rate, veh/h	0	2349	71				0	0	157	76	239	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1077	1127	1238	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.83	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1292	1061	1485	0
Grp Volume(v), veh/h		0.0					0	0	157	76	239	0
Grp Sat Flow(s),veh/h/ln							0	0	1292	1061	1485	0
Q Serve(g_s), s							0.0	0.0	0.6	1.5	3.3	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.6	2.1	3.3	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1077	1127	1238	0
V/C Ratio(X)							0.00	0.00	0.15	0.07	0.19	0.00
Avail Cap(c_a), veh/h							0	0	1077	1127	1238	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	2.6	2.8	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.3	0.1	0.3	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.3	0.5	1.5	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.7	2.7	3.2	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								157			315	
Approach Delay, s/veh								0.7			3.1	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				27.0				27.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				22.5				22.5
Max Q Clear Time (g_c+I1), s				5.3				2.6
Green Ext Time (p_c), s				0.7				0.4

Intersection Summary	
HCM 2010 Ctrl Delay	2.3
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	2096	195	0	0	0	0	240	20	50	115	0
Future Volume (veh/h)	90	2096	195	0	0	0	0	240	20	50	115	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97				1.00		0.96	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	98	2278	197				0	261	12	54	125	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	102	2494	219				0	685	31	285	530	0
Arrive On Green	0.19	0.19	0.19				0.00	0.22	0.22	0.01	0.11	0.00
Sat Flow, veh/h	180	4423	388				0	3149	140	1581	1660	0
Grp Volume(v), veh/h	945	784	844				0	134	139	54	125	0
Grp Sat Flow(s),veh/h/ln	1739	1590	1663				0	1577	1629	1581	1660	0
Q Serve(g_s), s	40.5	36.1	37.3				0.0	5.4	5.5	0.0	5.2	0.0
Cycle Q Clear(g_c), s	40.5	36.1	37.3				0.0	5.4	5.5	0.0	5.2	0.0
Prop In Lane	0.10		0.23				0.00		0.09	1.00		0.00
Lane Grp Cap(c), veh/h	980	897	937				0	352	364	285	530	0
V/C Ratio(X)	0.96	0.87	0.90				0.00	0.38	0.38	0.19	0.24	0.00
Avail Cap(c_a), veh/h	980	897	937				0	352	364	285	530	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	29.8	28.0	28.5				0.0	24.8	24.8	28.6	25.2	0.0
Incr Delay (d2), s/veh	21.3	11.6	13.3				0.0	3.1	3.0	1.5	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.3	18.8	20.6				0.0	2.6	2.7	1.1	2.5	0.0
LnGrp Delay(d),s/veh	51.1	39.6	41.9				0.0	27.9	27.8	30.0	26.3	0.0
LnGrp LOS	D	D	D					C	C	C	C	
Approach Vol, veh/h		2573						273			179	
Approach Delay, s/veh		44.6						27.8			27.4	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		47.0		28.2			7.2	21.0
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		42.4		* 24			* 3	* 17
Max Q Clear Time (g_c+I1), s		42.5		7.2			2.0	7.5
Green Ext Time (p_c), s		0.0		0.7			0.0	1.4

Intersection Summary	
HCM 2010 Ctrl Delay	42.1
HCM 2010 LOS	D

Notes

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

BioMarin
Baseline + BioMarin Only Conditions
AM Peak Hour

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	37	30	81.6%	15.6	6.6	C
	Through						
	Right Turn						
	Subtotal	37	30	81.6%	15.6	6.6	C
EB	Left Turn	25	25	98.6%	3.2	0.6	A
	Through	2,151	2,098	97.5%	2.6	0.1	A
	Right Turn						
	Subtotal	2,176	2,122	97.5%	2.6	0.1	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,213	2,152	97.3%	2.8	0.2	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	52	52	100.5%	16.3	3.1	B
	Right Turn	261	279	106.7%	18.0	4.2	B
	Subtotal	313	331	105.7%	17.8	3.4	B
SB	Left Turn	62	57	92.6%	38.0	5.4	D
	Through	427	407	95.3%	35.7	2.5	D
	Right Turn						
	Subtotal	489	464	95.0%	35.9	2.5	D
EB	Left Turn	41	35	85.3%	11.0	2.9	B
	Through	2,122	2,056	96.9%	12.0	1.2	B
	Right Turn	60	58	96.3%	9.9	3.0	A
	Subtotal	2,223	2,149	96.7%	11.9	1.1	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,025	2,944	97.3%	16.4	0.7	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	135	2270	40	0	0	0	0	106	50	130	255	0
Future Volume (veh/h)	135	2270	40	0	0	0	0	106	50	130	255	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1398	1382	1342	0
Adj Flow Rate, veh/h	147	2467	22				0	115	42	141	277	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	139	2510	598				0	500	411	284	541	0
Arrive On Green	0.18	0.18	0.18				0.00	0.36	0.36	0.12	0.12	0.00
Sat Flow, veh/h	262	4730	1126				0	1398	1151	571	1575	0
Grp Volume(v), veh/h	776	1838	22				0	115	42	215	203	0
Grp Sat Flow(s),veh/h/ln	1385	1202	1126				0	1398	1151	925	1160	0
Q Serve(g_s), s	39.8	37.9	1.2				0.0	4.3	1.8	13.6	12.3	0.0
Cycle Q Clear(g_c), s	39.8	37.9	1.2				0.0	4.3	1.8	17.9	12.3	0.0
Prop In Lane	0.19		1.00				0.00		1.00	0.66		0.00
Lane Grp Cap(c), veh/h	735	1914	598				0	500	411	410	415	0
V/C Ratio(X)	1.06	0.96	0.04				0.00	0.23	0.10	0.53	0.49	0.00
Avail Cap(c_a), veh/h	735	1914	598				0	500	411	410	415	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.9	30.1	15.0				0.0	16.9	16.1	30.3	26.7	0.0
Incr Delay (d2), s/veh	49.1	13.1	0.1				0.0	1.1	0.5	4.7	4.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.3	14.9	0.4				0.0	1.8	0.6	4.8	4.4	0.0
LnGrp Delay(d),s/veh	80.0	43.2	15.1				0.0	18.0	16.6	35.0	30.8	0.0
LnGrp LOS	F	D	B					B	B	D	C	
Approach Vol, veh/h		2636						157			418	
Approach Delay, s/veh		53.8						17.6			33.0	
Approach LOS		D						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		44.0		31.0				31.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 40		* 27				* 27
Max Q Clear Time (g_c+I1), s		41.8		6.3				19.9
Green Ext Time (p_c), s		0.0		0.5				1.0

Intersection Summary		
HCM 2010 Ctrl Delay		49.3
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	2325	60	0	0	0	0	50	250	110	180	0
Future Volume (veh/h)	50	2325	60	0	0	0	0	50	250	110	180	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1454	1398	1398	0
Adj Flow Rate, veh/h	54	2527	39				0	54	233	120	196	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	59	2940	651				0	317	273	265	317	0
Arrive On Green	0.20	0.20	0.20				0.00	0.23	0.23	0.07	0.07	0.00
Sat Flow, veh/h	98	4902	1086				0	1398	1203	862	1398	0
Grp Volume(v), veh/h	769	1812	39				0	54	233	120	196	0
Grp Sat Flow(s),veh/h/ln	1393	1202	1086				0	1398	1203	862	1398	0
Q Serve(g_s), s	40.6	36.2	2.2				0.0	2.3	13.9	10.2	10.2	0.0
Cycle Q Clear(g_c), s	40.6	36.2	2.2				0.0	2.3	13.9	12.6	10.2	0.0
Prop In Lane	0.07		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	835	2163	651				0	317	273	265	317	0
V/C Ratio(X)	0.92	0.84	0.06				0.00	0.17	0.85	0.45	0.62	0.00
Avail Cap(c_a), veh/h	835	2163	651				0	569	489	420	569	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	28.3	26.6	12.9				0.0	23.3	27.8	33.8	31.5	0.0
Incr Delay (d2), s/veh	2.1	0.4	0.0				0.0	0.3	7.4	1.2	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.2	12.2	0.7				0.0	0.9	5.2	2.5	4.1	0.0
LnGrp Delay(d),s/veh	30.5	27.0	12.9				0.0	23.6	35.2	34.9	33.4	0.0
LnGrp LOS	C	C	B					C	D	C	C	
Approach Vol, veh/h		2620						287			316	
Approach Delay, s/veh		27.8						33.0			34.0	
Approach LOS		C						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		51.5		23.5				23.5
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		31.5		30.5				30.5
Max Q Clear Time (g_c+I1), s		42.6		15.9				14.6
Green Ext Time (p_c), s		0.0		1.1				1.4

Intersection Summary			
HCM 2010 Ctrl Delay			28.9
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1171	1354	0	0	0	0	0	0	195	975	0
Future Volume (veh/h)	0	1171	1354	0	0	0	0	0	0	195	975	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1485							1485	1485	0
Adj Flow Rate, veh/h	0	1273	1447							212	1060	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.92	0.92	0.92							0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3							3	3	0
Cap, veh/h	0	2050	1162							519	1089	0
Arrive On Green	0.00	0.15	0.15							0.12	0.12	0.00
Sat Flow, veh/h	0	4456	2525							1415	2971	0
Grp Volume(v), veh/h	0	1273	1447							212	1060	0
Grp Sat Flow(s),veh/h/ln	0	1485	1263							1415	1485	0
Q Serve(g_s), s	0.0	20.1	34.5							10.4	26.7	0.0
Cycle Q Clear(g_c), s	0.0	20.1	34.5							10.4	26.7	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2050	1162							519	1089	0
V/C Ratio(X)	0.00	0.62	1.25							0.41	0.97	0.00
Avail Cap(c_a), veh/h	0	2050	1162							519	1089	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.12	0.12							0.81	0.81	0.00
Uniform Delay (d), s/veh	0.0	25.7	31.8							25.4	32.6	0.0
Incr Delay (d2), s/veh	0.0	0.2	111.5							0.4	18.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.3	30.0							4.1	13.8	0.0
LnGrp Delay(d),s/veh	0.0	25.9	143.3							25.9	51.0	0.0
LnGrp LOS		C	F							C	D	
Approach Vol, veh/h		2720									1272	
Approach Delay, s/veh		88.4									46.8	
Approach LOS		F									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		43.0		32.0				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		34.5		27.5				
Max Q Clear Time (g_c+I1), s		36.5		28.7				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary		
HCM 2010 Ctrl Delay		75.1
HCM 2010 LOS		E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	721	815	0	0	0	0	0	1398	460	0	0	0
Future Volume (veh/h)	721	815	0	0	0	0	0	1398	460	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1454	1485	0				0	1398	1398			
Adj Flow Rate, veh/h	784	886	0				0	1520	463			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	1329	1220	0				0	1946	551			
Arrive On Green	0.14	0.14	0.00				0.00	0.46	0.46			
Sat Flow, veh/h	2769	2971	0				0	4194	1188			
Grp Volume(v), veh/h	784	886	0				0	1520	463			
Grp Sat Flow(s),veh/h/ln	1385	1485	0				0	1398	1188			
Q Serve(g_s), s	20.2	21.4	0.0				0.0	22.8	25.7			
Cycle Q Clear(g_c), s	20.2	21.4	0.0				0.0	22.8	25.7			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1329	1220	0				0	1946	551			
V/C Ratio(X)	0.59	0.73	0.00				0.00	0.78	0.84			
Avail Cap(c_a), veh/h	1329	1220	0				0	1946	551			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	27.9	28.4	0.0				0.0	16.9	17.7			
Incr Delay (d2), s/veh	1.9	3.8	0.0				0.0	3.2	14.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.1	9.5	0.0				0.0	9.3	10.5			
LnGrp Delay(d),s/veh	29.8	32.2	0.0				0.0	20.1	31.9			
LnGrp LOS	C	C						C	C			
Approach Vol, veh/h		1670						1983				
Approach Delay, s/veh		31.0						22.9				
Approach LOS		C						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		35.0		40.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 31		* 35				
Max Q Clear Time (g_c+I1), s		23.4		27.7				
Green Ext Time (p_c), s		6.3		6.5				

Intersection Summary	
HCM 2010 Ctrl Delay	26.6
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	20	310	50	5	80	210	63	50	279	150	61	201
Future Volume (veh/h)	20	310	50	5	80	210	63	50	279	150	61	201
Number	5	2	12		1	6	16	3	8	18	7	4
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94		1.00		0.97	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2019	2019	2000		1942	1942	2000	1845	1845	1900	1845	1845
Adj Flow Rate, veh/h	22	337	46		87	228	55	54	303	139	66	218
Adj No. of Lanes	1	1	0		1	1	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3		3	3	3	3	3	3	3	3
Cap, veh/h	58	420	57		158	448	108	152	368	169	170	536
Arrive On Green	0.03	0.24	0.24		0.09	0.30	0.30	0.09	0.31	0.31	0.10	0.32
Sat Flow, veh/h	1923	1726	236		1849	1503	362	1757	1185	543	1757	1668
Grp Volume(v), veh/h	22	0	383		87	0	283	54	0	442	66	0
Grp Sat Flow(s),veh/h/ln	1923	0	1961		1849	0	1865	1757	0	1728	1757	0
Q Serve(g_s), s	0.7	0.0	11.9		2.9	0.0	8.1	1.9	0.0	15.4	2.3	0.0
Cycle Q Clear(g_c), s	0.7	0.0	11.9		2.9	0.0	8.1	1.9	0.0	15.4	2.3	0.0
Prop In Lane	1.00		0.12		1.00		0.19	1.00		0.31	1.00	
Lane Grp Cap(c), veh/h	58	0	477		158	0	557	152	0	538	170	0
V/C Ratio(X)	0.38	0.00	0.80		0.55	0.00	0.51	0.36	0.00	0.82	0.39	0.00
Avail Cap(c_a), veh/h	237	0	669		285	0	693	244	0	714	244	0
HCM Platoon Ratio	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00		1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.8	0.0	23.1		28.5	0.0	18.8	27.9	0.0	20.7	27.5	0.0
Incr Delay (d2), s/veh	1.5	0.0	4.8		1.1	0.0	0.7	0.5	0.0	5.8	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	7.0		1.5	0.0	4.3	0.9	0.0	8.1	1.1	0.0
LnGrp Delay(d),s/veh	32.3	0.0	27.9		29.6	0.0	19.5	28.4	0.0	26.5	28.0	0.0
LnGrp LOS	C		C		C		B	C		C	C	
Approach Vol, veh/h		405				370			496			302
Approach Delay, s/veh		28.1				21.9			26.7			19.9
Approach LOS		C				C			C			B

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.5	20.7	9.6	25.0	6.0	24.2	10.3	24.4
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	22.1	9.0	* 27	8.0	24.1	9.0	* 27
Max Q Clear Time (g_c+I1), s	4.9	13.9	3.9	8.6	2.7	10.1	4.3	17.4
Green Ext Time (p_c), s	0.1	1.1	0.0	0.9	0.0	0.9	0.0	1.4

Intersection Summary	
HCM 2010 Ctrl Delay	24.6
HCM 2010 LOS	C

Notes

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	20
Future Volume (veh/h)	20
Number	14
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.91
Parking Bus, Adj	1.00
Adj Sat Flow, veh/h/ln	1900
Adj Flow Rate, veh/h	18
Adj No. of Lanes	0
Peak Hour Factor	0.92
Percent Heavy Veh, %	3
Cap, veh/h	44
Arrive On Green	0.32
Sat Flow, veh/h	138
Grp Volume(v), veh/h	236
Grp Sat Flow(s),veh/h/ln	1805
Q Serve(g_s), s	6.6
Cycle Q Clear(g_c), s	6.6
Prop In Lane	0.08
Lane Grp Cap(c), veh/h	580
V/C Ratio(X)	0.41
Avail Cap(c_a), veh/h	746
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	17.2
Incr Delay (d2), s/veh	0.5
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	3.4
LnGrp Delay(d),s/veh	17.6
LnGrp LOS	B
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	

Timer

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	545	25	0	690	25	5
Future Volume (vph)	545	25	0	690	25	5
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			3.0	5.2	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	0.98	
Frt	0.99			1.00	0.98	
Flt Protected	1.00			1.00	0.96	
Satd. Flow (prot)	1560			1573	1441	
Flt Permitted	1.00			1.00	0.96	
Satd. Flow (perm)	1560			1573	1441	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	592	27	0	750	27	5
RTOR Reduction (vph)	2	0	0	0	4	0
Lane Group Flow (vph)	617	0	0	750	28	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA	Perm	
Protected Phases	2			3 4 6		
Permitted Phases					8	
Actuated Green, G (s)	30.1			51.2	13.4	
Effective Green, g (s)	30.1			45.6	13.4	
Actuated g/C Ratio	0.40			0.61	0.18	
Clearance Time (s)	5.6				5.2	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	626			956	257	
v/s Ratio Prot	c0.40			c0.48		
v/s Ratio Perm					c0.02	
v/c Ratio	0.98			0.78	0.11	
Uniform Delay, d1	22.2			11.0	25.8	
Progression Factor	0.78			0.69	1.05	
Incremental Delay, d2	28.6			0.4	0.2	
Delay (s)	46.0			7.9	27.3	
Level of Service	D			A	C	
Approach Delay (s)	46.0			7.9	27.3	
Approach LOS	D			A	C	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	365	20	0	330	50	10	10	10	5	25	20
Future Volume (vph)	0	365	20	0	330	50	10	10	10	5	25	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6			5.6	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			1.00			0.98	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		0.99			0.98			0.95			0.94	
Flt Protected		1.00			1.00			0.98			1.00	
Satd. Flow (prot)		1558			1536			1466			1452	
Flt Permitted		1.00			1.00			0.87			0.97	
Satd. Flow (perm)		1558			1536			1293			1409	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	397	22	0	359	54	11	11	11	5	27	22
RTOR Reduction (vph)	0	2	0	0	5	0	0	10	0	0	20	0
Lane Group Flow (vph)	0	417	0	0	408	0	0	23	0	0	34	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			4 6			8			8	
Permitted Phases							8			8		
Actuated Green, G (s)		39.8			56.0			7.8			7.8	
Effective Green, g (s)		39.8			56.0			7.8			7.8	
Actuated g/C Ratio		0.53			0.75			0.10			0.10	
Clearance Time (s)		5.6						5.6			5.6	
Vehicle Extension (s)		3.0						1.5			1.5	
Lane Grp Cap (vph)		826			1146			134			146	
v/s Ratio Prot		c0.27			c0.27							
v/s Ratio Perm								0.02			c0.02	
v/c Ratio		0.50			0.36			0.17			0.23	
Uniform Delay, d1		11.3			3.3			30.7			30.9	
Progression Factor		0.72			0.06			0.63			0.83	
Incremental Delay, d2		1.7			0.1			0.2			0.3	
Delay (s)		9.8			0.3			19.4			25.8	
Level of Service		A			A			B			C	
Approach Delay (s)		9.8			0.3			19.4			25.8	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	550	0	0	685	5	20
Future Volume (vph)	550	0	0	685	5	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			5.6	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.89	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1573			1573	1387	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1573			1573	1387	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	598	0	0	745	5	22
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	598	0	0	745	10	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	48.7			30.1	15.5	
Effective Green, g (s)	43.5			30.1	15.5	
Actuated g/C Ratio	0.58			0.40	0.21	
Clearance Time (s)				5.6		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	912			631	286	
v/s Ratio Prot	c0.38			c0.47	c0.01	
v/s Ratio Perm						
v/c Ratio	0.66			1.18	0.03	
Uniform Delay, d1	10.7			22.4	23.8	
Progression Factor	0.61			1.15	0.81	
Incremental Delay, d2	0.5			88.9	0.0	
Delay (s)	7.0			114.6	19.3	
Level of Service	A			F	B	
Approach Delay (s)	7.0			114.6	19.3	
Approach LOS	A			F	B	

Intersection Summary			
HCM 2000 Control Delay	65.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	380	0	0	340	20	40	5	25	0	0	0
Future Volume (vph)	0	380	0	0	340	20	40	5	25	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.98				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.97				
Satd. Flow (prot)		1573			1557			1431				
Flt Permitted		1.00			1.00			0.97				
Satd. Flow (perm)		1573			1557			1431				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	413	0	0	370	22	43	5	27	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	23	0	0	0	0
Lane Group Flow (vph)	0	413	0	0	390	0	0	52	0	0	0	0
Confl. Peds. (#/hr)	10					10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		53.2			39.8			10.6				
Effective Green, g (s)		53.2			39.8			10.6				
Actuated g/C Ratio		0.71			0.53			0.14				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1115			826			202				
v/s Ratio Prot		c0.26			c0.25			c0.04				
v/s Ratio Perm												
v/c Ratio		0.37			0.47			0.26				
Uniform Delay, d1		4.3			11.0			28.7				
Progression Factor		0.01			0.51			1.27				
Incremental Delay, d2		0.1			1.8			0.2				
Delay (s)		0.1			7.4			36.5				
Level of Service		A			A			D				
Approach Delay (s)		0.1			7.4			36.5			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	410	0	0	405	75	10	5	10	0	0	0
Future Volume (vph)	0	410	0	0	405	75	10	5	10	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1512			1441				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1512			1441				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	0	0	440	82	11	5	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	446	0	0	514	0	0	18	0	0	0	0
Confl. Peds. (#/hr)	39		22			39			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		50.7			32.7			13.5				
Effective Green, g (s)		50.7			32.7			13.5				
Actuated g/C Ratio		0.68			0.44			0.18				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1063			659			259				
v/s Ratio Prot		c0.28			c0.34			c0.01				
v/s Ratio Perm												
v/c Ratio		0.42			0.78			0.07				
Uniform Delay, d1		5.5			18.1			25.5				
Progression Factor		0.06			0.94			1.01				
Incremental Delay, d2		0.3			7.9			0.1				
Delay (s)		0.6			24.9			25.8				
Level of Service		A			C			C				
Approach Delay (s)		0.6			24.9			25.8			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	465	20	50	530	70	10	490	50	0	360	300
Future Volume (veh/h)	260	465	20	50	530	70	10	490	50	0	360	300
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1676	1676	1710	1676	1676	1710	1800	1694	1728	0	1765	1728
Adj Flow Rate, veh/h	271	484	19	52	552	67	10	510	42	0	375	116
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	2	2
Cap, veh/h	180	941	37	435	640	78	53	1125	91	0	968	294
Arrive On Green	0.11	0.59	0.59	0.87	0.87	0.87	0.77	0.77	0.77	0.00	0.39	0.39
Sat Flow, veh/h	1597	1601	63	844	1463	178	18	2904	236	0	2586	759
Grp Volume(v), veh/h	271	0	503	52	0	619	298	0	264	0	250	241
Grp Sat Flow(s),veh/h/ln	1597	0	1664	844	0	1640	1677	0	1480	0	1676	1580
Q Serve(g_s), s	9.0	0.0	14.3	1.0	0.0	15.4	0.0	0.0	5.0	0.0	8.6	8.8
Cycle Q Clear(g_c), s	9.0	0.0	14.3	3.3	0.0	15.4	4.9	0.0	5.0	0.0	8.6	8.8
Prop In Lane	1.00		0.04	1.00		0.11	0.03		0.16	0.00		0.48
Lane Grp Cap(c), veh/h	180	0	978	435	0	718	696	0	574	0	650	612
V/C Ratio(X)	1.51	0.00	0.51	0.12	0.00	0.86	0.43	0.00	0.46	0.00	0.38	0.39
Avail Cap(c_a), veh/h	180	0	978	435	0	718	696	0	574	0	650	612
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.81	0.00	0.81	0.81	0.00	0.81	0.00	1.00	1.00
Uniform Delay (d), s/veh	35.5	0.0	9.8	3.3	0.0	3.8	6.1	0.0	6.1	0.0	17.6	17.7
Incr Delay (d2), s/veh	255.5	0.0	1.9	0.5	0.0	10.9	1.6	0.0	2.2	0.0	1.7	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.7	0.0	7.1	0.3	0.0	8.0	2.4	0.0	2.2	0.0	4.3	4.1
LnGrp Delay(d),s/veh	291.0	0.0	11.7	3.7	0.0	14.6	7.6	0.0	8.2	0.0	19.3	19.6
LnGrp LOS	F		B	A		B	A		A		B	B
Approach Vol, veh/h		774			671			562			491	
Approach Delay, s/veh		109.5			13.8			7.9			19.5	
Approach LOS		F			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		51.2		35.8	12.0	39.2		35.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 47		24.4	9.0	* 35		24.4
Max Q Clear Time (g_c+I1), s		16.3		7.0	11.0	17.4		10.8
Green Ext Time (p_c), s		5.4		4.6	0.0	6.3		3.5

Intersection Summary	
HCM 2010 Ctrl Delay	43.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	50	40	175	0	0	0	0	230	1166	450
Future Volume (vph)	0	490	50	40	175	0	0	0	0	230	1166	450
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.98
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.99			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2769			1781						2993	1321
Flt Permitted		1.00			0.85						0.99	1.00
Satd. Flow (perm)		2769			1520						2993	1321
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	510	52	42	182	0	0	0	0	240	1215	469
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	224	0	0	0	0	0	1455	469
Confl. Peds. (#/hr)			15	15		4			11			
Confl. Bikes (#/hr)			3			3			3			2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.8			30.8						40.4	33.4
Effective Green, g (s)		30.8			30.8						40.4	33.4
Actuated g/C Ratio		0.39			0.39						0.50	0.42
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1066			585						1511	551
v/s Ratio Prot		c0.20									c0.49	
v/s Ratio Perm					0.15							0.36
v/c Ratio		0.52			0.38						0.96	0.85
Uniform Delay, d1		18.9			17.7						19.1	21.1
Progression Factor		0.34			0.36						1.00	1.00
Incremental Delay, d2		1.6			1.6						15.9	15.2
Delay (s)		8.1			7.9						34.9	36.3
Level of Service		A			A						C	D
Approach Delay (s)		8.1			7.9			0.0			35.3	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	27.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	395	20	305	135	300	20	75	1518	190	50
Future Volume (vph)	395	20	305	135	300	20	75	1518	190	50
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1509	1812	1812	1485			3677	1316	
Flt Permitted		0.63	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		1000	1812	1812	1485			3677	1316	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	411	21	318	141	312	21	78	1581	198	52
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	38	0
Lane Group Flow (vph)	0	432	318	141	334	0	0	1659	212	0
Confl. Peds. (#/hr)							8			3
Confl. Bikes (#/hr)					4	4				
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Effective Green, g (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Actuated g/C Ratio		0.41	0.41	0.21	0.21			0.48	0.48	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		485	742	380	311			1783	638	
v/s Ratio Prot		c0.13	0.18	0.08	c0.22					
v/s Ratio Perm		0.23						0.45	0.16	
v/c Ratio		0.89	0.43	0.37	1.07			0.93	0.33	
Uniform Delay, d1		21.7	16.9	27.1	31.6			19.3	12.6	
Progression Factor		0.72	0.75	1.00	1.00			0.45	0.23	
Incremental Delay, d2		16.7	1.3	2.8	72.1			6.5	0.8	
Delay (s)		32.5	14.0	29.8	103.7			15.1	3.7	
Level of Service		C	B	C	F			B	A	
Approach Delay (s)			24.7	81.8				13.6		
Approach LOS			C	F				B		

Intersection Summary			
HCM 2000 Control Delay	26.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	80	370	40	30	250	50	40	420	50	60	330	40
Future Volume (veh/h)	80	370	40	30	250	50	40	420	50	60	330	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	1.00		0.98	0.98		0.92	0.98		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1412	1560	1530	1412	1500	1530	1440	1500	1469	1440	1500	1469
Adj Flow Rate, veh/h	83	385	37	31	260	43	42	438	41	62	344	32
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	520	706	68	333	632	104	104	890	81	159	778	73
Arrive On Green	0.50	0.50	0.50	1.00	1.00	1.00	0.76	0.76	0.76	0.76	0.76	0.76
Sat Flow, veh/h	852	1398	134	768	1251	207	138	2342	214	268	2047	192
Grp Volume(v), veh/h	83	0	422	31	0	303	271	0	250	219	0	219
Grp Sat Flow(s),veh/h/ln	852	0	1532	768	0	1457	1389	0	1306	1194	0	1313
Q Serve(g_s), s	4.3	0.0	15.1	1.3	0.0	0.0	0.0	0.0	5.9	0.5	0.0	4.8
Cycle Q Clear(g_c), s	4.3	0.0	15.1	16.4	0.0	0.0	5.4	0.0	5.9	6.5	0.0	4.8
Prop In Lane	1.00		0.09	1.00		0.14	0.15		0.16	0.28		0.15
Lane Grp Cap(c), veh/h	520	0	774	333	0	736	580	0	496	512	0	499
V/C Ratio(X)	0.16	0.00	0.55	0.09	0.00	0.41	0.47	0.00	0.50	0.43	0.00	0.44
Avail Cap(c_a), veh/h	520	0	774	333	0	736	580	0	496	512	0	499
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.97	0.00	0.97	0.84	0.00	0.84	0.75	0.00	0.75
Uniform Delay (d), s/veh	10.9	0.0	13.5	3.0	0.0	0.0	6.6	0.0	6.7	6.4	0.0	6.5
Incr Delay (d2), s/veh	0.7	0.0	2.8	0.5	0.0	1.7	2.3	0.0	3.1	2.0	0.0	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	6.9	0.3	0.0	0.3	2.5	0.0	2.4	1.9	0.0	1.9
LnGrp Delay(d),s/veh	11.5	0.0	16.3	3.6	0.0	1.7	8.9	0.0	9.7	8.4	0.0	8.6
LnGrp LOS	B		B	A		A	A		A	A		A
Approach Vol, veh/h		505			334			521			438	
Approach Delay, s/veh		15.5			1.8			9.3			8.5	
Approach LOS		B			A			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0				
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6				
Max Green Setting (Gmax), s		40.4		30.4		40.4		30.4				
Max Q Clear Time (g_c+I1), s		17.1		7.9		18.4		8.5				
Green Ext Time (p_c), s		2.5		2.3		1.5		2.0				
Intersection Summary												
HCM 2010 Ctrl Delay			9.5									
HCM 2010 LOS			A									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	325	180	60	170	0	0	0	0	50	1076	130
Future Volume (vph)	0	325	180	60	170	0	0	0	0	50	1076	130
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.96
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1697			1775						4163	1148
Flt Permitted		1.00			0.67						1.00	1.00
Satd. Flow (perm)		1697			1213						4163	1148
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	339	188	62	177	0	0	0	0	52	1121	135
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	508	0	0	240	0	0	0	0	0	1173	135
Confl. Peds. (#/hr)	12		12	12		12			12	12		7
Confl. Bikes (#/hr)			6			4			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		35.8			35.8						35.4	28.4
Effective Green, g (s)		35.8			35.8						35.4	28.4
Actuated g/C Ratio		0.45			0.45						0.44	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		759			542						1842	407
v/s Ratio Prot		c0.30										
v/s Ratio Perm					0.20						0.28	0.12
v/c Ratio		0.67			0.44						0.64	0.33
Uniform Delay, d1		17.4			15.2						17.3	18.9
Progression Factor		0.32			1.00						0.35	0.43
Incremental Delay, d2		4.4			2.1						0.6	0.8
Delay (s)		10.0			17.3						6.7	9.0
Level of Service		B			B						A	A
Approach Delay (s)		10.0			17.3			0.0			6.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	245	150	0	0	130	110	90	1463	20	0	0	0
Future Volume (veh/h)	245	150	0	0	130	110	90	1463	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.96			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1620	1588	1620			
Adj Flow Rate, veh/h	255	156	0	0	135	107	94	1524	19			
Adj No. of Lanes	1	1	0	0	1	0	0	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	0	2	0			
Cap, veh/h	358	643	0	0	285	226	119	2061	26			
Arrive On Green	0.68	0.68	0.00	0.00	0.41	0.41	0.16	0.16	0.16			
Sat Flow, veh/h	1015	1588	0	0	703	557	248	4294	55			
Grp Volume(v), veh/h	255	156	0	0	0	242	596	498	543			
Grp Sat Flow(s),veh/h/ln	1015	1588	0	0	0	1260	1576	1445	1576			
Q Serve(g_s), s	19.4	3.0	0.0	0.0	0.0	11.3	29.1	26.2	26.2			
Cycle Q Clear(g_c), s	30.7	3.0	0.0	0.0	0.0	11.3	29.1	26.2	26.2			
Prop In Lane	1.00		0.00	0.00		0.44	0.16		0.04			
Lane Grp Cap(c), veh/h	358	643	0	0	0	510	756	694	757			
V/C Ratio(X)	0.71	0.24	0.00	0.00	0.00	0.47	0.79	0.72	0.72			
Avail Cap(c_a), veh/h	358	643	0	0	0	510	756	694	757			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00			
Uniform Delay (d), s/veh	18.1	8.2	0.0	0.0	0.0	17.5	29.8	28.5	28.5			
Incr Delay (d2), s/veh	11.5	0.9	0.0	0.0	0.0	3.1	8.2	6.3	5.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.5	1.5	0.0	0.0	0.0	4.3	14.4	11.7	12.6			
LnGrp Delay(d),s/veh	29.6	9.1	0.0	0.0	0.0	20.7	37.9	34.8	34.3			
LnGrp LOS	C	A				C	D	C	C			
Approach Vol, veh/h		411			242			1637				
Approach Delay, s/veh		21.8			20.7			35.8				
Approach LOS		C			C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		37.0		43.0		37.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		32.4		38.4		32.4		
Max Q Clear Time (g_c+I1), s		32.7		31.1		13.3		
Green Ext Time (p_c), s		0.0		4.4		1.0		

Intersection Summary			
HCM 2010 Ctrl Delay			31.7
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	230	40	105	250	70	30	400	85	45	290	65
Future Volume (veh/h)	55	230	40	105	250	70	30	400	85	45	290	65
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.91	0.97		0.91	0.92		0.83	0.96		0.83
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1588	1525	1620	1588	1588	1620	1620	1588	1555	1620	1588	1555
Adj Flow Rate, veh/h	57	240	34	109	260	59	31	417	67	47	302	47
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	390	657	93	472	626	142	85	902	140	121	719	119
Arrive On Green	0.51	0.51	0.51	0.17	0.17	0.17	0.13	0.13	0.13	0.77	0.77	0.77
Sat Flow, veh/h	937	1288	182	960	1227	278	92	2344	363	170	1867	309
Grp Volume(v), veh/h	57	0	274	109	0	319	277	0	238	196	0	200
Grp Sat Flow(s),veh/h/ln	937	0	1471	960	0	1505	1509	0	1290	1030	0	1316
Q Serve(g_s), s	3.5	0.0	9.0	8.2	0.0	15.2	0.0	0.0	13.7	3.3	0.0	4.0
Cycle Q Clear(g_c), s	18.7	0.0	9.0	17.2	0.0	15.2	12.9	0.0	13.7	17.0	0.0	4.0
Prop In Lane	1.00		0.12	1.00		0.18	0.11		0.28	0.24		0.24
Lane Grp Cap(c), veh/h	390	0	750	472	0	768	631	0	497	452	0	507
V/C Ratio(X)	0.15	0.00	0.37	0.23	0.00	0.42	0.44	0.00	0.48	0.43	0.00	0.39
Avail Cap(c_a), veh/h	390	0	750	472	0	768	631	0	497	452	0	507
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.87	0.00	0.87	0.85	0.00	0.85
Uniform Delay (d), s/veh	19.7	0.0	11.8	27.5	0.0	22.6	27.1	0.0	27.5	7.0	0.0	6.1
Incr Delay (d2), s/veh	0.8	0.0	1.4	1.1	0.0	1.5	1.9	0.0	2.9	2.6	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	3.9	2.3	0.0	6.7	6.0	0.0	5.3	1.5	0.0	1.6
LnGrp Delay(d),s/veh	20.5	0.0	13.2	28.5	0.0	24.1	29.1	0.0	30.3	9.6	0.0	8.1
LnGrp LOS	C		B	C		C	C		C	A		A
Approach Vol, veh/h		331			428			515			396	
Approach Delay, s/veh		14.4			25.3			29.6			8.8	
Approach LOS		B			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 41		* 31		* 41		* 31
Max Q Clear Time (g_c+I1), s		20.7		15.7		19.2		19.0
Green Ext Time (p_c), s		2.9		4.0		4.1		2.7

Intersection Summary	
HCM 2010 Ctrl Delay	20.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	370	380	65	0	55
Future Volume (vph)	0	370	380	65	0	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0	6.0			5.6
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.97			0.78
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.98			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1588	1516			1074
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1588	1516			1074
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	385	396	68	0	57
RTOR Reduction (vph)	0	0	7	0	0	48
Lane Group Flow (vph)	0	385	457	0	0	9
Confl. Peds. (#/hr)				59		78
Confl. Bikes (#/hr)				14		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		55.1	56.1			12.3
Effective Green, g (s)		55.1	56.1			12.3
Actuated g/C Ratio		0.69	0.70			0.15
Clearance Time (s)						5.6
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1093	1063			165
v/s Ratio Prot		c0.24	c0.30			
v/s Ratio Perm						0.01
v/c Ratio		0.35	0.43			0.05
Uniform Delay, d1		5.1	5.1			28.9
Progression Factor		0.96	0.17			1.00
Incremental Delay, d2		0.2	0.2			0.1
Delay (s)		5.1	1.1			29.0
Level of Service		A	A			C
Approach Delay (s)		5.1	1.1		29.0	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	4.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	270	110	80	240	0	0	0	0	125	961	230
Future Volume (vph)	0	270	110	80	240	0	0	0	0	125	961	230
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.93	1.00	1.00						1.00	0.92
Flpb, ped/bikes		1.00	1.00	0.97	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1173	1605	1535						4143	1102
Flt Permitted		1.00	1.00	0.52	1.00						0.99	1.00
Satd. Flow (perm)		1641	1173	874	1535						4143	1102
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	281	115	83	250	0	0	0	0	130	1001	240
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	281	86	83	250	0	0	0	0	0	1131	240
Confl. Peds. (#/hr)			51	51		28			11	11		19
Confl. Bikes (#/hr)			10			16			1			1
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		34.8	34.8	34.8	34.8						36.4	29.4
Effective Green, g (s)		34.8	34.8	34.8	34.8						36.4	29.4
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.45	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		713	510	380	667						1885	404
v/s Ratio Prot		c0.17			0.16							
v/s Ratio Perm			0.07	0.10							0.27	0.22
v/c Ratio		0.39	0.17	0.22	0.37						0.60	0.59
Uniform Delay, d1		15.4	13.8	14.1	15.3						16.3	20.5
Progression Factor		0.52	0.38	0.89	0.92						0.38	0.49
Incremental Delay, d2		1.6	0.7	1.2	1.5						1.1	4.9
Delay (s)		9.6	6.0	13.7	15.5						7.4	14.9
Level of Service		A	A	B	B						A	B
Approach Delay (s)		8.5			15.1			0.0			8.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	210	0	0	195	90	125	1313	160	0	0	0
Future Volume (veh/h)	175	210	0	0	195	90	125	1313	160	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1525	1588	1620			
Adj Flow Rate, veh/h	182	219	0	0	203	72	130	1368	147			
Adj No. of Lanes	1	1	0	0	1	0	1	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	234	552	0	0	333	118	795	2174	234			
Arrive On Green	0.11	0.11	0.00	0.00	0.11	0.11	0.18	0.18	0.18			
Sat Flow, veh/h	985	1588	0	0	959	340	1452	3971	427			
Grp Volume(v), veh/h	182	219	0	0	0	275	130	996	519			
Grp Sat Flow(s),veh/h/ln	985	1588	0	0	0	1299	1452	1445	1507			
Q Serve(g_s), s	11.7	10.2	0.0	0.0	0.0	16.1	6.0	25.5	25.5			
Cycle Q Clear(g_c), s	27.8	10.2	0.0	0.0	0.0	16.1	6.0	25.5	25.5			
Prop In Lane	1.00		0.00	0.00		0.26	1.00		0.28			
Lane Grp Cap(c), veh/h	234	552	0	0	0	451	795	1583	825			
V/C Ratio(X)	0.78	0.40	0.00	0.00	0.00	0.61	0.16	0.63	0.63			
Avail Cap(c_a), veh/h	234	552	0	0	0	451	795	1583	825			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.92	0.92	0.00	0.00	0.00	1.00	0.29	0.29	0.29			
Uniform Delay (d), s/veh	44.7	27.6	0.0	0.0	0.0	30.2	17.3	25.3	25.3			
Incr Delay (d2), s/veh	20.7	2.0	0.0	0.0	0.0	6.0	0.1	0.6	1.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.4	4.8	0.0	0.0	0.0	6.6	2.5	10.3	10.9			
LnGrp Delay(d),s/veh	65.4	29.6	0.0	0.0	0.0	36.3	17.4	25.8	26.3			
LnGrp LOS	E	C				D	B	C	C			
Approach Vol, veh/h		401			275			1645				
Approach Delay, s/veh		45.9			36.3			25.3				
Approach LOS		D			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		32.0		48.0		32.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 28		* 44		* 28		
Max Q Clear Time (g_c+I1), s		29.8		27.5		18.1		
Green Ext Time (p_c), s		0.0		7.9		0.8		

Intersection Summary		
HCM 2010 Ctrl Delay		30.2
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	300	1495	0	0	0	0	0	280	50
Future Volume (veh/h)	0	0	0	300	1495	0	0	0	0	0	280	50
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.95
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.82
Adj Sat Flow, veh/h/ln				1530	1500	0				0	1500	1530
Adj Flow Rate, veh/h				312	1557	0				0	292	33
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				453	1997	0				0	626	70
Arrive On Green				0.21	0.21	0.00				0.00	0.27	0.27
Sat Flow, veh/h				621	3330	0				0	2415	261
Grp Volume(v), veh/h				675	1194	0				0	176	149
Grp Sat Flow(s),veh/h/ln				1345	1242	0				0	1425	1176
Q Serve(g_s), s				38.2	36.3	0.0				0.0	8.3	8.5
Cycle Q Clear(g_c), s				38.2	36.3	0.0				0.0	8.3	8.5
Prop In Lane				0.46		0.00				0.00		0.22
Lane Grp Cap(c), veh/h				903	1546	0				0	381	315
V/C Ratio(X)				0.75	0.77	0.00				0.00	0.46	0.47
Avail Cap(c_a), veh/h				903	1546	0				0	381	315
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				27.2	26.4	0.0				0.0	24.5	24.6
Incr Delay (d2), s/veh				5.6	3.8	0.0				0.0	4.0	5.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.7	13.3	0.0				0.0	3.7	3.2
LnGrp Delay(d),s/veh				32.8	30.2	0.0				0.0	28.5	29.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1869						325	
Approach Delay, s/veh					31.2						29.0	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.0		26.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 50		21.4				
Max Q Clear Time (g_c+I1), s		40.2		10.5				
Green Ext Time (p_c), s		6.3		1.0				

Intersection Summary		
HCM 2010 Ctrl Delay		30.8
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1665	150	140	310	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1665	150	140	310	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1412	1412	1440	1412	0			
Adj Flow Rate, veh/h				0	1734	120	146	323	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	2	2	0			
Cap, veh/h				0	2351	717	266	507	0			
Arrive On Green				0.00	0.20	0.20	0.09	0.09	0.00			
Sat Flow, veh/h				0	3981	1175	683	1842	0			
Grp Volume(v), veh/h				0	1734	120	253	216	0			
Grp Sat Flow(s),veh/h/ln				0	1285	1175	1241	1220	0			
Q Serve(g_s), s				0.0	33.8	6.8	14.8	13.6	0.0			
Cycle Q Clear(g_c), s				0.0	33.8	6.8	15.8	13.6	0.0			
Prop In Lane				0.00		1.00	0.58		0.00			
Lane Grp Cap(c), veh/h				0	2351	717	425	348	0			
V/C Ratio(X)				0.00	0.74	0.17	0.60	0.62	0.00			
Avail Cap(c_a), veh/h				0	2351	717	425	348	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	25.9	15.2	33.0	32.1	0.0			
Incr Delay (d2), s/veh				0.0	2.1	0.5	6.0	8.1	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	12.5	2.3	6.1	5.4	0.0			
LnGrp Delay(d),s/veh				0.0	28.1	15.7	39.0	40.2	0.0			
LnGrp LOS					C	B	D	D				
Approach Vol, veh/h					1854			469				
Approach Delay, s/veh					27.3			39.6				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		53.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 49		* 23				
Max Q Clear Time (g_c+I1), s		35.8		17.8				
Green Ext Time (p_c), s		8.2		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	29.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	180	1730	0	0	0	0	0	275	90
Future Volume (veh/h)	0	0	0	180	1730	0	0	0	0	0	275	90
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1412	0				0	1412	1440
Adj Flow Rate, veh/h				188	1802	0				0	286	77
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				263	2124	0				0	499	129
Arrive On Green				0.21	0.21	0.00				0.00	0.26	0.26
Sat Flow, veh/h				325	3460	0				0	1988	496
Grp Volume(v), veh/h				733	1257	0				0	196	167
Grp Sat Flow(s),veh/h/ln				1331	1169	0				0	1341	1072
Q Serve(g_s), s				40.2	41.3	0.0				0.0	10.2	10.9
Cycle Q Clear(g_c), s				42.5	41.3	0.0				0.0	10.2	10.9
Prop In Lane				0.26		0.00				0.00		0.46
Lane Grp Cap(c), veh/h				901	1485	0				0	349	279
V/C Ratio(X)				0.81	0.85	0.00				0.00	0.56	0.60
Avail Cap(c_a), veh/h				901	1485	0				0	349	279
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				28.3	27.9	0.0				0.0	25.7	25.9
Incr Delay (d2), s/veh				7.9	6.1	0.0				0.0	6.4	9.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.7	14.7	0.0				0.0	4.4	3.9
LnGrp Delay(d),s/veh				36.2	34.0	0.0				0.0	32.1	35.1
LnGrp LOS				D	C						C	D
Approach Vol, veh/h					1990						363	
Approach Delay, s/veh					34.8						33.5	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		55.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 51		* 21				
Max Q Clear Time (g_c+I1), s		44.5		12.9				
Green Ext Time (p_c), s		4.7		1.0				

Intersection Summary	
HCM 2010 Ctrl Delay	34.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	70	1580	90	240	155	0	0	170	50
Future Volume (veh/h)	0	0	0	70	1580	90	240	155	0	0	170	50
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				73	1646	87	250	161	0	0	177	38
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				105	2506	137	299	649	0	0	299	64
Arrive On Green				0.18	0.18	0.18	0.10	0.58	0.00	0.00	0.23	0.23
Sat Flow, veh/h				192	4609	251	1765	1853	0	0	1294	278
Grp Volume(v), veh/h				666	554	586	250	161	0	0	0	215
Grp Sat Flow(s),veh/h/ln				1755	1606	1692	1765	1853	0	0	0	1571
Q Serve(g_s), s				28.5	25.6	25.6	2.1	3.4	0.0	0.0	0.0	9.7
Cycle Q Clear(g_c), s				28.5	25.6	25.6	2.1	3.4	0.0	0.0	0.0	9.7
Prop In Lane				0.11		0.15	1.00		0.00	0.00		0.18
Lane Grp Cap(c), veh/h				954	873	920	299	649	0	0	0	363
V/C Ratio(X)				0.70	0.63	0.64	0.84	0.25	0.00	0.00	0.00	0.59
Avail Cap(c_a), veh/h				954	873	920	299	649	0	0	0	363
HCM Platoon Ratio				0.33	0.33	0.33	1.67	1.67	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				26.7	25.5	25.5	32.4	11.5	0.0	0.0	0.0	27.4
Incr Delay (d2), s/veh				4.2	3.5	3.4	23.3	0.9	0.0	0.0	0.0	6.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				14.9	12.2	12.9	7.0	1.9	0.0	0.0	0.0	4.9
LnGrp Delay(d),s/veh				30.9	29.0	28.9	55.7	12.4	0.0	0.0	0.0	34.3
LnGrp LOS				C	C	C	E	B				C
Approach Vol, veh/h					1806			411			215	
Approach Delay, s/veh					29.6			38.7			34.3	
Approach LOS					C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			9.0	23.0		48.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			5.0	18.5		43.5		28.0
Max Q Clear Time (g_c+I1), s			4.1	11.7		30.5		5.4
Green Ext Time (p_c), s			0.2	0.8		10.9		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	31.6
HCM 2010 LOS	C

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	41	37	90.8%	10.9	3.2	B
	Through	5	7	130.6%	12.6	12.2	B
	Right Turn						
	Subtotal	46	44	95.2%	12.4	3.4	B
SB	Left Turn						
	Through	10	12	115.2%	25.1	12.5	D
	Right Turn	5	7	138.2%	15.5	13.6	C
	Subtotal	15	18	122.9%	20.7	7.1	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	65	70	107.5%	3.0	0.3	A
	Through	1,699	1,687	99.3%	2.1	0.2	A
	Right Turn	5	4	76.8%	1.7	0.2	A
	Subtotal	1,769	1,760	99.5%	2.2	0.2	A
Total		1,830	1,822	99.6%	2.6	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	119	127	106.8%	25.8	3.2	C
	Through	20	26	128.6%	28.0	4.4	C
	Right Turn						
	Subtotal	139	153	110.0%	26.2	2.9	C
SB	Left Turn						
	Through	50	52	103.7%	22.1	5.0	C
	Right Turn	10	13	126.7%	14.1	9.2	B
	Subtotal	60	65	107.5%	20.6	4.9	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	232	239	103.0%	12.4	2.0	B
	Through	1,727	1,694	98.1%	9.4	1.5	A
	Right Turn	40	39	97.9%	8.1	1.6	A
	Subtotal	1,999	1,972	98.6%	9.7	1.5	A
Total		2,198	2,189	99.6%	11.2	1.4	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	100	1699	130	40	330	0	0	265	150
Future Volume (veh/h)	0	0	0	100	1699	130	40	330	0	0	265	150
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.97		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1620	1588	1620	1620	1588	0	0	1525	1555
Adj Flow Rate, veh/h				104	1770	125	42	344	0	0	276	149
Adj No. of Lanes				0	3	0	0	2	0	0	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				126	2285	166	100	738	0	0	552	279
Arrive On Green				0.19	0.19	0.19	0.64	0.64	0.00	0.00	0.11	0.11
Sat Flow, veh/h				222	4017	292	142	2387	0	0	1807	874
Grp Volume(v), veh/h				738	615	646	193	193	0	0	228	197
Grp Sat Flow(s),veh/h/ln				1577	1445	1509	1084	1373	0	0	1448	1157
Q Serve(g_s), s				36.0	32.2	32.4	2.5	5.7	0.0	0.0	11.9	12.9
Cycle Q Clear(g_c), s				36.0	32.2	32.4	15.4	5.7	0.0	0.0	11.9	12.9
Prop In Lane				0.14		0.19	0.22		0.00	0.00		0.76
Lane Grp Cap(c), veh/h				897	822	858	400	438	0	0	462	369
V/C Ratio(X)				0.82	0.75	0.75	0.48	0.44	0.00	0.00	0.49	0.53
Avail Cap(c_a), veh/h				897	822	858	400	438	0	0	462	369
HCM Platoon Ratio				0.33	0.33	0.33	2.00	2.00	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				28.6	27.1	27.2	11.4	10.9	0.0	0.0	29.7	30.2
Incr Delay (d2), s/veh				8.4	6.2	6.1	4.1	3.2	0.0	0.0	3.7	5.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.8	14.3	15.0	2.4	2.4	0.0	0.0	5.3	4.7
LnGrp Delay(d),s/veh				37.0	33.2	33.2	15.5	14.1	0.0	0.0	33.4	35.6
LnGrp LOS				D	C	C	B	B			C	D
Approach Vol, veh/h					1999			386			425	
Approach Delay, s/veh					34.6			14.8			34.5	
Approach LOS					C			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				30.0		50.0		30.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				25.5		45.5		25.5
Max Q Clear Time (g_c+I1), s				17.4		38.0		14.9
Green Ext Time (p_c), s				1.1		5.4		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	31.9
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	300	1774	30	110	50	0	0	30	30
Future Volume (vph)	0	0	0	300	1774	30	110	50	0	0	30	30
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6			7.6	
Lane Util. Factor					0.91		1.00	1.00			1.00	
Frpb, ped/bikes					1.00		1.00	1.00			0.97	
Flpb, ped/bikes					0.97		0.96	1.00			1.00	
Frt					1.00		1.00	1.00			0.93	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3682		1100	1249			1128	
Flt Permitted					0.99		0.72	1.00			1.00	
Satd. Flow (perm)					3682		830	1249			1128	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	312	1848	31	115	52	0	0	31	31
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	0	0	0	2190	0	115	52	0	0	54	0
Confl. Peds. (#/hr)			106	106		44	30		69			30
Confl. Bikes (#/hr)						2			3			8
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			4			8	
Permitted Phases				6			4					
Actuated Green, G (s)					51.4		19.4	19.4			19.4	
Effective Green, g (s)					51.4		19.4	19.4			19.4	
Actuated g/C Ratio					0.57		0.22	0.22			0.22	
Clearance Time (s)					11.6		7.6	7.6			7.6	
Lane Grp Cap (vph)					2102		178	269			243	
v/s Ratio Prot								0.04			0.05	
v/s Ratio Perm					0.59		c0.14					
v/c Ratio					1.04		0.65	0.19			0.22	
Uniform Delay, d1					19.3		32.2	28.9			29.1	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					31.6		16.7	1.6			2.1	
Delay (s)					50.9		48.9	30.5			31.2	
Level of Service					D		D	C			C	
Approach Delay (s)		0.0			50.9			43.2			31.2	
Approach LOS		A			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	49.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	157.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	480	1593	0	0	0	0	0	665	486
Future Volume (veh/h)	0	0	0	480	1593	0	0	0	0	0	665	486
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.85
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1560	1588	0				0	1588	1500
Adj Flow Rate, veh/h				500	1659	0				0	693	498
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				740	2085	0				0	1951	489
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1486	4765	0				0	4479	1088
Grp Volume(v), veh/h				500	1659	0				0	693	498
Grp Sat Flow(s),veh/h/ln				1486	1588	0				0	1445	1088
Q Serve(g_s), s				25.9	26.9	0.0				0.0	11.5	36.0
Cycle Q Clear(g_c), s				25.9	26.9	0.0				0.0	11.5	36.0
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				740	2085	0				0	1951	489
V/C Ratio(X)				0.68	0.80	0.00				0.00	0.36	1.02
Avail Cap(c_a), veh/h				740	2085	0				0	1951	489
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				30.3	30.8	0.0				0.0	23.6	34.1
Incr Delay (d2), s/veh				4.9	3.3	0.0				0.0	0.5	45.2
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.7	12.5	0.0				0.0	4.7	17.0
LnGrp Delay(d),s/veh				35.2	34.0	0.0				0.0	24.1	79.2
LnGrp LOS				D	C						C	F
Approach Vol, veh/h					2159						1191	
Approach Delay, s/veh					34.3						47.2	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						39.0		41.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						35.0		36.0
Max Q Clear Time (g_c+I1), s						28.9		38.0
Green Ext Time (p_c), s						4.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	38.9
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1150	195	918	1403	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1150	195	918	1403	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1500	1500	1398	1398	0			
Adj Flow Rate, veh/h				0	1198	189	1053	1326	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	3	3	0			
Cap, veh/h				0	1510	441	1381	1450	0			
Arrive On Green				0.00	0.37	0.37	0.17	0.17	0.00			
Sat Flow, veh/h				0	4230	1195	2663	2796	0			
Grp Volume(v), veh/h				0	1198	189	1053	1326	0			
Grp Sat Flow(s),veh/h/ln				0	1365	1195	1331	1398	0			
Q Serve(g_s), s				0.0	20.9	9.5	30.2	37.3	0.0			
Cycle Q Clear(g_c), s				0.0	20.9	9.5	30.2	37.3	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1510	441	1381	1450	0			
V/C Ratio(X)				0.00	0.79	0.43	0.76	0.91	0.00			
Avail Cap(c_a), veh/h				0	1510	441	1381	1450	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.5	18.9	28.5	31.4	0.0			
Incr Delay (d2), s/veh				0.0	4.4	3.0	4.0	10.4	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	8.4	3.5	11.9	16.5	0.0			
LnGrp Delay(d),s/veh				0.0	26.9	22.0	32.5	41.8	0.0			
LnGrp LOS					C	C	C	D				
Approach Vol, veh/h					1387			2379				
Approach Delay, s/veh					26.2			37.7				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				46.0		34.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				41.5		29.5		
Max Q Clear Time (g_c+I1), s				39.3		22.9		
Green Ext Time (p_c), s				2.0		3.9		

Intersection Summary			
HCM 2010 Ctrl Delay			33.5
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1526	100	0	0	0	0	0	400	170	430	0
Future Volume (veh/h)	0	1526	100	0	0	0	0	0	400	170	430	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1676	1710				0	1588	1620	1765	1765	0
Adj Flow Rate, veh/h	0	1590	95				0	0	402	177	448	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1145	992	1526	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.86	0.29	0.29	0.00
Sat Flow, veh/h		0					0	0	1324	969	1765	0
Grp Volume(v), veh/h		0.0					0	0	402	177	448	0
Grp Sat Flow(s),veh/h/ln							0	0	1324	969	1765	0
Q Serve(g_s), s							0.0	0.0	2.0	4.9	6.7	0.0
Cycle Q Clear(g_c), s							0.0	0.0	2.0	6.9	6.7	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1145	992	1526	0
V/C Ratio(X)							0.00	0.00	0.35	0.18	0.29	0.00
Avail Cap(c_a), veh/h							0	0	1145	992	1526	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.9	4.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.8	0.4	0.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.9	1.4	3.6	0.0
LnGrp Delay(d),s/veh							0.0	0.0	1.3	5.3	4.5	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								402			625	
Approach Delay, s/veh								1.3			4.7	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				34.0				34.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				29.4				29.4
Max Q Clear Time (g_c+I1), s				8.9				4.0
Green Ext Time (p_c), s				1.8				1.2

Intersection Summary	
HCM 2010 Ctrl Delay	3.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	1916	0	0	0	0	0	245	120	0	0	0
Future Volume (veh/h)	185	1916	0	0	0	0	0	245	120	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1500	0				0	1500	1440			
Adj Flow Rate, veh/h	193	1996	0				0	255	120			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	251	2157	0				0	626	284			
Arrive On Green	0.19	0.19	0.00				0.00	0.32	0.32			
Sat Flow, veh/h	344	3801	0				0	1940	881			
Grp Volume(v), veh/h	763	1426	0				0	195	180			
Grp Sat Flow(s),veh/h/ln	1414	1365	0				0	1500	1322			
Q Serve(g_s), s	40.9	41.0	0.0				0.0	8.1	8.5			
Cycle Q Clear(g_c), s	42.7	41.0	0.0				0.0	8.1	8.5			
Prop In Lane	0.25		0.00				0.00		0.67			
Lane Grp Cap(c), veh/h	859	1549	0				0	484	426			
V/C Ratio(X)	0.89	0.92	0.00				0.00	0.40	0.42			
Avail Cap(c_a), veh/h	859	1549	0				0	484	426			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	31.3	30.7	0.0				0.0	21.1	21.3			
Incr Delay (d2), s/veh	13.2	10.4	0.0				0.0	2.5	3.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	19.9	17.8	0.0				0.0	3.7	3.5			
LnGrp Delay(d),s/veh	44.5	41.2	0.0				0.0	23.6	24.3			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2189						375				
Approach Delay, s/veh		42.3						23.9				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				30.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 26		45.4		
Max Q Clear Time (g_c+I1), s				10.5		44.7		
Green Ext Time (p_c), s				2.8		0.7		

Intersection Summary	
HCM 2010 Ctrl Delay	39.6
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1961	80	0	0	0	0	0	230	200	270	0
Future Volume (veh/h)	0	1961	80	0	0	0	0	0	230	200	270	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1382				0	1588	1591	1560	1500	0
Adj Flow Rate, veh/h	0	2043	78				0	0	224	208	281	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1101	1057	1282	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1288	1001	1500	0
Grp Volume(v), veh/h		0.0					0	0	224	208	281	0
Grp Sat Flow(s),veh/h/ln							0	0	1288	1001	1500	0
Q Serve(g_s), s							0.0	0.0	0.9	5.0	4.4	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.9	6.0	4.4	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1101	1057	1282	0
V/C Ratio(X)							0.00	0.00	0.20	0.20	0.22	0.00
Avail Cap(c_a), veh/h							0	0	1101	1057	1282	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.1	3.2	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.4	0.4	0.4	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.4	1.5	2.0	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.8	4.5	3.6	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								224			489	
Approach Delay, s/veh								0.8			4.0	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				31.0				31.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				26.5				26.5
Max Q Clear Time (g_c+I1), s				8.0				2.9
Green Ext Time (p_c), s				1.4				0.6

Intersection Summary		
HCM 2010 Ctrl Delay		3.0
HCM 2010 LOS		A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	2116	175	0	0	0	0	305	30	110	130	0
Future Volume (veh/h)	100	2116	175	0	0	0	0	305	30	110	130	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.92	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	104	2204	171				0	318	22	115	135	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	116	2597	205				0	629	43	255	543	0
Arrive On Green	0.19	0.19	0.19				0.00	0.21	0.21	0.03	0.21	0.00
Sat Flow, veh/h	200	4488	355				0	3088	206	1597	1744	0
Grp Volume(v), veh/h	911	757	811				0	167	173	115	135	0
Grp Sat Flow(s),veh/h/ln	1755	1606	1682				0	1593	1618	1597	1744	0
Q Serve(g_s), s	40.7	36.2	37.2				0.0	7.4	7.6	0.0	5.2	0.0
Cycle Q Clear(g_c), s	40.7	36.2	37.2				0.0	7.4	7.6	0.0	5.2	0.0
Prop In Lane	0.11		0.21				0.00		0.13	1.00		0.00
Lane Grp Cap(c), veh/h	1015	929	973				0	334	339	255	543	0
V/C Ratio(X)	0.90	0.81	0.83				0.00	0.50	0.51	0.45	0.25	0.00
Avail Cap(c_a), veh/h	1015	929	973				0	334	339	255	543	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.67	0.67	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.1	28.3	28.7				0.0	28.0	28.1	34.1	23.9	0.0
Incr Delay (d2), s/veh	12.3	7.8	8.3				0.0	5.3	5.4	5.7	1.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	23.2	18.1	19.6				0.0	3.7	3.9	2.9	2.7	0.0
LnGrp Delay(d),s/veh	42.4	36.1	37.1				0.0	33.3	33.4	39.8	25.0	0.0
LnGrp LOS	D	D	D					C	C	D	C	
Approach Vol, veh/h		2479						340			250	
Approach Delay, s/veh		38.7						33.4			31.8	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		51.0		29.2			8.2	21.0
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		46.4		* 25			* 4	* 17
Max Q Clear Time (g_c+I1), s		42.7		7.2			2.0	9.6
Green Ext Time (p_c), s		3.7		0.9			0.1	1.5

Intersection Summary			
HCM 2010 Ctrl Delay			37.6
HCM 2010 LOS			D

Notes

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

BioMarin
Baseline Plus BioMarin Only Conditions
PM Peak Hour

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	89	97	108.7%	31.7	5.8	D
	Through						
	Right Turn						
	Subtotal	89	97	108.7%	31.7	5.8	D
EB	Left Turn	45	43	96.4%	3.1	0.4	A
	Through	2,246	2,286	101.8%	2.8	0.2	A
	Right Turn						
	Subtotal	2,291	2,330	101.7%	2.8	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,380	2,426	102.0%	4.0	0.6	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	89	93	104.8%	18.9	4.5	B
	Right Turn	413	401	97.2%	26.7	10.4	C
	Subtotal	502	495	98.5%	25.1	8.5	C
SB	Left Turn	107	106	98.7%	26.2	3.6	C
	Through	180	184	102.4%	18.5	2.7	B
	Right Turn						
	Subtotal	287	290	101.0%	21.2	1.6	C
EB	Left Turn	50	56	112.9%	17.1	4.4	B
	Through	2,213	2,223	100.4%	15.9	1.5	B
	Right Turn	42	40	94.2%	9.6	2.6	A
	Subtotal	2,305	2,319	100.6%	15.8	1.5	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,094	3,103	100.3%	17.9	1.9	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	220	2402	51	0	0	0	0	200	130	130	180	0
Future Volume (veh/h)	220	2402	51	0	0	0	0	200	130	130	180	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1412	1382	1355	0
Adj Flow Rate, veh/h	229	2502	31				0	208	125	135	188	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	216	2541	642				0	491	404	257	439	0
Arrive On Green	0.18	0.18	0.18				0.00	0.35	0.35	0.69	0.69	0.00
Sat Flow, veh/h	394	4640	1172				0	1412	1162	496	1324	0
Grp Volume(v), veh/h	809	1922	31				0	208	125	156	167	0
Grp Sat Flow(s),veh/h/ln	1392	1214	1172				0	1412	1162	587	1172	0
Q Serve(g_s), s	43.8	41.9	1.7				0.0	9.0	6.3	11.6	4.9	0.0
Cycle Q Clear(g_c), s	43.8	41.9	1.7				0.0	9.0	6.3	20.6	4.9	0.0
Prop In Lane	0.28		1.00				0.00		1.00	0.87		0.00
Lane Grp Cap(c), veh/h	762	1994	642				0	491	404	288	407	0
V/C Ratio(X)	1.06	0.96	0.05				0.00	0.42	0.31	0.54	0.41	0.00
Avail Cap(c_a), veh/h	762	1994	642				0	491	404	288	407	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.8	32.0	15.5				0.0	20.0	19.1	14.3	8.7	0.0
Incr Delay (d2), s/veh	50.2	13.2	0.1				0.0	2.7	2.0	7.1	3.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.5	16.5	0.6				0.0	3.9	2.2	3.3	1.8	0.0
LnGrp Delay(d),s/veh	83.0	45.2	15.7				0.0	22.6	21.1	21.4	11.8	0.0
LnGrp LOS	F	D	B					C	C	C	B	
Approach Vol, veh/h		2762						333			323	
Approach Delay, s/veh		56.0						22.1			16.4	
Approach LOS		E						C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		48.0		32.0				32.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 44		* 28				* 28
Max Q Clear Time (g_c+I1), s		45.8		11.0				22.6
Green Ext Time (p_c), s		0.0		1.3				0.7
Intersection Summary								
HCM 2010 Ctrl Delay			48.9					
HCM 2010 LOS			D					
Notes								

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	2512	120	0	0	0	0	140	340	85	235	0
Future Volume (veh/h)	30	2512	120	0	0	0	0	140	340	85	235	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1468	1412	1412	0
Adj Flow Rate, veh/h	31	2617	78				0	146	319	89	245	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	30	2740	614				0	408	351	243	408	0
Arrive On Green	0.18	0.18	0.18				0.00	0.29	0.29	0.58	0.58	0.00
Sat Flow, veh/h	55	4996	1119				0	1412	1216	738	1412	0
Grp Volume(v), veh/h	790	1858	78				0	146	319	89	245	0
Grp Sat Flow(s),veh/h/ln	1409	1214	1119				0	1412	1216	738	1412	0
Q Serve(g_s), s	43.9	40.2	4.7				0.0	6.6	20.2	7.4	9.0	0.0
Cycle Q Clear(g_c), s	43.9	40.2	4.7				0.0	6.6	20.2	14.0	9.0	0.0
Prop In Lane	0.04		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	773	1998	614				0	408	351	243	408	0
V/C Ratio(X)	1.02	0.93	0.13				0.00	0.36	0.91	0.37	0.60	0.00
Avail Cap(c_a), veh/h	773	1998	614				0	468	403	274	468	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	32.8	31.2	16.7				0.0	22.6	27.4	17.5	13.9	0.0
Incr Delay (d2), s/veh	16.1	1.0	0.0				0.0	0.5	22.1	0.9	1.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.6	13.7	1.5				0.0	2.6	8.9	1.5	3.6	0.0
LnGrp Delay(d),s/veh	48.8	32.3	16.7				0.0	23.1	49.5	18.4	15.5	0.0
LnGrp LOS	F	C	B					C	D	B	B	
Approach Vol, veh/h		2726						465			334	
Approach Delay, s/veh		36.6						41.2			16.3	
Approach LOS		D						D			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		50.4		29.6				29.6
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		40.5		26.5				26.5
Max Q Clear Time (g_c+I1), s		45.9		22.2				16.0
Green Ext Time (p_c), s		0.0		0.9				1.2

Intersection Summary	
HCM 2010 Ctrl Delay	35.3
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1848	1084	0	0	0	0	0	0	365	780	0
Future Volume (veh/h)	0	1848	1084	0	0	0	0	0	0	365	780	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1500							1500	1500	0
Adj Flow Rate, veh/h	0	1907	1072							380	812	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.96	0.96	0.96							0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2							2	2	0
Cap, veh/h	0	2268	1285							476	1000	0
Arrive On Green	0.00	0.17	0.17							0.11	0.11	0.00
Sat Flow, veh/h	0	4500	2550							1429	3000	0
Grp Volume(v), veh/h	0	1907	1072							380	812	0
Grp Sat Flow(s),veh/h/ln	0	1500	1275							1429	1500	0
Q Serve(g_s), s	0.0	32.9	32.6							20.8	21.2	0.0
Cycle Q Clear(g_c), s	0.0	32.9	32.6							20.8	21.2	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2268	1285							476	1000	0
V/C Ratio(X)	0.00	0.84	0.83							0.80	0.81	0.00
Avail Cap(c_a), veh/h	0	2268	1285							545	1144	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.88	0.88	0.00
Uniform Delay (d), s/veh	0.0	30.2	30.1							33.0	33.1	0.0
Incr Delay (d2), s/veh	0.0	0.4	0.6							6.5	3.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	13.7	11.6							9.1	9.3	0.0
LnGrp Delay(d),s/veh	0.0	30.6	30.7							39.4	36.7	0.0
LnGrp LOS		C	C							D	D	
Approach Vol, veh/h		2979									1192	
Approach Delay, s/veh		30.7									37.6	
Approach LOS		C									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		48.8		31.2				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		36.5		30.5				
Max Q Clear Time (g_c+I1), s		34.9		23.2				
Green Ext Time (p_c), s		1.6		3.5				

Intersection Summary	
HCM 2010 Ctrl Delay	32.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	953	1310	0	0	0	0	0	1388	560	0	0	0
Future Volume (veh/h)	953	1310	0	0	0	0	0	1388	560	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1468	1500	0				0	1412	1412			
Adj Flow Rate, veh/h	1030	1314	0				0	1539	503			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	1473	1388	0				0	1779	492			
Arrive On Green	0.15	0.15	0.00				0.00	0.42	0.42			
Sat Flow, veh/h	2797	3000	0				0	4235	1172			
Grp Volume(v), veh/h	1030	1314	0				0	1539	503			
Grp Sat Flow(s),veh/h/ln	1398	1500	0				0	1412	1172			
Q Serve(g_s), s	28.4	34.7	0.0				0.0	26.5	33.6			
Cycle Q Clear(g_c), s	28.4	34.7	0.0				0.0	26.5	33.6			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1473	1388	0				0	1779	492			
V/C Ratio(X)	0.70	0.95	0.00				0.00	0.87	1.02			
Avail Cap(c_a), veh/h	1473	1388	0				0	1779	492			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	30.3	32.9	0.0				0.0	21.1	23.2			
Incr Delay (d2), s/veh	2.8	14.4	0.0				0.0	5.9	46.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	11.6	17.2	0.0				0.0	11.2	17.1			
LnGrp Delay(d),s/veh	33.0	47.4	0.0				0.0	27.1	69.5			
LnGrp LOS	C	D						C	F			
Approach Vol, veh/h		2344						2042				
Approach Delay, s/veh		41.1						37.5				
Approach LOS		D						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		41.2		38.8				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 37		* 34				
Max Q Clear Time (g_c+I1), s		36.7		35.6				
Green Ext Time (p_c), s		0.3		0.0				

Intersection Summary			
HCM 2010 Ctrl Delay			39.4
HCM 2010 LOS			D

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	280	40	70	280	51	60	221	170	102	139	30
Future Volume (veh/h)	20	280	40	70	280	51	60	221	170	102	139	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		0.96	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2039	2039	2000	1961	1961	2000	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	21	292	35	73	292	46	62	230	145	106	145	23
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	57	388	47	154	446	70	268	302	190	222	406	64
Arrive On Green	0.03	0.22	0.22	0.08	0.27	0.27	0.15	0.29	0.29	0.12	0.26	0.26
Sat Flow, veh/h	1942	1778	213	1867	1644	259	1774	1049	662	1774	1551	246
Grp Volume(v), veh/h	21	0	327	73	0	338	62	0	375	106	0	168
Grp Sat Flow(s),veh/h/ln	1942	0	1991	1867	0	1903	1774	0	1711	1774	0	1796
Q Serve(g_s), s	0.6	0.0	9.2	2.2	0.0	9.4	1.8	0.0	11.9	3.3	0.0	4.5
Cycle Q Clear(g_c), s	0.6	0.0	9.2	2.2	0.0	9.4	1.8	0.0	11.9	3.3	0.0	4.5
Prop In Lane	1.00		0.11	1.00		0.14	1.00		0.39	1.00		0.14
Lane Grp Cap(c), veh/h	57	0	434	154	0	516	268	0	492	222	0	470
V/C Ratio(X)	0.37	0.00	0.75	0.47	0.00	0.66	0.23	0.00	0.76	0.48	0.00	0.36
Avail Cap(c_a), veh/h	261	0	831	313	0	858	298	0	660	298	0	693
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.4	0.0	21.8	26.1	0.0	19.3	22.3	0.0	19.4	24.3	0.0	17.9
Incr Delay (d2), s/veh	1.4	0.0	2.7	0.8	0.0	1.4	0.2	0.0	3.6	0.6	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	5.3	1.2	0.0	5.1	0.9	0.0	6.1	1.7	0.0	2.3
LnGrp Delay(d),s/veh	29.8	0.0	24.5	27.0	0.0	20.7	22.4	0.0	23.0	24.9	0.0	18.4
LnGrp LOS	C		C	C		C	C		C	C		B
Approach Vol, veh/h		348			411			437			274	
Approach Delay, s/veh		24.8			21.8			22.9			20.9	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.9	17.9	13.0	19.8	5.8	21.1	11.4	21.4
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	24.9	10.0	* 23	8.0	26.9	10.0	* 23
Max Q Clear Time (g_c+I1), s	4.2	11.2	3.8	6.5	2.6	11.4	5.3	13.9
Green Ext Time (p_c), s	0.0	1.1	0.0	0.5	0.0	1.2	0.1	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	22.7
HCM 2010 LOS	C

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	490	50	0	635	10	25
Future Volume (vph)	490	50	0	635	10	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			3.0	5.6	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	0.99	
Frt	0.99			1.00	0.90	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1561			1588	1401	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1561			1588	1401	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	510	52	0	661	10	26
RTOR Reduction (vph)	5	0	0	0	21	0
Lane Group Flow (vph)	557	0	0	661	15	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA	Perm	
Protected Phases	2			3 4 6		
Permitted Phases					8	
Actuated Green, G (s)	34.1			54.9	13.9	
Effective Green, g (s)	34.1			48.9	13.9	
Actuated g/C Ratio	0.43			0.61	0.17	
Clearance Time (s)	6.0				5.6	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	665			970	243	
v/s Ratio Prot	c0.36			c0.42		
v/s Ratio Perm					c0.01	
v/c Ratio	0.84			0.68	0.06	
Uniform Delay, d1	20.5			10.4	27.6	
Progression Factor	0.64			0.35	0.72	
Incremental Delay, d2	10.7			0.5	0.1	
Delay (s)	23.8			4.2	20.0	
Level of Service	C			A	C	
Approach Delay (s)	23.8			4.2	20.0	
Approach LOS	C			A	C	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	455	5	0	290	15	30	25	20	10	20	20
Future Volume (vph)	0	455	5	0	290	15	30	25	20	10	20	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			1.00			0.98	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		1.00			0.99			0.96			0.95	
Flt Protected		1.00			1.00			0.98			0.99	
Satd. Flow (prot)		1585			1574			1487			1461	
Flt Permitted		1.00			1.00			0.85			0.92	
Satd. Flow (perm)		1585			1574			1285			1356	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	474	5	0	302	16	31	26	21	10	21	21
RTOR Reduction (vph)	0	0	0	0	2	0	0	19	0	0	19	0
Lane Group Flow (vph)	0	479	0	0	316	0	0	59	0	0	33	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			4 6			8			8	
Permitted Phases							8			8		
Actuated Green, G (s)		43.0			58.8			9.2			9.2	
Effective Green, g (s)		43.0			58.8			9.2			9.2	
Actuated g/C Ratio		0.54			0.73			0.11			0.11	
Clearance Time (s)		6.0						6.0			6.0	
Vehicle Extension (s)		3.0						1.5			1.5	
Lane Grp Cap (vph)		851			1156			147			155	
v/s Ratio Prot		c0.30			c0.20							
v/s Ratio Perm								c0.05			0.02	
v/c Ratio		0.56			0.27			0.40			0.22	
Uniform Delay, d1		12.3			3.5			32.9			32.1	
Progression Factor		0.58			0.05			0.38			0.84	
Incremental Delay, d2		2.3			0.0			0.6			0.1	
Delay (s)		9.4			0.2			13.0			27.1	
Level of Service		A			A			B			C	
Approach Delay (s)		9.4			0.2			13.0			27.1	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	515	0	0	625	10	25
Future Volume (vph)	515	0	0	625	10	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			6.0	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.90	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1588			1588	1414	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1588			1588	1414	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	536	0	0	651	10	26
RTOR Reduction (vph)	0	0	0	0	21	0
Lane Group Flow (vph)	536	0	0	651	15	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	53.6			34.1	14.8	
Effective Green, g (s)	48.0			34.1	14.8	
Actuated g/C Ratio	0.60			0.43	0.19	
Clearance Time (s)				6.0		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	952			676	261	
v/s Ratio Prot	c0.34			c0.41	c0.01	
v/s Ratio Perm						
v/c Ratio	0.56			0.96	0.06	
Uniform Delay, d1	9.7			22.3	26.9	
Progression Factor	0.29			1.04	1.83	
Incremental Delay, d2	0.4			20.9	0.0	
Delay (s)	3.3			44.0	49.1	
Level of Service	A			D	D	
Approach Delay (s)	3.3			44.0	49.1	
Approach LOS	A			D	D	

Intersection Summary			
HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	485	0	0	285	15	20	20	20	0	0	0
Future Volume (vph)	0	485	0	0	285	15	20	20	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1573			1470				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1573			1470				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	505	0	0	297	16	21	21	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	505	0	0	311	0	0	45	0	0	0	0
Confl. Peds. (#/hr)	10		10			10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		58.2			43.0			9.8				
Effective Green, g (s)		58.2			43.0			9.8				
Actuated g/C Ratio		0.73			0.54			0.12				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1155			845			180				
v/s Ratio Prot		c0.32			0.20			c0.03				
v/s Ratio Perm												
v/c Ratio		0.44			0.37			0.25				
Uniform Delay, d1		4.4			10.7			31.8				
Progression Factor		0.09			0.51			1.01				
Incremental Delay, d2		0.1			1.2			0.2				
Delay (s)		0.5			6.7			32.2				
Level of Service		A			A			C				
Approach Delay (s)		0.5			6.7			32.2			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	370	0	0	425	50	20	5	20	0	0	0
Future Volume (vph)	0	370	0	0	425	50	20	5	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1537			1442				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1537			1442				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	385	0	0	443	52	21	5	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	385	0	0	490	0	0	29	0	0	0	0
Confl. Peds. (#/hr)	59		21			59			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		55.1			36.8			13.3				
Effective Green, g (s)		55.1			36.8			13.3				
Actuated g/C Ratio		0.69			0.46			0.17				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1093			707			239				
v/s Ratio Prot		c0.24			c0.32			c0.02				
v/s Ratio Perm												
v/c Ratio		0.35			0.69			0.12				
Uniform Delay, d1		5.1			17.1			28.4				
Progression Factor		0.21			0.78			1.01				
Incremental Delay, d2		0.2			5.0			0.2				
Delay (s)		1.2			18.4			28.8				
Level of Service		A			B			C				
Approach Delay (s)		1.2			18.4			28.8			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	28.8	46.9	0.07	5.2	F
C	IV	25	18.9	11.8	30.7	0.07	8.4	E
B	IV	25	17.9	45.4	63.3	0.07	3.8	F
A	IV	25	18.5	13.6	32.1	0.07	7.8	E
Lindaro	IV	25	25.3	20.3	45.6	0.14	11.1	D
Lincoln	IV	25	21.4	60.1	81.5	0.10	4.3	F
Francisco W.	IV	25	12.2	33.5	45.7	0.05	3.6	F
101 SBOn 2nd	IV	25	14.2	23.0	37.2	0.05	5.2	F
Total	IV		146.5	236.5	383.0	0.61	5.8	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	36.2	55.2	0.07	4.7	F
Tamalpais	IV	25	14.4	53.9	68.3	0.05	2.9	F
Lincoln	IV	25	13.2	20.0	33.2	0.05	5.4	F
Lindaro	IV	25	21.4	2.9	24.3	0.10	14.4	C
A	IV	25	25.3	14.8	40.1	0.14	12.6	D
B	IV	25	17.9	8.8	26.7	0.07	9.1	D
C	IV	25	19.0	4.5	23.5	0.07	11.0	D
D	IV	25	18.7	2.6	21.3	0.07	11.9	D
Total	IV		148.9	143.7	292.6	0.62	7.7	E

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	29	24.0	54.8	78.8	0.16	7.3	E
5th	IV	25	16.3	3.1	19.4	0.06	11.4	D
4th	IV	25	14.6	6.2	20.8	0.05	9.5	D
3rd	IV	25	17.7	10.4	28.1	0.07	8.5	E
2nd	IV	25	15.6	75.5	91.1	0.06	2.3	F
Total	IV		88.2	150.0	238.2	0.40	6.1	F

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	30	25.2	32.1	57.3	0.17	10.6	D
3rd St	IV	25	14.8	20.3	35.1	0.06	5.7	F
4th	IV	25	18.3	17.0	35.3	0.07	7.0	E
5th	IV	25	14.6	9.8	24.4	0.06	8.1	E
Mission	IV	25	15.7	5.9	21.6	0.06	9.9	D
Total	IV		88.6	85.1	173.7	0.41	8.4	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	14.6	43.1	0.16	13.2	C
Tamalpais	IV	25	16.0	49.8	65.8	0.06	3.3	F
Tamalpais	IV	25	3.1	5.7	8.8	0.01	4.8	F
Hetherton	IV	25	8.7	10.3	19.0	0.03	6.2	F
Irwin	IV	25	18.9	14.7	33.6	0.07	7.6	E
Total	IV		75.2	95.1	170.3	0.33	7.1	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	27.6	49.2	0.10	7.2	E
Hetherton	IV	25	18.9	23.4	42.3	0.07	6.1	F
Tamalpais	IV	25	8.7	115.6	124.3	0.03	1.0	F
Tamalpais	IV	25	3.1	4.7	7.8	0.01	5.4	F
Lincoln	IV	25	16.0	80.8	96.8	0.06	2.2	F
Total	IV		68.3	252.1	320.4	0.27	3.1	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	17.6	35.7	0.07	6.9	F
C	IV	25	18.9	13.8	32.7	0.07	7.9	E
B	IV	25	17.9	14.9	32.8	0.07	7.4	E
A	IV	25	18.5	12.1	30.6	0.07	8.2	E
Lindaro	IV	25	25.3	13.2	38.5	0.14	13.1	C
Lincoln	IV	25	21.4	63.0	84.4	0.10	4.1	F
Francisco W.	IV	25	12.2	35.3	47.5	0.05	3.5	F
101 SBOn Hetherton	IV	25	14.2	81.7	95.9	0.05	2.0	F
Total	IV		146.5	251.6	398.1	0.61	5.6	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	42.1	61.1	0.07	4.2	F
Tamalpais	IV	25	14.4	52.1	66.5	0.05	2.9	F
Lincoln	IV	25	13.2	18.0	31.2	0.05	5.8	F
Lindaro	IV	25	21.4	4.5	25.9	0.10	13.5	C
A	IV	25	25.3	6.4	31.7	0.14	16.0	C
B	IV	25	17.9	7.2	25.1	0.07	9.7	D
C	IV	25	19.0	4.3	23.3	0.07	11.1	D
D	IV	25	18.7	2.9	21.6	0.07	11.7	D
Total	IV		148.9	137.5	286.4	0.62	7.8	E

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	35	22.2	36.4	58.6	0.16	9.8	D
5th	IV	25	16.3	6.8	23.1	0.06	9.6	D
4th	IV	25	14.6	7.4	22.0	0.05	9.0	E
3rd	IV	25	17.7	22.8	40.5	0.07	5.9	F
2nd	IV	25	15.6	25.7	41.3	0.06	5.1	F
Total	IV		86.4	99.1	185.5	0.40	7.8	E

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	38	19.3	57.5	76.8	0.17	7.9	E
3rd St	IV	25	14.8	20.3	35.1	0.06	5.7	F
4th	IV	25	18.9	3.7	22.6	0.07	11.4	D
5th	IV	25	14.0	12.6	26.6	0.05	7.2	E
Mission	IV	25	15.7	3.0	18.7	0.06	11.4	D
Total	IV		82.7	97.1	179.8	0.41	8.2	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	12.1	40.6	0.16	14.0	C
Tamalpais	IV	25	16.1	25.9	42.0	0.06	5.2	F
Tamalpais	IV	25	4.3	3.1	7.4	0.02	7.9	E
Hetherton	IV	25	7.5	8.0	15.5	0.03	6.6	F
Irwin	IV	25	18.9	14.4	33.3	0.07	7.7	E
Total	IV		75.3	63.5	138.8	0.33	8.7	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	30.4	52.0	0.10	6.8	F
Hetherton	IV	25	18.9	8.1	27.0	0.07	9.5	D
Tamalpais	IV	25	7.5	46.6	54.1	0.03	1.9	F
Tamalpais	IV	25	4.3	2.7	7.0	0.02	8.4	E
Lincoln	IV	25	16.1	31.9	48.0	0.06	4.6	F
Total	IV		68.4	119.7	188.1	0.27	5.3	F

Leisch Method for Weaving Analysis

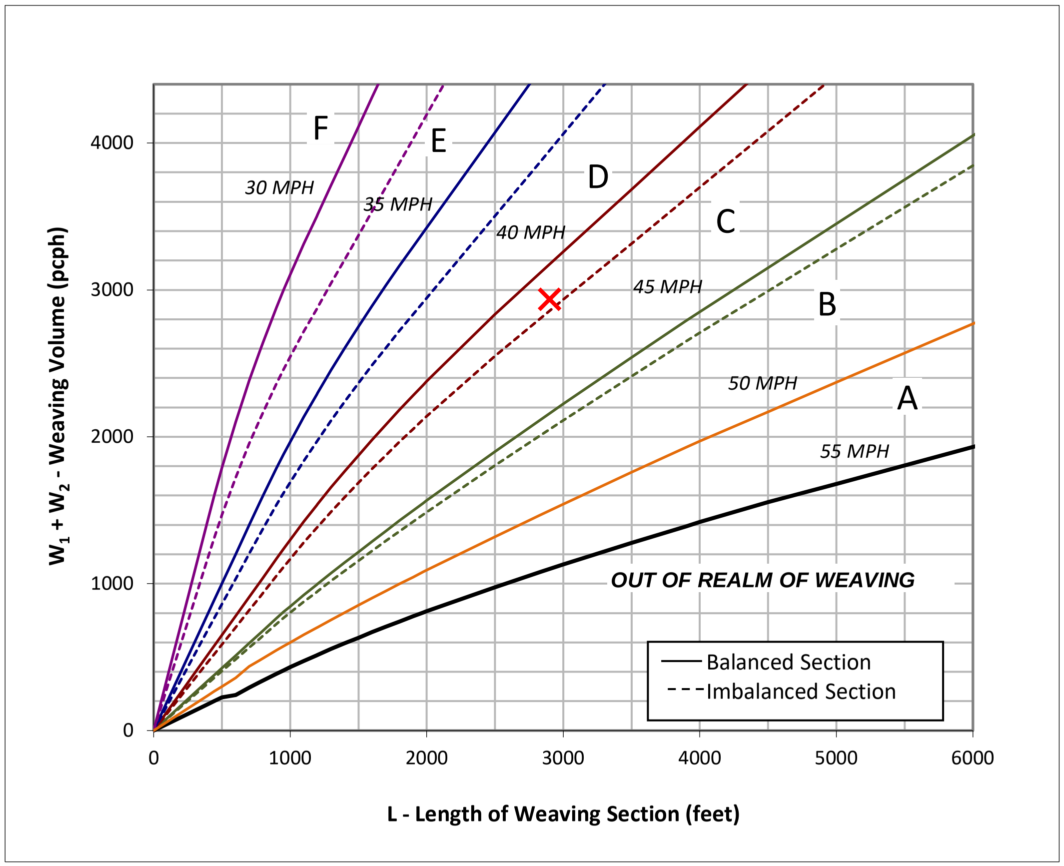
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

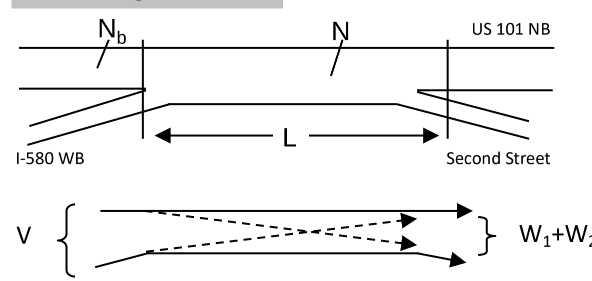
Project Information

Project	BioMarin
Scenario	Baseline + Project No SenCent AM PH
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,787	Volume (vph)*	1,755	Volume (vph)*	1,061
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	4%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	6,042	Volume (pcph)	1,832	Volume (pcph)	1,104



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 39.6
4. Weaving Intensity Factor (k) — 2.55
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,550

6. Level of Service (LOS) — D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3833	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1404
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	23.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	718	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	820
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	13.7
Speed 2 (S_3), mi/h	1.4	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5617	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1596
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	26.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5857	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	2116
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.92
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	55.2
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	38.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	3/17/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	Baseline + Project No Senior Center, AM Peak Hour
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5857	1508
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	4.40	3.72
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.958
Flow Rate (v_i), pc/h	6349	1711
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.92	0.81

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	65224.1	Density in Ramp Influence Area (D_R), pc/mi/ln	38.3
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	0.387
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2212
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	53.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.523	Outer Lanes Freeway Speed (S_O), mi/h	61.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	4137	Ramp Junction Speed (S), mi/h	55.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	38.1
Level of Service (LOS)	E		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	Baseline + Project No Senior Center, AM Peak Hour
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4355	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1628
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.71
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	27.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	998	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1104
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.0
Speed 2 (S_2), mi/h	1.0	Density (D_{ML}), pc/mi/ln	18.7
Speed 2 (S_3), mi/h	5.0	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

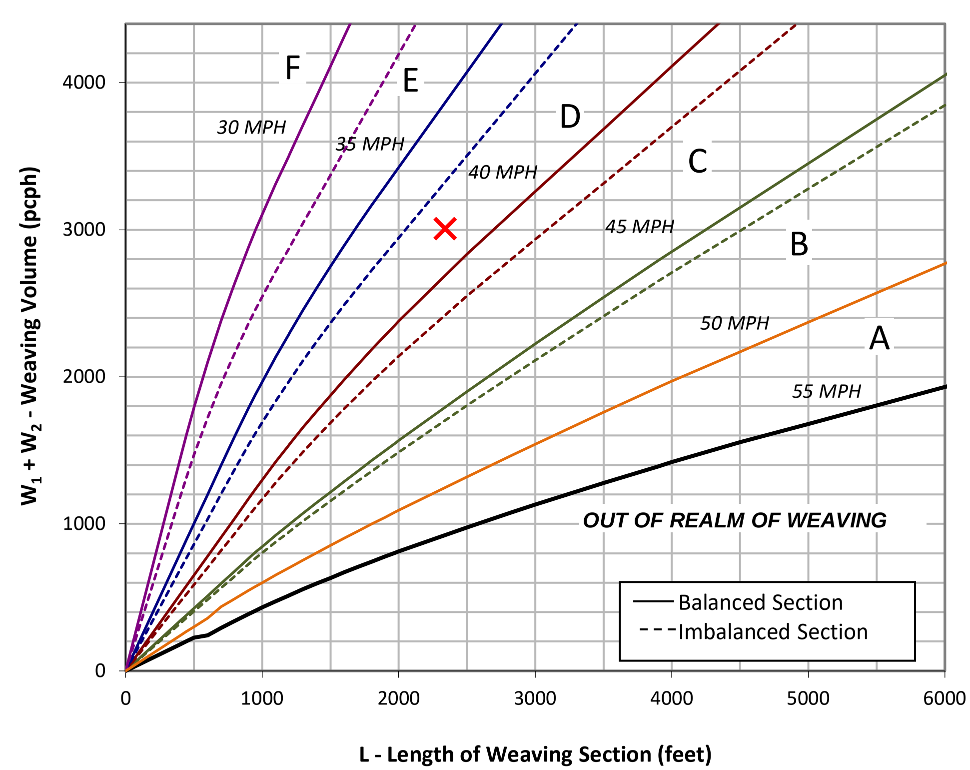
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

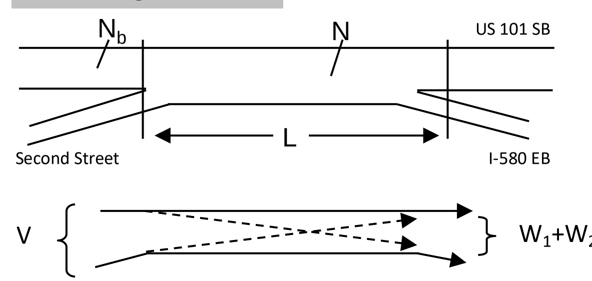
Project Information

Project	BioMarin
Scenario	Baseline + Project No SenCent AM PH
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,705	Volume (vph)*	1,714	Volume (vph)*	1,178
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	2%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	7,000	Volume (pcph)	1,760	Volume (pcph)	1,248



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)?	Y
If optional exit lane, then "Y". Otherwise "N".	
2. In the chart to the left, which two speed curves is the red "x" between?	
35 MPH and 40 MPH	
If left of the 30 MPH curve, LOS is F. Select "-".	
If below the 55 MPH curve, out of the realm of weaving.	
3. Interpolated Weaving Speed (S_w, mph)	38.7
4. Weaving Intensity Factor (k)	2.60
5. Service Volume (SV, pcph) $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$	2,251
6. Level of Service (LOS)	F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

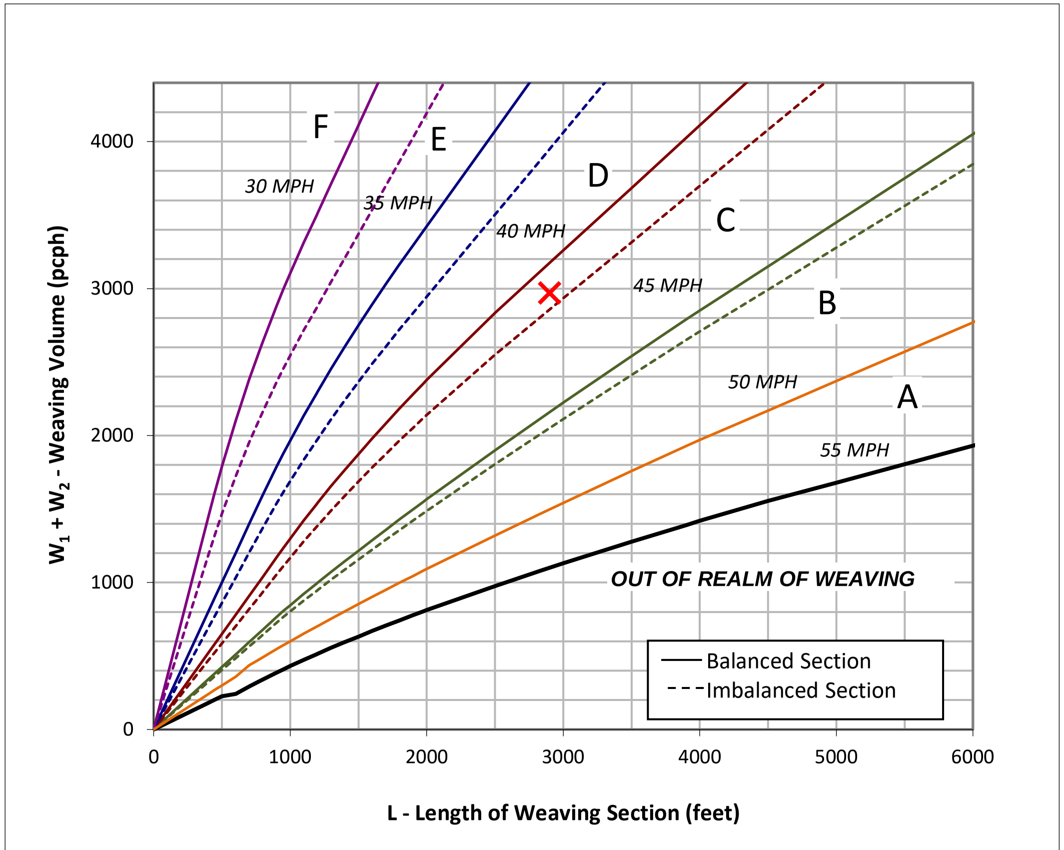
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

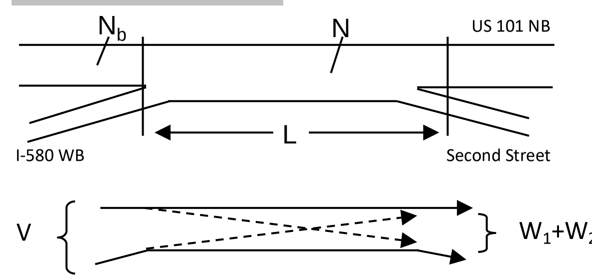
Project Information

Project	BioMarin
Scenario	Baseline + Project No SenCent PM PH
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,746	Volume (vph)*	1,547	Volume (vph)*	1,321
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	7,043	Volume (pcph)	1,615	Volume (pcph)	1,356



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? — N

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 39.5
4. Weaving Intensity Factor (k) — 2.55
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,830

6. Level of Service (LOS) — E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4799	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1776
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	29.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	848	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	890
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.7
Speed 2 (S_2), mi/h	0.3	Density (D_{ML}), pc/mi/ln	14.9
Speed 2 (S_3), mi/h	2.1	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	7010	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	2012
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	56.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	35.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1217	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	1342
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	47.9
Speed 2 (S_2), mi/h	2.3	Density (D_{ML}), pc/mi/ln	28.0
Speed 2 (S_3), mi/h	9.8	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5077	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1835
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	31.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1377	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1555
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	56.0
Speed 2 (S_2), mi/h	4.0	Density (D_{ML}), pc/mi/ln	27.8
Speed 2 (S_3), mi/h	15.4	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5077	1749
Peak Hour Factor (PHF)	0.97	0.96
Total Trucks, %	4.40	2.00
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.973
Flow Rate (v_i), pc/h	5504	1872
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.80	0.89

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	102565.3	Density in Ramp Influence Area (D_R), pc/mi/ln	35.6
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	0.401
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1685
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	52.8
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.536	Outer Lanes Freeway Speed (S_O), mi/h	63.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3819	Ramp Junction Speed (S), mi/h	55.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	33.0
Level of Service (LOS)	E		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1380	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1559
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	55.9
Speed 2 (S_2), mi/h	4.1	Density (D_{ML}), pc/mi/ln	27.9
Speed 2 (S_3), mi/h	15.5	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project No Senior Center Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3335	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1247
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	20.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	918	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1049
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.2
Speed 2 (S_2), mi/h	0.8	Density (D_{ML}), pc/mi/ln	17.7
Speed 2 (S_3), mi/h	4.2	Level of Service (LOS)	B

Leisch Method for Weaving Analysis

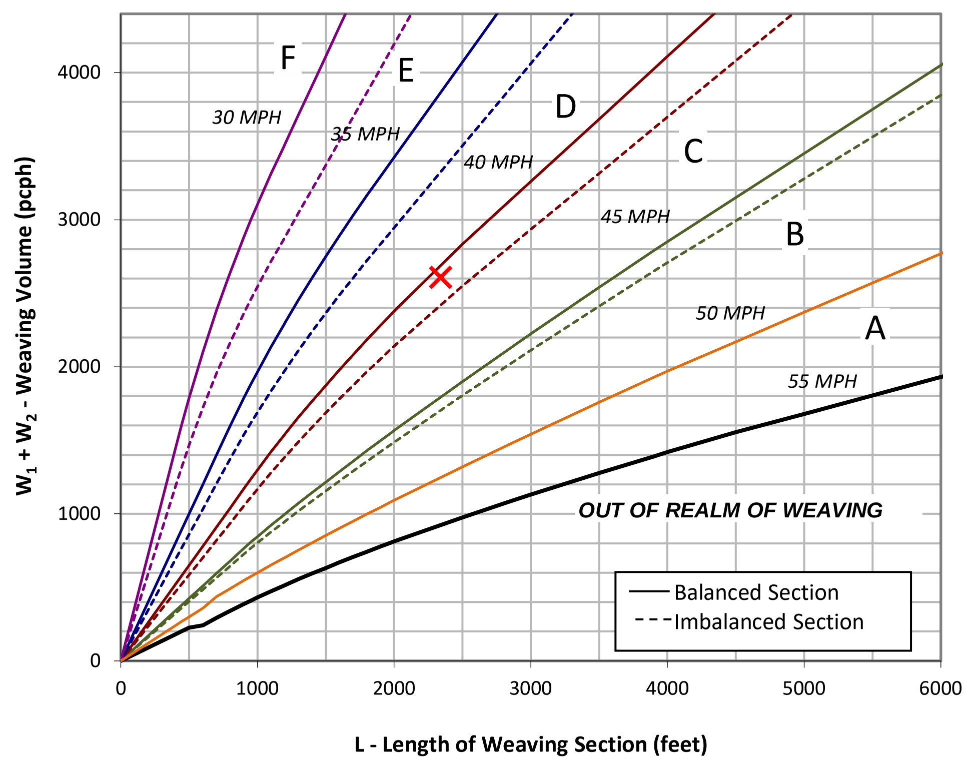
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

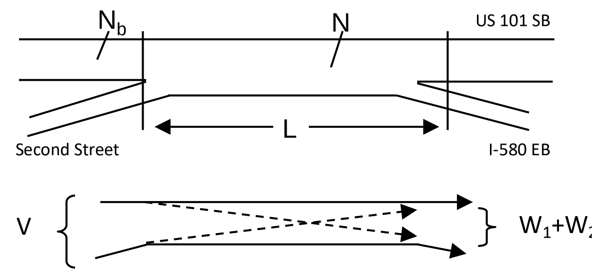
Project Information

Project	BioMarin
Scenario	Baseline + Project PM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,130	Volume (vph)*	1,035	Volume (vph)*	1,411
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	5,356	Volume (pcph)	1,061	Volume (pcph)	1,548



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   40 MPH and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) **40.5**
4. Weaving Intensity Factor (k) **2.49**
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ **1,733**
6. Level of Service (LOS) **E**

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Appendix D:
Baseline Plus Project Conditions (R&D and Senior Services and Housing) – Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

April 5, 2019

FEHR PEERS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	460	20	70	570	50	20	210	40	60	391	360
Future Volume (veh/h)	110	460	20	70	570	50	20	210	40	60	391	360
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	0.99		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1710	1660	1660	1710	1800	1678	1728	1800	1748	1728
Adj Flow Rate, veh/h	120	500	20	76	620	50	22	228	34	65	425	182
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	148	865	35	372	625	50	73	508	72	144	846	349
Arrive On Green	0.09	0.55	0.55	0.55	0.55	0.55	0.85	0.85	0.85	0.43	0.43	0.43
Sat Flow, veh/h	1581	1582	63	817	1512	122	49	1192	169	205	1983	818
Grp Volume(v), veh/h	120	0	520	76	0	670	284	0	0	364	0	308
Grp Sat Flow(s),veh/h/ln	1581	0	1646	817	0	1634	1410	0	0	1621	0	1384
Q Serve(g_s), s	5.6	0.0	15.7	4.4	0.0	30.5	0.0	0.0	0.0	3.0	0.0	12.3
Cycle Q Clear(g_c), s	5.6	0.0	15.7	10.1	0.0	30.5	3.5	0.0	0.0	11.7	0.0	12.3
Prop In Lane	1.00		0.04	1.00		0.07	0.08		0.12	0.18		0.59
Lane Grp Cap(c), veh/h	148	0	900	372	0	675	653	0	0	748	0	590
V/C Ratio(X)	0.81	0.00	0.58	0.20	0.00	0.99	0.43	0.00	0.00	0.49	0.00	0.52
Avail Cap(c_a), veh/h	148	0	900	372	0	675	653	0	0	748	0	590
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.72	0.00	0.72	0.87	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.4	0.0	11.3	14.0	0.0	16.8	3.4	0.0	0.0	15.6	0.0	15.9
Incr Delay (d2), s/veh	36.9	0.0	2.7	0.9	0.0	27.5	1.8	0.0	0.0	2.3	0.0	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	7.8	1.1	0.0	18.6	1.5	0.0	0.0	5.9	0.0	5.2
LnGrp Delay(d),s/veh	70.3	0.0	14.0	14.9	0.0	44.2	5.2	0.0	0.0	17.9	0.0	19.1
LnGrp LOS	E		B	B		D	A			B		B
Approach Vol, veh/h		640			746			284			672	
Approach Delay, s/veh		24.5			41.2			5.2			18.4	
Approach LOS		C			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		45.2		36.8	10.0	35.2		36.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 41		25.4	7.0	* 31		25.4
Max Q Clear Time (g_c+I1), s		17.7		5.5	7.6	32.5		14.3
Green Ext Time (p_c), s		5.1		2.4	0.0	0.0		4.5

Intersection Summary		
HCM 2010 Ctrl Delay		25.8
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	80	40	220	0	0	0	0	220	1032	465
Future Volume (vph)	0	490	80	40	220	0	0	0	0	220	1032	465
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.97
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2715			1766						2962	1302
Flt Permitted		1.00			0.86						0.99	1.00
Satd. Flow (perm)		2715			1534						2962	1302
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	533	87	43	239	0	0	0	0	239	1122	505
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	603	0	0	282	0	0	0	0	0	1361	505
Confl. Peds. (#/hr)	15		22	22		15			16			1
Confl. Bikes (#/hr)			3			2			1			3
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1187			670						1319	458
v/s Ratio Prot		c0.22									c0.46	
v/s Ratio Perm					0.18							0.39
v/c Ratio		0.51			0.42						1.03	1.10
Uniform Delay, d1		15.3			14.6						20.8	24.3
Progression Factor		0.61			1.45						1.00	1.00
Incremental Delay, d2		1.3			1.5						33.3	72.9
Delay (s)		10.5			22.6						54.1	97.2
Level of Service		B			C						D	F
Approach Delay (s)		10.5			22.6			0.0			65.8	
Approach LOS		B			C			A			E	

Intersection Summary			
HCM 2000 Control Delay	49.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	92.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	380	20	310	160	320	5	110	1075	130	40
Future Volume (vph)	380	20	310	160	320	5	110	1075	130	40
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1494	1794	1615	1471			3428	1295	
Flt Permitted		0.60	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		938	1794	1615	1471			3428	1295	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	413	22	337	174	348	5	120	1168	141	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	44	0
Lane Group Flow (vph)	0	435	337	174	353	0	0	1288	140	0
Confl. Peds. (#/hr)							13			6
Confl. Bikes (#/hr)					2	2				2
Parking (#/hr)				0				2		
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Effective Green, g (s)		33.8	33.8	18.8	18.8			32.8	32.8	
Actuated g/C Ratio		0.45	0.45	0.25	0.25			0.44	0.44	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		502	808	404	368			1499	566	
v/s Ratio Prot		c0.12	0.19	0.11	c0.24					
v/s Ratio Perm		0.27						0.38	0.11	
v/c Ratio		0.87	0.42	0.43	0.96			0.86	0.25	
Uniform Delay, d1		19.1	13.9	23.6	27.7			19.0	13.3	
Progression Factor		0.99	0.95	1.00	1.00			0.74	0.67	
Incremental Delay, d2		13.8	1.2	3.3	37.7			3.1	0.5	
Delay (s)		32.8	14.4	26.9	65.4			17.2	9.3	
Level of Service		C	B	C	E			B	A	
Approach Delay (s)			24.8	52.7				16.2		
Approach LOS			C	D				B		

Intersection Summary			
HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	300	40	70	280	30	10	220	45	40	401	40
Future Volume (veh/h)	30	300	40	70	280	30	10	220	45	40	401	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1398	1545	1530	1398	1485	1530	1440	1485	1469	1440	1485	1469
Adj Flow Rate, veh/h	33	326	36	76	304	28	11	239	39	43	436	39
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	243	534	59	257	524	48	58	523	83	82	534	46
Arrive On Green	0.39	0.39	0.39	0.13	0.13	0.13	0.97	0.97	0.97	0.97	0.97	0.97
Sat Flow, veh/h	825	1361	150	802	1336	123	16	1077	171	62	1101	95
Grp Volume(v), veh/h	33	0	362	76	0	332	289	0	0	518	0	0
Grp Sat Flow(s),veh/h/ln	825	0	1511	802	0	1459	1264	0	0	1258	0	0
Q Serve(g_s), s	2.6	0.0	14.4	6.9	0.0	16.1	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	18.6	0.0	14.4	21.2	0.0	16.1	0.9	0.0	0.0	4.4	0.0	0.0
Prop In Lane	1.00		0.10	1.00		0.08	0.04		0.13	0.08		0.08
Lane Grp Cap(c), veh/h	243	0	592	257	0	572	663	0	0	662	0	0
V/C Ratio(X)	0.14	0.00	0.61	0.30	0.00	0.58	0.44	0.00	0.00	0.78	0.00	0.00
Avail Cap(c_a), veh/h	243	0	592	257	0	572	663	0	0	662	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.94	0.00	0.94	0.85	0.00	0.00	0.50	0.00	0.00
Uniform Delay (d), s/veh	26.4	0.0	18.2	36.0	0.0	26.8	0.6	0.0	0.0	0.6	0.0	0.0
Incr Delay (d2), s/veh	1.2	0.0	4.6	2.8	0.0	4.0	1.8	0.0	0.0	4.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	6.7	1.7	0.0	7.1	0.6	0.0	0.0	1.3	0.0	0.0
LnGrp Delay(d),s/veh	27.6	0.0	22.9	38.8	0.0	30.9	2.3	0.0	0.0	5.3	0.0	0.0
LnGrp LOS	C		C	D		C	A			A		
Approach Vol, veh/h		395			408			289			518	
Approach Delay, s/veh		23.3			32.3			2.3			5.3	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		34.0		41.0		34.0		41.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		29.4		36.4		29.4		36.4
Max Q Clear Time (g_c+I1), s		20.6		2.9		23.2		6.4
Green Ext Time (p_c), s		1.2		1.3		1.0		2.6

Intersection Summary	
HCM 2010 Ctrl Delay	16.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	240	165	40	245	0	0	0	0	50	987	115
Future Volume (vph)	0	240	165	40	245	0	0	0	0	50	987	115
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1665			1769						4118	1127
Flt Permitted		1.00			0.91						1.00	1.00
Satd. Flow (perm)		1665			1612						4118	1127
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	261	179	43	266	0	0	0	0	54	1073	125
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	417	0	0	309	0	0	0	0	0	1127	125
Confl. Peds. (#/hr)			15	15		14			22	22		10
Confl. Bikes (#/hr)			4			2			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		32.8			32.8						33.4	26.4
Actuated g/C Ratio		0.44			0.44						0.45	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		728			704						1833	396
v/s Ratio Prot		c0.25										
v/s Ratio Perm					0.19						0.27	0.11
v/c Ratio		0.57			0.44						0.61	0.32
Uniform Delay, d1		15.8			14.7						15.9	17.7
Progression Factor		0.44			1.25						0.17	0.24
Incremental Delay, d2		3.1			1.2						0.4	0.6
Delay (s)		10.1			19.5						3.1	4.9
Level of Service		B			B						A	A
Approach Delay (s)		10.1			19.5			0.0			3.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	100	0	0	155	120	155	1125	10	0	0	0
Future Volume (veh/h)	140	100	0	0	155	120	155	1125	10	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	0.89	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1620	1573	1620			
Adj Flow Rate, veh/h	152	109	0	0	168	90	168	1223	10			
Adj No. of Lanes	1	1	0	0	1	0	0	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	0	3	0			
Cap, veh/h	237	491	0	0	265	142	180	1380	12			
Arrive On Green	0.10	0.10	0.00	0.00	0.31	0.31	0.19	0.19	0.19			
Sat Flow, veh/h	993	1573	0	0	849	455	318	2441	21			
Grp Volume(v), veh/h	152	109	0	0	0	258	731	0	670			
Grp Sat Flow(s),veh/h/ln	993	1573	0	0	0	1304	1384	0	1396			
Q Serve(g_s), s	10.7	4.8	0.0	0.0	0.0	12.7	39.0	0.0	34.8			
Cycle Q Clear(g_c), s	23.4	4.8	0.0	0.0	0.0	12.7	39.0	0.0	34.8			
Prop In Lane	1.00		0.00	0.00		0.35	0.23		0.01			
Lane Grp Cap(c), veh/h	237	491	0	0	0	407	782	0	789			
V/C Ratio(X)	0.64	0.22	0.00	0.00	0.00	0.63	0.93	0.00	0.85			
Avail Cap(c_a), veh/h	237	491	0	0	0	407	782	0	789			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	40.4	25.3	0.0	0.0	0.0	22.1	29.1	0.0	27.4			
Incr Delay (d2), s/veh	12.5	1.0	0.0	0.0	0.0	7.3	19.7	0.0	11.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	2.2	0.0	0.0	0.0	5.4	19.2	0.0	15.9			
LnGrp Delay(d),s/veh	52.9	26.3	0.0	0.0	0.0	29.5	48.8	0.0	38.4			
LnGrp LOS	D	C				C	D		D			
Approach Vol, veh/h		261			258			1401				
Approach Delay, s/veh		41.8			29.5			43.8				
Approach LOS		D			C			D				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6						
Phs Duration (G+Y+Rc), s		28.0		47.0		28.0						
Change Period (Y+Rc), s		4.6		4.6		4.6						
Max Green Setting (Gmax), s		23.4		42.4		23.4						
Max Q Clear Time (g_c+I1), s		25.4		41.0		14.7						
Green Ext Time (p_c), s		0.0		0.9		0.7						
Intersection Summary												
HCM 2010 Ctrl Delay			41.6									
HCM 2010 LOS			D									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	260	20	70	310	30	20	225	65	65	371	80
Future Volume (veh/h)	30	260	20	70	310	30	20	225	65	65	371	80
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.92	0.98		0.92	0.97		0.91	0.99		0.91
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1573	1510	1620	1573	1573	1620	1620	1573	1555	1620	1573	1555
Adj Flow Rate, veh/h	33	283	18	76	337	28	22	245	57	71	403	77
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	238	536	34	309	546	45	71	517	115	113	496	90
Arrive On Green	0.38	0.38	0.38	0.13	0.13	0.13	0.17	0.17	0.17	1.00	1.00	1.00
Sat Flow, veh/h	894	1396	89	937	1422	118	40	1026	228	116	984	179
Grp Volume(v), veh/h	33	0	301	76	0	365	324	0	0	551	0	0
Grp Sat Flow(s),veh/h/ln	894	0	1485	937	0	1540	1294	0	0	1279	0	0
Q Serve(g_s), s	2.4	0.0	11.7	5.8	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	19.3	0.0	11.7	17.5	0.0	16.8	16.5	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.06	1.00		0.08	0.07		0.18	0.13		0.14
Lane Grp Cap(c), veh/h	238	0	570	309	0	591	703	0	0	699	0	0
V/C Ratio(X)	0.14	0.00	0.53	0.25	0.00	0.62	0.46	0.00	0.00	0.79	0.00	0.00
Avail Cap(c_a), veh/h	238	0	570	309	0	591	703	0	0	699	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.43	0.00	0.00	0.45	0.00	0.00
Uniform Delay (d), s/veh	27.5	0.0	17.8	33.4	0.0	27.5	22.4	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	1.2	0.0	3.5	1.7	0.0	4.4	0.9	0.0	0.0	4.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	5.3	1.6	0.0	7.9	6.3	0.0	0.0	0.8	0.0	0.0
LnGrp Delay(d),s/veh	28.7	0.0	21.3	35.2	0.0	31.9	23.3	0.0	0.0	4.2	0.0	0.0
LnGrp LOS	C		C	D		C	C			A		
Approach Vol, veh/h		334			441			324			551	
Approach Delay, s/veh		22.1			32.5			23.3			4.2	
Approach LOS		C			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0		42.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 29		* 38		* 29		* 38
Max Q Clear Time (g_c+I1), s		21.3		18.5		19.5		2.0
Green Ext Time (p_c), s		1.6		2.8		2.6		6.7

Intersection Summary	
HCM 2010 Ctrl Delay	19.1
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	410	380	35	0	35
Future Volume (vph)	0	410	380	35	0	35
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6	5.6			5.2
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.99			0.87
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.99			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1573	1540			1188
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1573	1540			1188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	413	38	0	38
RTOR Reduction (vph)	0	0	4	0	0	32
Lane Group Flow (vph)	0	446	447	0	0	6
Confl. Peds. (#/hr)				39		46
Confl. Bikes (#/hr)				4		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		50.7	51.8			12.4
Effective Green, g (s)		50.7	51.8			12.4
Actuated g/C Ratio		0.68	0.69			0.17
Clearance Time (s)						5.2
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1063	1063			196
v/s Ratio Prot		c0.28	c0.29			
v/s Ratio Perm						0.01
v/c Ratio		0.42	0.42			0.03
Uniform Delay, d1		5.5	5.1			26.3
Progression Factor		1.63	0.49			1.00
Incremental Delay, d2		0.2	0.2			0.1
Delay (s)		9.1	2.6			26.3
Level of Service		A	A			C
Approach Delay (s)		9.1	2.6		26.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	6.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	285	130	185	285	0	0	0	0	105	887	200
Future Volume (vph)	0	285	130	185	285	0	0	0	0	105	887	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00						1.00	0.89
Flpb, ped/bikes		1.00	1.00	0.98	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1625	1180	1606	1520						4264	1185
Flt Permitted		1.00	1.00	0.49	1.00						0.99	1.00
Satd. Flow (perm)		1625	1180	832	1520						4264	1185
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	310	141	201	310	0	0	0	0	114	964	217
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	310	112	201	310	0	0	0	0	0	1078	217
Confl. Peds. (#/hr)			40	40		22			9	9		30
Confl. Bikes (#/hr)			8			4						2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		32.8	32.8	32.8	32.8						33.4	26.4
Effective Green, g (s)		32.8	32.8	32.8	32.8						33.4	26.4
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.45	0.35
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		710	516	363	664						1898	417
v/s Ratio Prot		0.19			0.20							
v/s Ratio Perm			0.09	c0.24							0.25	0.18
v/c Ratio		0.44	0.22	0.55	0.47						0.57	0.52
Uniform Delay, d1		14.7	13.1	15.7	14.9						15.4	19.3
Progression Factor		0.39	0.26	1.01	1.03						0.33	0.43
Incremental Delay, d2		1.8	0.9	4.4	1.7						1.0	3.7
Delay (s)		7.5	4.3	20.3	17.2						6.1	11.9
Level of Service		A	A	C	B						A	B
Approach Delay (s)		6.5			18.4			0.0			7.1	
Approach LOS		A			B			A			A	

Intersection Summary				
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.58			
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8	
Intersection Capacity Utilization	84.7%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	230	0	0	345	70	130	1090	50	0	0	0
Future Volume (veh/h)	160	230	0	0	345	70	130	1090	50	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1510	1573	1620			
Adj Flow Rate, veh/h	174	250	0	0	375	65	141	1185	50			
Adj No. of Lanes	1	1	0	0	1	0	1	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	152	604	0	0	443	77	725	1389	59			
Arrive On Green	0.77	0.77	0.00	0.00	0.13	0.13	0.17	0.17	0.17			
Sat Flow, veh/h	842	1573	0	0	1153	200	1438	2756	116			
Grp Volume(v), veh/h	174	250	0	0	0	440	141	642	593			
Grp Sat Flow(s),veh/h/ln	842	1573	0	0	0	1353	1438	1494	1378			
Q Serve(g_s), s	4.9	4.1	0.0	0.0	0.0	23.9	6.3	31.3	31.3			
Cycle Q Clear(g_c), s	28.8	4.1	0.0	0.0	0.0	23.9	6.3	31.3	31.3			
Prop In Lane	1.00		0.00	0.00		0.15	1.00		0.08			
Lane Grp Cap(c), veh/h	152	604	0	0	0	520	725	753	695			
V/C Ratio(X)	1.15	0.41	0.00	0.00	0.00	0.85	0.19	0.85	0.85			
Avail Cap(c_a), veh/h	152	604	0	0	0	520	725	753	695			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.90	0.90	0.00	0.00	0.00	1.00	0.29	0.29	0.29			
Uniform Delay (d), s/veh	22.2	5.8	0.0	0.0	0.0	30.6	18.1	28.6	28.6			
Incr Delay (d2), s/veh	114.7	1.9	0.0	0.0	0.0	15.6	0.2	3.8	4.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	7.9	1.9	0.0	0.0	0.0	11.2	2.6	13.8	12.8			
LnGrp Delay(d),s/veh	136.9	7.7	0.0	0.0	0.0	46.2	18.3	32.4	32.7			
LnGrp LOS	F	A				D	B	C	C			
Approach Vol, veh/h		424			440			1376				
Approach Delay, s/veh		60.7			46.2			31.1				
Approach LOS		E			D			C				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6						
Phs Duration (G+Y+Rc), s		33.0		42.0		33.0						
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2						
Max Green Setting (Gmax), s		* 29		* 38		* 29						
Max Q Clear Time (g_c+I1), s		30.8		33.3		25.9						
Green Ext Time (p_c), s		0.0		2.6		0.6						
Intersection Summary												
HCM 2010 Ctrl Delay			39.7									
HCM 2010 LOS			D									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	295	1137	0	0	0	0	0	230	30
Future Volume (veh/h)	0	0	0	295	1137	0	0	0	0	0	230	30
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.99
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1530	1485	0				0	1485	1530
Adj Flow Rate, veh/h				321	1236	0				0	250	18
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				502	1719	0				0	786	56
Arrive On Green				0.19	0.19	0.00				0.00	0.31	0.31
Sat Flow, veh/h				747	3134	0				0	2593	180
Grp Volume(v), veh/h				558	999	0				0	139	129
Grp Sat Flow(s),veh/h/ln				1299	1230	0				0	1411	1288
Q Serve(g_s), s				30.5	28.5	0.0				0.0	5.6	5.7
Cycle Q Clear(g_c), s				30.5	28.5	0.0				0.0	5.6	5.7
Prop In Lane				0.57		0.00				0.00		0.14
Lane Grp Cap(c), veh/h				817	1404	0				0	440	402
V/C Ratio(X)				0.68	0.71	0.00				0.00	0.32	0.32
Avail Cap(c_a), veh/h				817	1404	0				0	440	402
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				25.4	24.6	0.0				0.0	19.7	19.7
Incr Delay (d2), s/veh				4.6	3.1	0.0				0.0	1.9	2.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.0	10.3	0.0				0.0	2.4	2.3
LnGrp Delay(d),s/veh				30.1	27.7	0.0				0.0	21.6	21.8
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1557						268	
Approach Delay, s/veh					28.6						21.7	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		47.0		28.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 43		23.4				
Max Q Clear Time (g_c+I1), s		32.5		7.7				
Green Ext Time (p_c), s		5.7		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	27.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1317	110	100	235	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1317	110	100	235	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1398	1398	1440	1398	0			
Adj Flow Rate, veh/h				0	1432	82	109	255	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	2229	679	266	553	0			
Arrive On Green				0.00	0.19	0.19	0.10	0.10	0.00			
Sat Flow, veh/h				0	3943	1163	630	1883	0			
Grp Volume(v), veh/h				0	1432	82	197	167	0			
Grp Sat Flow(s),veh/h/ln				0	1272	1163	1241	1209	0			
Q Serve(g_s), s				0.0	25.9	4.4	9.6	9.7	0.0			
Cycle Q Clear(g_c), s				0.0	25.9	4.4	11.2	9.7	0.0			
Prop In Lane				0.00		1.00	0.55		0.00			
Lane Grp Cap(c), veh/h				0	2229	679	452	367	0			
V/C Ratio(X)				0.00	0.64	0.12	0.44	0.45	0.00			
Avail Cap(c_a), veh/h				0	2229	679	452	367	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	23.1	14.4	28.4	27.9	0.0			
Incr Delay (d2), s/veh				0.0	1.4	0.4	3.1	4.0	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	9.4	1.5	4.3	3.7	0.0			
LnGrp Delay(d),s/veh				0.0	24.5	14.7	31.5	31.9	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1514			364				
Approach Delay, s/veh					24.0			31.7				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		48.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 44		* 23				
Max Q Clear Time (g_c+I1), s		27.9		13.2				
Green Ext Time (p_c), s		7.6		1.0				

Intersection Summary	
HCM 2010 Ctrl Delay	25.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	90	1372	0	0	0	0	0	190	50
Future Volume (veh/h)	0	0	0	90	1372	0	0	0	0	0	190	50
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.87
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1398	0				0	1398	1440
Adj Flow Rate, veh/h				98	1491	0				0	207	25
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				167	2129	0				0	616	72
Arrive On Green				0.20	0.20	0.00				0.00	0.28	0.28
Sat Flow, veh/h				181	3601	0				0	2290	261
Grp Volume(v), veh/h				590	999	0				0	122	110
Grp Sat Flow(s),veh/h/ln				1353	1158	0				0	1328	1153
Q Serve(g_s), s				21.9	30.1	0.0				0.0	5.5	5.7
Cycle Q Clear(g_c), s				30.4	30.1	0.0				0.0	5.5	5.7
Prop In Lane				0.17		0.00				0.00		0.23
Lane Grp Cap(c), veh/h				882	1414	0				0	368	320
V/C Ratio(X)				0.67	0.71	0.00				0.00	0.33	0.34
Avail Cap(c_a), veh/h				882	1414	0				0	368	320
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.7	23.7	0.0				0.0	21.6	21.7
Incr Delay (d2), s/veh				4.0	3.0	0.0				0.0	2.4	2.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.4	10.3	0.0				0.0	2.2	2.1
LnGrp Delay(d),s/veh				27.7	26.7	0.0				0.0	24.0	24.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1589						232	
Approach Delay, s/veh					27.1						24.3	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		50.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 46		* 21				
Max Q Clear Time (g_c+I1), s		32.4		7.7				
Green Ext Time (p_c), s		6.8		0.7				

Intersection Summary	
HCM 2010 Ctrl Delay	26.7
HCM 2010 LOS	C

Notes

HCM 2010 Signalized Intersection Summary
14: A & 3rd

Baseline Plus Project Buildout
Timing Plan: AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	1227	80	195	120	0	0	130	30
Future Volume (veh/h)	0	0	0	40	1227	80	195	120	0	0	130	30
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.97		1.00	1.00		0.93
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				43	1334	77	212	130	0	0	141	21
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				72	2357	141	371	685	0	0	358	53
Arrive On Green				0.17	0.17	0.17	0.02	0.12	0.00	0.00	0.26	0.26
Sat Flow, veh/h				139	4591	274	1748	1835	0	0	1375	205
Grp Volume(v), veh/h				537	447	470	212	130	0	0	0	162
Grp Sat Flow(s),veh/h/ln				1741	1590	1674	1748	1835	0	0	0	1580
Q Serve(g_s), s				21.4	19.3	19.3	0.0	4.8	0.0	0.0	0.0	6.3
Cycle Q Clear(g_c), s				21.4	19.3	19.3	0.0	4.8	0.0	0.0	0.0	6.3
Prop In Lane				0.08		0.16	1.00		0.00	0.00		0.13
Lane Grp Cap(c), veh/h				894	816	859	371	685	0	0	0	411
V/C Ratio(X)				0.60	0.55	0.55	0.57	0.19	0.00	0.00	0.00	0.39
Avail Cap(c_a), veh/h				894	816	859	371	685	0	0	0	411
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				24.0	23.2	23.2	30.1	22.7	0.0	0.0	0.0	22.9
Incr Delay (d2), s/veh				3.0	2.6	2.5	6.2	0.6	0.0	0.0	0.0	2.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.0	9.1	9.5	5.0	2.5	0.0	0.0	0.0	3.1
LnGrp Delay(d),s/veh				27.0	25.8	25.7	36.3	23.3	0.0	0.0	0.0	25.7
LnGrp LOS				C	C	C	D	C				C
Approach Vol, veh/h					1454			342			162	
Approach Delay, s/veh					26.2			31.4			25.7	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.0	24.0		43.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			4.0	19.5		38.5		28.0
Max Q Clear Time (g_c+I1), s			2.0	8.3		23.4		6.8
Green Ext Time (p_c), s			0.3	0.8		10.6		0.9

Intersection Summary			
HCM 2010 Ctrl Delay			27.1
HCM 2010 LOS			C

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	21	18	84.1%	8.7	2.9	A
	Through	5	5	103.0%	24.9	20.1	C
	Right Turn						
	Subtotal	26	23	87.8%	13.0	4.3	B
SB	Left Turn						
	Through	5	7	132.5%	23.5	17.4	C
	Right Turn	5	4	88.3%	8.9	9.5	A
	Subtotal	10	11	110.4%	22.3	11.5	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	51	54	106.1%	2.7	0.2	A
	Through	1,321	1,301	98.5%	2.4	0.3	A
	Right Turn	5	6	110.4%	2.2	1.9	A
	Subtotal	1,377	1,361	98.8%	2.4	0.3	A
Total		1,413	1,395	98.7%	2.8	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	86	82	95.0%	15.7	5.4	B
	Through	10	11	114.1%	10.5	9.9	B
	Right Turn						
	Subtotal	96	93	97.0%	15.5	5.5	B
SB	Left Turn						
	Through	40	37	92.0%	28.3	7.5	C
	Right Turn	10	8	77.3%	16.1	12.4	B
	Subtotal	50	45	89.1%	26.5	7.9	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	452	426	94.3%	20.0	11.1	B
	Through	1,311	1,304	99.5%	7.4	3.5	A
	Right Turn	30	28	94.5%	5.8	2.4	A
	Subtotal	1,793	1,759	98.1%	10.4	5.3	B
Total		1,939	1,896	97.8%	11.1	5.1	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	160	1675	55	32	195	0	0	280	166
Future Volume (veh/h)	0	0	0	160	1675	55	32	195	0	0	280	166
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.92	1.00		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1620	1573	1620	1620	1573	0	0	1510	1555
Adj Flow Rate, veh/h				174	1821	56	35	212	0	0	304	175
Adj No. of Lanes				0	3	0	0	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				200	2233	71	55	212	0	0	250	144
Arrive On Green				0.18	0.18	0.18	0.11	0.11	0.00	0.00	0.11	0.11
Sat Flow, veh/h				361	4035	127	0	649	0	0	765	440
Grp Volume(v), veh/h				749	626	675	247	0	0	0	0	479
Grp Sat Flow(s),veh/h/ln				1555	1431	1537	649	0	0	0	0	1205
Q Serve(g_s), s				35.1	31.4	31.5	0.0	0.0	0.0	0.0	0.0	24.5
Cycle Q Clear(g_c), s				35.1	31.4	31.5	24.5	0.0	0.0	0.0	0.0	24.5
Prop In Lane				0.23		0.08	0.14		0.00	0.00		0.37
Lane Grp Cap(c), veh/h				860	792	851	267	0	0	0	0	394
V/C Ratio(X)				0.87	0.79	0.79	0.93	0.00	0.00	0.00	0.00	1.22
Avail Cap(c_a), veh/h				860	792	851	267	0	0	0	0	394
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				28.0	26.5	26.6	29.0	0.0	0.0	0.0	0.0	33.5
Incr Delay (d2), s/veh				11.7	7.9	7.5	38.9	0.0	0.0	0.0	0.0	118.6
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.9	14.2	15.2	8.0	0.0	0.0	0.0	0.0	21.1
LnGrp Delay(d),s/veh				39.8	34.4	34.1	68.0	0.0	0.0	0.0	0.0	152.0
LnGrp LOS				D	C	C	E					F
Approach Vol, veh/h					2051			247			479	
Approach Delay, s/veh					36.3			68.0			152.0	
Approach LOS					D			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				29.0		46.0		29.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				24.5		41.5		24.5
Max Q Clear Time (g_c+I1), s				26.5		37.1		26.5
Green Ext Time (p_c), s				0.0		3.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	59.1
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	235	1815	20	50	50	0	0	50	10
Future Volume (vph)	0	0	0	235	1815	20	50	50	0	0	50	10
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6			7.6	
Lane Util. Factor					0.91		1.00	1.00			1.00	
Frpb, ped/bikes					1.00		1.00	1.00			0.99	
Flpb, ped/bikes					0.98		0.93	1.00			1.00	
Frt					1.00		1.00	1.00			0.98	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3715		1060	1237			1191	
Flt Permitted					0.99		0.71	1.00			1.00	
Satd. Flow (perm)					3715		797	1237			1191	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	255	1973	22	54	54	0	0	54	11
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	6	0
Lane Group Flow (vph)	0	0	0	0	2249	0	54	54	0	0	59	0
Confl. Peds. (#/hr)			73	73		38	49		63			49
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			4			8	
Permitted Phases				6			4					
Actuated Green, G (s)					51.6		19.2	19.2			19.2	
Effective Green, g (s)					51.6		19.2	19.2			19.2	
Actuated g/C Ratio					0.57		0.21	0.21			0.21	
Clearance Time (s)					11.6		7.6	7.6			7.6	
Lane Grp Cap (vph)					2129		170	263			254	
v/s Ratio Prot								0.04			0.05	
v/s Ratio Perm					0.61		c0.07					
v/c Ratio					1.06		0.32	0.21			0.23	
Uniform Delay, d1					19.2		29.9	29.1			29.3	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					36.4		4.9	1.8			2.1	
Delay (s)					55.6		34.7	30.9			31.4	
Level of Service					E		C	C			C	
Approach Delay (s)		0.0			55.6			32.8			31.4	
Approach LOS		A			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	53.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	146.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	420	1563	0	0	0	0	0	750	452
Future Volume (veh/h)	0	0	0	420	1563	0	0	0	0	0	750	452
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1545	1573	0				0	1573	1485
Adj Flow Rate, veh/h				457	1699	0				0	815	482
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				743	2076	0				0	1889	462
Arrive On Green				0.15	0.15	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1471	4718	0				0	4435	1051
Grp Volume(v), veh/h				457	1699	0				0	815	482
Grp Sat Flow(s),veh/h/ln				1471	1573	0				0	1431	1051
Q Serve(g_s), s				22.2	26.2	0.0				0.0	13.0	33.0
Cycle Q Clear(g_c), s				22.2	26.2	0.0				0.0	13.0	33.0
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				743	2076	0				0	1889	462
V/C Ratio(X)				0.61	0.82	0.00				0.00	0.43	1.04
Avail Cap(c_a), veh/h				743	2076	0				0	1889	462
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				27.4	29.1	0.0				0.0	23.5	32.1
Incr Delay (d2), s/veh				3.8	3.7	0.0				0.0	0.7	53.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				9.8	12.2	0.0				0.0	5.3	16.4
LnGrp Delay(d),s/veh				31.2	32.9	0.0				0.0	24.2	85.4
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2156						1297	
Approach Delay, s/veh					32.5						47.0	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						37.0		38.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						33.0		33.0
Max Q Clear Time (g_c+I1), s						28.2		35.0
Green Ext Time (p_c), s						3.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	37.9
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1026	120	967	1155	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1026	120	967	1155	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1485	1485	1398	1398	0			
Adj Flow Rate, veh/h				0	1115	100	1051	1255	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	1379	403	1438	1510	0			
Arrive On Green				0.00	0.34	0.34	0.18	0.18	0.00			
Sat Flow, veh/h				0	4189	1186	2663	2796	0			
Grp Volume(v), veh/h				0	1115	100	1051	1255	0			
Grp Sat Flow(s),veh/h/ln				0	1352	1186	1331	1398	0			
Q Serve(g_s), s				0.0	18.8	4.6	28.0	32.5	0.0			
Cycle Q Clear(g_c), s				0.0	18.8	4.6	28.0	32.5	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1379	403	1438	1510	0			
V/C Ratio(X)				0.00	0.81	0.25	0.73	0.83	0.00			
Avail Cap(c_a), veh/h				0	1379	403	1438	1510	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.5	17.8	25.7	27.5	0.0			
Incr Delay (d2), s/veh				0.0	5.2	1.5	3.3	5.5	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	7.6	1.6	11.0	13.7	0.0			
LnGrp Delay(d),s/veh				0.0	27.7	19.3	29.0	33.0	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1215			2306				
Approach Delay, s/veh					27.0			31.2				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				45.0		30.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				40.5		25.5		
Max Q Clear Time (g_c+I1), s				34.5		20.8		
Green Ext Time (p_c), s				5.0		2.7		

Intersection Summary	
HCM 2010 Ctrl Delay	29.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1932	80	0	0	0	0	0	255	70	450	0
Future Volume (veh/h)	0	1932	80	0	0	0	0	0	255	70	450	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.99	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1660	1710				0	1573	1620	1748	1748	0
Adj Flow Rate, veh/h	0	2100	80				0	0	261	76	489	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1126	1125	1488	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1323	1095	1748	0
Grp Volume(v), veh/h		0.0					0	0	261	76	489	0
Grp Sat Flow(s),veh/h/ln							0	0	1323	1095	1748	0
Q Serve(g_s), s							0.0	0.0	1.1	1.6	6.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	1.1	2.7	6.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1126	1125	1488	0
V/C Ratio(X)							0.00	0.00	0.23	0.07	0.33	0.00
Avail Cap(c_a), veh/h							0	0	1126	1125	1488	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	3.1	4.1	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.5	0.1	0.6	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.5	0.5	3.6	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.9	3.2	4.7	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								261			565	
Approach Delay, s/veh								0.9			4.5	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				31.0				31.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				26.4				26.4
Max Q Clear Time (g_c+I1), s				8.9				3.1
Green Ext Time (p_c), s				1.4				0.7

Intersection Summary		
HCM 2010 Ctrl Delay		3.4
HCM 2010 LOS		A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2147	0	0	0	0	0	200	90	0	0	0
Future Volume (veh/h)	110	2147	0	0	0	0	0	200	90	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1485	0				0	1485	1440			
Adj Flow Rate, veh/h	120	2334	0				0	217	94			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	158	2406	0				0	549	228			
Arrive On Green	0.20	0.20	0.00				0.00	0.28	0.28			
Sat Flow, veh/h	171	3975	0				0	1978	823			
Grp Volume(v), veh/h	866	1588	0				0	161	150			
Grp Sat Flow(s),veh/h/ln	1443	1352	0				0	1485	1315			
Q Serve(g_s), s	38.7	43.7	0.0				0.0	6.6	7.0			
Cycle Q Clear(g_c), s	44.9	43.7	0.0				0.0	6.6	7.0			
Prop In Lane	0.14		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	928	1637	0				0	412	365			
V/C Ratio(X)	0.93	0.97	0.00				0.00	0.39	0.41			
Avail Cap(c_a), veh/h	928	1637	0				0	412	365			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	29.7	29.3	0.0				0.0	22.0	22.1			
Incr Delay (d2), s/veh	17.3	16.2	0.0				0.0	2.8	3.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	22.4	20.1	0.0				0.0	3.0	2.9			
LnGrp Delay(d),s/veh	47.0	45.6	0.0				0.0	24.7	25.5			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2454						311				
Approach Delay, s/veh		46.1						25.1				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				25.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		45.4		
Max Q Clear Time (g_c+I1), s				9.0		46.9		
Green Ext Time (p_c), s				1.9		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	43.7
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2162	70	0	0	0	0	0	160	70	220	0
Future Volume (veh/h)	0	2162	70	0	0	0	0	0	160	70	220	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1382				0	1573	1591	1545	1485	0
Adj Flow Rate, veh/h	0	2350	71				0	0	157	76	239	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	1077	1127	1238	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.83	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1292	1061	1485	0
Grp Volume(v), veh/h		0.0					0	0	157	76	239	0
Grp Sat Flow(s),veh/h/ln							0	0	1292	1061	1485	0
Q Serve(g_s), s							0.0	0.0	0.6	1.5	3.3	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.6	2.1	3.3	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1077	1127	1238	0
V/C Ratio(X)							0.00	0.00	0.15	0.07	0.19	0.00
Avail Cap(c_a), veh/h							0	0	1077	1127	1238	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	2.6	2.8	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.3	0.1	0.3	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.3	0.5	1.5	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.7	2.7	3.2	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								157			315	
Approach Delay, s/veh								0.7			3.1	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				27.0				27.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				22.5				22.5
Max Q Clear Time (g_c+I1), s				5.3				2.6
Green Ext Time (p_c), s				0.7				0.4

Intersection Summary			
HCM 2010 Ctrl Delay			2.3
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	2097	195	0	0	0	0	240	20	50	115	0
Future Volume (veh/h)	90	2097	195	0	0	0	0	240	20	50	115	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.96	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	98	2279	197				0	261	12	54	125	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	102	2494	219				0	685	31	285	530	0
Arrive On Green	0.19	0.19	0.19				0.00	0.22	0.22	0.01	0.11	0.00
Sat Flow, veh/h	180	4423	388				0	3149	140	1581	1660	0
Grp Volume(v), veh/h	945	785	844				0	134	139	54	125	0
Grp Sat Flow(s),veh/h/ln	1739	1590	1662				0	1577	1629	1581	1660	0
Q Serve(g_s), s	40.6	36.1	37.3				0.0	5.4	5.5	0.0	5.2	0.0
Cycle Q Clear(g_c), s	40.6	36.1	37.3				0.0	5.4	5.5	0.0	5.2	0.0
Prop In Lane	0.10		0.23				0.00		0.09	1.00		0.00
Lane Grp Cap(c), veh/h	980	897	937				0	352	364	285	530	0
V/C Ratio(X)	0.96	0.87	0.90				0.00	0.38	0.38	0.19	0.24	0.00
Avail Cap(c_a), veh/h	980	897	937				0	352	364	285	530	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	29.9	28.0	28.5				0.0	24.8	24.8	28.6	25.2	0.0
Incr Delay (d2), s/veh	21.3	11.6	13.4				0.0	3.1	3.0	1.5	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.4	18.8	20.6				0.0	2.6	2.7	1.1	2.5	0.0
LnGrp Delay(d),s/veh	51.2	39.7	41.9				0.0	27.9	27.8	30.0	26.3	0.0
LnGrp LOS	D	D	D					C	C	C	C	
Approach Vol, veh/h		2574						273			179	
Approach Delay, s/veh		44.6						27.8			27.4	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		47.0		28.2			7.2	21.0
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		42.4		* 24			* 3	* 17
Max Q Clear Time (g_c+I1), s		42.6		7.2			2.0	7.5
Green Ext Time (p_c), s		0.0		0.7			0.0	1.4

Intersection Summary	
HCM 2010 Ctrl Delay	42.1
HCM 2010 LOS	D

Notes

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Baseline + Project Buildout Conditions (Updated)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	50	50	100.8%	19.9	7.9	C
	Through						
	Right Turn						
	Subtotal	50	50	100.8%	19.9	7.9	C
EB	Left Turn	25	22	89.8%	2.8	0.4	A
	Through	2,152	2,093	97.3%	2.6	0.2	A
	Right Turn						
	Subtotal	2,177	2,116	97.2%	2.6	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,227	2,166	97.3%	3.0	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	54	100.2%	15.6	2.7	B
	Right Turn	261	274	104.9%	16.6	5.2	B
	Subtotal	315	328	104.1%	16.5	4.2	B
SB	Left Turn	62	60	96.7%	35.1	7.0	D
	Through	427	394	92.4%	33.4	3.2	C
	Right Turn						
	Subtotal	489	454	92.9%	33.7	3.4	C
EB	Left Turn	42	43	101.6%	13.1	3.4	B
	Through	2,134	2,074	97.2%	12.6	1.3	B
	Right Turn	61	61	100.7%	11.7	2.5	B
	Subtotal	2,237	2,178	97.4%	12.6	1.3	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,041	2,961	97.4%	16.3	1.1	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	135	2281	41	0	0	0	0	107	50	130	255	0
Future Volume (veh/h)	135	2281	41	0	0	0	0	107	50	130	255	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1398	1382	1342	0
Adj Flow Rate, veh/h	147	2479	23				0	116	42	141	277	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	139	2511	598				0	500	411	283	541	0
Arrive On Green	0.18	0.18	0.18				0.00	0.36	0.36	0.12	0.12	0.00
Sat Flow, veh/h	261	4731	1126				0	1398	1151	570	1574	0
Grp Volume(v), veh/h	780	1846	23				0	116	42	215	203	0
Grp Sat Flow(s),veh/h/ln	1385	1202	1126				0	1398	1151	923	1160	0
Q Serve(g_s), s	39.8	38.1	1.3				0.0	4.4	1.8	13.6	12.3	0.0
Cycle Q Clear(g_c), s	39.8	38.1	1.3				0.0	4.4	1.8	17.9	12.3	0.0
Prop In Lane	0.19		1.00				0.00		1.00	0.66		0.00
Lane Grp Cap(c), veh/h	735	1914	598				0	500	411	409	415	0
V/C Ratio(X)	1.06	0.96	0.04				0.00	0.23	0.10	0.53	0.49	0.00
Avail Cap(c_a), veh/h	735	1914	598				0	500	411	409	415	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.9	30.2	15.0				0.0	16.9	16.1	30.3	26.7	0.0
Incr Delay (d2), s/veh	50.6	13.7	0.1				0.0	1.1	0.5	4.8	4.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.6	15.1	0.4				0.0	1.8	0.6	4.8	4.4	0.0
LnGrp Delay(d),s/veh	81.6	44.0	15.2				0.0	18.0	16.6	35.1	30.8	0.0
LnGrp LOS	F	D	B					B	B	D	C	
Approach Vol, veh/h		2649						158			418	
Approach Delay, s/veh		54.8						17.6			33.0	
Approach LOS		D						B			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		44.0		31.0				31.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2				
Max Green Setting (Gmax), s		* 40		* 27				* 27				
Max Q Clear Time (g_c+I1), s		41.8		6.4				19.9				
Green Ext Time (p_c), s		0.0		0.6				1.0				
Intersection Summary												
HCM 2010 Ctrl Delay			50.1									
HCM 2010 LOS			D									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	2336	60	0	0	0	0	50	250	110	180	0
Future Volume (veh/h)	50	2336	60	0	0	0	0	50	250	110	180	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1454	1398	1398	0
Adj Flow Rate, veh/h	54	2539	39				0	54	233	120	196	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	58	2940	651				0	317	273	265	317	0
Arrive On Green	0.20	0.20	0.20				0.00	0.23	0.23	0.07	0.07	0.00
Sat Flow, veh/h	97	4903	1086				0	1398	1203	862	1398	0
Grp Volume(v), veh/h	773	1820	39				0	54	233	120	196	0
Grp Sat Flow(s),veh/h/ln	1393	1202	1086				0	1398	1203	862	1398	0
Q Serve(g_s), s	40.9	36.4	2.2				0.0	2.3	13.9	10.2	10.2	0.0
Cycle Q Clear(g_c), s	40.9	36.4	2.2				0.0	2.3	13.9	12.6	10.2	0.0
Prop In Lane	0.07		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	835	2163	651				0	317	273	265	317	0
V/C Ratio(X)	0.93	0.84	0.06				0.00	0.17	0.85	0.45	0.62	0.00
Avail Cap(c_a), veh/h	835	2163	651				0	569	489	420	569	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	28.4	26.7	12.9				0.0	23.3	27.8	33.8	31.5	0.0
Incr Delay (d2), s/veh	2.2	0.4	0.0				0.0	0.3	7.4	1.2	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.3	12.2	0.7				0.0	0.9	5.2	2.5	4.1	0.0
LnGrp Delay(d),s/veh	30.7	27.0	12.9				0.0	23.6	35.2	34.9	33.4	0.0
LnGrp LOS	C	C	B					C	D	C	C	
Approach Vol, veh/h		2632						287			316	
Approach Delay, s/veh		27.9						33.0			34.0	
Approach LOS		C						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		51.5		23.5				23.5
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		31.5		30.5				30.5
Max Q Clear Time (g_c+I1), s		42.9		15.9				14.6
Green Ext Time (p_c), s		0.0		1.1				1.4

Intersection Summary			
HCM 2010 Ctrl Delay			29.0
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1175	1361	0	0	0	0	0	0	195	975	0
Future Volume (veh/h)	0	1175	1361	0	0	0	0	0	0	195	975	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1485							1485	1485	0
Adj Flow Rate, veh/h	0	1277	1454							212	1060	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.92	0.92	0.92							0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3							3	3	0
Cap, veh/h	0	2050	1162							519	1089	0
Arrive On Green	0.00	0.15	0.15							0.12	0.12	0.00
Sat Flow, veh/h	0	4456	2525							1415	2971	0
Grp Volume(v), veh/h	0	1277	1454							212	1060	0
Grp Sat Flow(s),veh/h/ln	0	1485	1263							1415	1485	0
Q Serve(g_s), s	0.0	20.1	34.5							10.4	26.7	0.0
Cycle Q Clear(g_c), s	0.0	20.1	34.5							10.4	26.7	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2050	1162							519	1089	0
V/C Ratio(X)	0.00	0.62	1.25							0.41	0.97	0.00
Avail Cap(c_a), veh/h	0	2050	1162							519	1089	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.11	0.11							0.81	0.81	0.00
Uniform Delay (d), s/veh	0.0	25.7	31.8							25.4	32.6	0.0
Incr Delay (d2), s/veh	0.0	0.2	114.1							0.4	18.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.3	30.5							4.1	13.8	0.0
LnGrp Delay(d),s/veh	0.0	25.9	145.9							25.9	51.0	0.0
LnGrp LOS		C	F							C	D	
Approach Vol, veh/h		2731									1272	
Approach Delay, s/veh		89.8									46.8	
Approach LOS		F									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		43.0		32.0				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		34.5		27.5				
Max Q Clear Time (g_c+I1), s		36.5		28.7				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary		
HCM 2010 Ctrl Delay		76.1
HCM 2010 LOS		E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	725	815	0	0	0	0	0	1407	460	0	0	0
Future Volume (veh/h)	725	815	0	0	0	0	0	1407	460	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1454	1485	0				0	1398	1398			
Adj Flow Rate, veh/h	788	886	0				0	1529	463			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	1329	1220	0				0	1946	551			
Arrive On Green	0.14	0.14	0.00				0.00	0.46	0.46			
Sat Flow, veh/h	2769	2971	0				0	4194	1188			
Grp Volume(v), veh/h	788	886	0				0	1529	463			
Grp Sat Flow(s),veh/h/ln	1385	1485	0				0	1398	1188			
Q Serve(g_s), s	20.4	21.4	0.0				0.0	23.1	25.7			
Cycle Q Clear(g_c), s	20.4	21.4	0.0				0.0	23.1	25.7			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1329	1220	0				0	1946	551			
V/C Ratio(X)	0.59	0.73	0.00				0.00	0.79	0.84			
Avail Cap(c_a), veh/h	1329	1220	0				0	1946	551			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	27.9	28.4	0.0				0.0	17.0	17.7			
Incr Delay (d2), s/veh	2.0	3.8	0.0				0.0	3.3	14.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.2	9.5	0.0				0.0	9.4	10.5			
LnGrp Delay(d),s/veh	29.9	32.2	0.0				0.0	20.2	31.9			
LnGrp LOS	C	C						C	C			
Approach Vol, veh/h		1674						1992				
Approach Delay, s/veh		31.1						23.0				
Approach LOS		C						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		35.0		40.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 31		* 35				
Max Q Clear Time (g_c+I1), s		23.4		27.7				
Green Ext Time (p_c), s		6.3		6.5				

Intersection Summary	
HCM 2010 Ctrl Delay	26.7
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	20	310	50	5	80	210	64	50	280	150	61	202
Future Volume (veh/h)	20	310	50	5	80	210	64	50	280	150	61	202
Number	5	2	12		1	6	16	3	8	18	7	4
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94		1.00		0.97	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2019	2019	2000		1942	1942	2000	1845	1845	1900	1845	1845
Adj Flow Rate, veh/h	22	337	46		87	228	57	54	304	139	66	220
Adj No. of Lanes	1	1	0		1	1	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3		3	3	3	3	3	3	3	3
Cap, veh/h	58	420	57		158	445	111	152	369	169	170	537
Arrive On Green	0.03	0.24	0.24		0.09	0.30	0.30	0.09	0.31	0.31	0.10	0.32
Sat Flow, veh/h	1923	1726	236		1849	1490	373	1757	1186	542	1757	1669
Grp Volume(v), veh/h	22	0	383		87	0	285	54	0	443	66	0
Grp Sat Flow(s),veh/h/ln	1923	0	1961		1849	0	1863	1757	0	1728	1757	0
Q Serve(g_s), s	0.7	0.0	11.9		2.9	0.0	8.2	1.9	0.0	15.4	2.3	0.0
Cycle Q Clear(g_c), s	0.7	0.0	11.9		2.9	0.0	8.2	1.9	0.0	15.4	2.3	0.0
Prop In Lane	1.00		0.12		1.00		0.20	1.00		0.31	1.00	
Lane Grp Cap(c), veh/h	58	0	477		158	0	556	152	0	538	170	0
V/C Ratio(X)	0.38	0.00	0.80		0.55	0.00	0.51	0.36	0.00	0.82	0.39	0.00
Avail Cap(c_a), veh/h	237	0	668		285	0	692	244	0	714	244	0
HCM Platoon Ratio	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00		1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.9	0.0	23.1		28.5	0.0	18.9	27.9	0.0	20.7	27.5	0.0
Incr Delay (d2), s/veh	1.5	0.0	4.8		1.1	0.0	0.7	0.5	0.0	5.9	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	7.0		1.5	0.0	4.3	0.9	0.0	8.1	1.1	0.0
LnGrp Delay(d),s/veh	32.4	0.0	27.9		29.6	0.0	19.6	28.5	0.0	26.6	28.1	0.0
LnGrp LOS	C		C		C		B	C		C	C	
Approach Vol, veh/h		405				372			497			304
Approach Delay, s/veh		28.2				21.9			26.8			19.9
Approach LOS		C				C			C			B
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	9.5	20.7	9.6	25.1	6.0	24.3	10.3	24.4				
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2				
Max Green Setting (Gmax), s	10.0	22.1	9.0	* 27	8.0	24.1	9.0	* 27				
Max Q Clear Time (g_c+I1), s	4.9	13.9	3.9	8.7	2.7	10.2	4.3	17.4				
Green Ext Time (p_c), s	0.1	1.1	0.0	0.9	0.0	0.9	0.0	1.4				
Intersection Summary												
HCM 2010 Ctrl Delay			24.7									
HCM 2010 LOS			C									
Notes												

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	20
Future Volume (veh/h)	20
Number	14
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.91
Parking Bus, Adj	1.00
Adj Sat Flow, veh/h/ln	1900
Adj Flow Rate, veh/h	18
Adj No. of Lanes	0
Peak Hour Factor	0.92
Percent Heavy Veh, %	3
Cap, veh/h	44
Arrive On Green	0.32
Sat Flow, veh/h	137
Grp Volume(v), veh/h	238
Grp Sat Flow(s),veh/h/ln	1806
Q Serve(g_s), s	6.7
Cycle Q Clear(g_c), s	6.7
Prop In Lane	0.08
Lane Grp Cap(c), veh/h	581
V/C Ratio(X)	0.41
Avail Cap(c_a), veh/h	746
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	17.2
Incr Delay (d2), s/veh	0.5
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	3.4
LnGrp Delay(d),s/veh	17.7
LnGrp LOS	B
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	545	25	0	690	25	5
Future Volume (vph)	545	25	0	690	25	5
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			3.0	5.2	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	0.98	
Frt	0.99			1.00	0.98	
Flt Protected	1.00			1.00	0.96	
Satd. Flow (prot)	1560			1573	1441	
Flt Permitted	1.00			1.00	0.96	
Satd. Flow (perm)	1560			1573	1441	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	592	27	0	750	27	5
RTOR Reduction (vph)	2	0	0	0	4	0
Lane Group Flow (vph)	617	0	0	750	28	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA	Perm	
Protected Phases	2			3 4 6		
Permitted Phases					8	
Actuated Green, G (s)	30.1			51.2	13.4	
Effective Green, g (s)	30.1			45.6	13.4	
Actuated g/C Ratio	0.40			0.61	0.18	
Clearance Time (s)	5.6				5.2	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	626			956	257	
v/s Ratio Prot	c0.40			c0.48		
v/s Ratio Perm					c0.02	
v/c Ratio	0.98			0.78	0.11	
Uniform Delay, d1	22.2			11.0	25.8	
Progression Factor	0.78			0.69	1.05	
Incremental Delay, d2	28.6			0.4	0.2	
Delay (s)	46.0			7.9	27.3	
Level of Service	D			A	C	
Approach Delay (s)	46.0			7.9	27.3	
Approach LOS	D			A	C	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	365	20	0	330	50	10	10	10	5	25	20
Future Volume (vph)	0	365	20	0	330	50	10	10	10	5	25	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6			5.6	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			1.00			0.98	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		0.99			0.98			0.95			0.94	
Flt Protected		1.00			1.00			0.98			1.00	
Satd. Flow (prot)		1558			1536			1466			1452	
Flt Permitted		1.00			1.00			0.87			0.97	
Satd. Flow (perm)		1558			1536			1293			1409	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	397	22	0	359	54	11	11	11	5	27	22
RTOR Reduction (vph)	0	2	0	0	5	0	0	10	0	0	20	0
Lane Group Flow (vph)	0	417	0	0	408	0	0	23	0	0	34	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			4 6			8			8	
Permitted Phases							8			8		
Actuated Green, G (s)		39.8			56.0			7.8			7.8	
Effective Green, g (s)		39.8			56.0			7.8			7.8	
Actuated g/C Ratio		0.53			0.75			0.10			0.10	
Clearance Time (s)		5.6						5.6			5.6	
Vehicle Extension (s)		3.0						1.5			1.5	
Lane Grp Cap (vph)		826			1146			134			146	
v/s Ratio Prot		c0.27			c0.27							
v/s Ratio Perm								0.02			c0.02	
v/c Ratio		0.50			0.36			0.17			0.23	
Uniform Delay, d1		11.3			3.3			30.7			30.9	
Progression Factor		0.72			0.06			0.63			0.83	
Incremental Delay, d2		1.7			0.1			0.2			0.3	
Delay (s)		9.8			0.3			19.4			25.9	
Level of Service		A			A			B			C	
Approach Delay (s)		9.8			0.3			19.4			25.9	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	550	0	0	685	5	20
Future Volume (vph)	550	0	0	685	5	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			5.6	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.89	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1573			1573	1387	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1573			1573	1387	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	598	0	0	745	5	22
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	598	0	0	745	10	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	48.7			30.1	15.5	
Effective Green, g (s)	43.5			30.1	15.5	
Actuated g/C Ratio	0.58			0.40	0.21	
Clearance Time (s)				5.6		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	912			631	286	
v/s Ratio Prot	c0.38			c0.47	c0.01	
v/s Ratio Perm						
v/c Ratio	0.66			1.18	0.03	
Uniform Delay, d1	10.7			22.4	23.8	
Progression Factor	0.61			1.15	0.81	
Incremental Delay, d2	0.5			88.9	0.0	
Delay (s)	7.0			114.6	19.3	
Level of Service	A			F	B	
Approach Delay (s)	7.0			114.6	19.3	
Approach LOS	A			F	B	

Intersection Summary			
HCM 2000 Control Delay	65.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	380	0	0	340	20	40	5	25	0	0	0
Future Volume (vph)	0	380	0	0	340	20	40	5	25	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.98				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.97				
Satd. Flow (prot)		1573			1557			1431				
Flt Permitted		1.00			1.00			0.97				
Satd. Flow (perm)		1573			1557			1431				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	413	0	0	370	22	43	5	27	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	23	0	0	0	0
Lane Group Flow (vph)	0	413	0	0	390	0	0	52	0	0	0	0
Confl. Peds. (#/hr)	10					10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		53.2			39.8			10.6				
Effective Green, g (s)		53.2			39.8			10.6				
Actuated g/C Ratio		0.71			0.53			0.14				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1115			826			202				
v/s Ratio Prot		c0.26			c0.25			c0.04				
v/s Ratio Perm												
v/c Ratio		0.37			0.47			0.26				
Uniform Delay, d1		4.3			11.0			28.7				
Progression Factor		0.01			0.51			1.27				
Incremental Delay, d2		0.1			1.8			0.2				
Delay (s)		0.1			7.4			36.5				
Level of Service		A			A			D				
Approach Delay (s)		0.1			7.4			36.5			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	410	0	0	405	75	10	5	10	0	0	0
Future Volume (vph)	0	410	0	0	405	75	10	5	10	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1512			1441				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1512			1441				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	0	0	440	82	11	5	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	446	0	0	514	0	0	18	0	0	0	0
Confl. Peds. (#/hr)	39		22			39			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		50.7			32.7			13.5				
Effective Green, g (s)		50.7			32.7			13.5				
Actuated g/C Ratio		0.68			0.44			0.18				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1063			659			259				
v/s Ratio Prot		c0.28			c0.34			c0.01				
v/s Ratio Perm												
v/c Ratio		0.42			0.78			0.07				
Uniform Delay, d1		5.5			18.1			25.5				
Progression Factor		0.06			0.94			1.01				
Incremental Delay, d2		0.3			7.9			0.1				
Delay (s)		0.6			24.9			25.9				
Level of Service		A			C			C				
Approach Delay (s)		0.6			24.9			25.9			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	465	20	50	530	70	10	491	50	0	361	300
Future Volume (veh/h)	260	465	20	50	530	70	10	491	50	0	361	300
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1676	1676	1710	1676	1676	1710	1800	1694	1728	0	1765	1728
Adj Flow Rate, veh/h	271	484	19	52	552	67	10	511	43	0	376	116
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	2	2
Cap, veh/h	180	941	37	435	640	78	53	1123	93	0	968	294
Arrive On Green	0.11	0.59	0.59	0.87	0.87	0.87	0.77	0.77	0.77	0.00	0.39	0.39
Sat Flow, veh/h	1597	1601	63	844	1463	178	18	2898	240	0	2587	758
Grp Volume(v), veh/h	271	0	503	52	0	619	299	0	265	0	250	242
Grp Sat Flow(s),veh/h/ln	1597	0	1664	844	0	1640	1677	0	1479	0	1676	1581
Q Serve(g_s), s	9.0	0.0	14.3	1.0	0.0	15.4	0.0	0.0	5.0	0.0	8.6	8.9
Cycle Q Clear(g_c), s	9.0	0.0	14.3	3.3	0.0	15.4	4.9	0.0	5.0	0.0	8.6	8.9
Prop In Lane	1.00		0.04	1.00		0.11	0.03		0.16	0.00		0.48
Lane Grp Cap(c), veh/h	180	0	978	435	0	718	696	0	573	0	650	612
V/C Ratio(X)	1.51	0.00	0.51	0.12	0.00	0.86	0.43	0.00	0.46	0.00	0.38	0.40
Avail Cap(c_a), veh/h	180	0	978	435	0	718	696	0	573	0	650	612
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.81	0.00	0.81	0.81	0.00	0.81	0.00	1.00	1.00
Uniform Delay (d), s/veh	35.5	0.0	9.8	3.3	0.0	3.8	6.1	0.0	6.1	0.0	17.6	17.7
Incr Delay (d2), s/veh	255.5	0.0	1.9	0.5	0.0	10.9	1.6	0.0	2.2	0.0	1.7	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.7	0.0	7.1	0.3	0.0	8.0	2.5	0.0	2.2	0.0	4.3	4.2
LnGrp Delay(d),s/veh	291.0	0.0	11.7	3.7	0.0	14.6	7.6	0.0	8.2	0.0	19.4	19.6
LnGrp LOS	F		B	A		B	A		A		B	B
Approach Vol, veh/h		774			671			564			492	
Approach Delay, s/veh		109.5			13.8			7.9			19.5	
Approach LOS		F			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		51.2		35.8	12.0	39.2		35.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 47		24.4	9.0	* 35		24.4
Max Q Clear Time (g_c+I1), s		16.3		7.0	11.0	17.4		10.9
Green Ext Time (p_c), s		5.4		4.6	0.0	6.3		3.5

Intersection Summary	
HCM 2010 Ctrl Delay	43.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	50	40	175	0	0	0	0	230	1173	450
Future Volume (vph)	0	490	50	40	175	0	0	0	0	230	1173	450
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.98
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.99			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2769			1781						2993	1321
Flt Permitted		1.00			0.85						0.99	1.00
Satd. Flow (perm)		2769			1520						2993	1321
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	510	52	42	182	0	0	0	0	240	1222	469
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	224	0	0	0	0	0	1462	469
Confl. Peds. (#/hr)			15	15		4			11			
Confl. Bikes (#/hr)			3			3			3			2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.8			30.8						40.4	33.4
Effective Green, g (s)		30.8			30.8						40.4	33.4
Actuated g/C Ratio		0.39			0.39						0.50	0.42
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1066			585						1511	551
v/s Ratio Prot		c0.20									c0.49	
v/s Ratio Perm					0.15							0.36
v/c Ratio		0.52			0.38						0.97	0.85
Uniform Delay, d1		18.9			17.7						19.2	21.1
Progression Factor		0.34			0.36						1.00	1.00
Incremental Delay, d2		1.6			1.6						16.6	15.2
Delay (s)		8.1			7.9						35.8	36.3
Level of Service		A			A						D	D
Approach Delay (s)		8.1			7.9			0.0			35.9	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	395	20	305	135	300	20	75	1525	190	50
Future Volume (vph)	395	20	305	135	300	20	75	1525	190	50
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1509	1812	1812	1485			3677	1316	
Flt Permitted		0.63	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		1000	1812	1812	1485			3677	1316	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	411	21	318	141	312	21	78	1589	198	52
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	38	0
Lane Group Flow (vph)	0	432	318	141	334	0	0	1667	212	0
Confl. Peds. (#/hr)							8			3
Confl. Bikes (#/hr)					4	4				
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Effective Green, g (s)		32.8	32.8	16.8	16.8			38.8	38.8	
Actuated g/C Ratio		0.41	0.41	0.21	0.21			0.48	0.48	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Grp Cap (vph)		485	742	380	311			1783	638	
v/s Ratio Prot		c0.13	0.18	0.08	c0.22					
v/s Ratio Perm		0.23						0.45	0.16	
v/c Ratio		0.89	0.43	0.37	1.07			0.93	0.33	
Uniform Delay, d1		21.7	16.9	27.1	31.6			19.4	12.6	
Progression Factor		0.72	0.75	1.00	1.00			0.44	0.23	
Incremental Delay, d2		16.7	1.3	2.8	72.1			6.8	0.8	
Delay (s)		32.4	14.0	29.8	103.7			15.4	3.7	
Level of Service		C	B	C	F			B	A	
Approach Delay (s)			24.6	81.8				13.9		
Approach LOS			C	F				B		

Intersection Summary			
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	99.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	80	370	40	30	250	50	40	421	50	60	331	40
Future Volume (veh/h)	80	370	40	30	250	50	40	421	50	60	331	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	1.00		0.98	0.98		0.92	0.98		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1412	1560	1530	1412	1500	1530	1440	1500	1469	1440	1500	1469
Adj Flow Rate, veh/h	83	385	37	31	260	43	42	439	42	62	345	32
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	520	706	68	333	632	104	104	888	83	159	778	73
Arrive On Green	0.50	0.50	0.50	1.00	1.00	1.00	0.76	0.76	0.76	0.76	0.76	0.76
Sat Flow, veh/h	852	1398	134	768	1251	207	137	2338	219	267	2048	191
Grp Volume(v), veh/h	83	0	422	31	0	303	272	0	251	220	0	219
Grp Sat Flow(s),veh/h/ln	852	0	1532	768	0	1457	1389	0	1305	1193	0	1313
Q Serve(g_s), s	4.3	0.0	15.1	1.3	0.0	0.0	0.0	0.0	6.0	0.6	0.0	4.8
Cycle Q Clear(g_c), s	4.3	0.0	15.1	16.4	0.0	0.0	5.5	0.0	6.0	6.5	0.0	4.8
Prop In Lane	1.00		0.09	1.00		0.14	0.15		0.17	0.28		0.15
Lane Grp Cap(c), veh/h	520	0	774	333	0	736	580	0	496	511	0	499
V/C Ratio(X)	0.16	0.00	0.55	0.09	0.00	0.41	0.47	0.00	0.51	0.43	0.00	0.44
Avail Cap(c_a), veh/h	520	0	774	333	0	736	580	0	496	511	0	499
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.97	0.00	0.97	0.84	0.00	0.84	0.75	0.00	0.75
Uniform Delay (d), s/veh	10.9	0.0	13.5	3.0	0.0	0.0	6.6	0.0	6.7	6.4	0.0	6.5
Incr Delay (d2), s/veh	0.7	0.0	2.8	0.5	0.0	1.7	2.3	0.0	3.1	2.0	0.0	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	6.9	0.3	0.0	0.3	2.5	0.0	2.4	1.9	0.0	1.9
LnGrp Delay(d),s/veh	11.5	0.0	16.3	3.6	0.0	1.7	8.9	0.0	9.8	8.4	0.0	8.6
LnGrp LOS	B		B	A		A	A		A	A		A
Approach Vol, veh/h		505			334			523			439	
Approach Delay, s/veh		15.5			1.8			9.3			8.5	
Approach LOS		B			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		40.4		30.4		40.4		30.4
Max Q Clear Time (g_c+I1), s		17.1		8.0		18.4		8.5
Green Ext Time (p_c), s		2.5		2.3		1.5		2.0

Intersection Summary			
HCM 2010 Ctrl Delay			9.5
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	325	180	60	170	0	0	0	0	50	1083	130
Future Volume (vph)	0	325	180	60	170	0	0	0	0	50	1083	130
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.96
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1697			1775						4163	1148
Flt Permitted		1.00			0.67						1.00	1.00
Satd. Flow (perm)		1697			1213						4163	1148
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	339	188	62	177	0	0	0	0	52	1128	135
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	509	0	0	240	0	0	0	0	0	1180	135
Confl. Peds. (#/hr)	12		12	12		12			12	12		7
Confl. Bikes (#/hr)			6			4			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		35.8			35.8						35.4	28.4
Effective Green, g (s)		35.8			35.8						35.4	28.4
Actuated g/C Ratio		0.45			0.45						0.44	0.35
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		759			542						1842	407
v/s Ratio Prot		c0.30										
v/s Ratio Perm					0.20						0.28	0.12
v/c Ratio		0.67			0.44						0.64	0.33
Uniform Delay, d1		17.4			15.2						17.4	18.9
Progression Factor		0.32			1.00						0.35	0.43
Incremental Delay, d2		4.4			2.1						0.6	0.8
Delay (s)		10.1			17.3						6.7	9.0
Level of Service		B			B						A	A
Approach Delay (s)		10.1			17.3			0.0			6.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	245	150	0	0	130	110	90	1470	20	0	0	0
Future Volume (veh/h)	245	150	0	0	130	110	90	1470	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.96			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1620	1588	1620			
Adj Flow Rate, veh/h	255	156	0	0	135	107	94	1531	19			
Adj No. of Lanes	1	1	0	0	1	0	0	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	0	2	0			
Cap, veh/h	358	643	0	0	285	226	119	2062	26			
Arrive On Green	0.68	0.68	0.00	0.00	0.41	0.41	0.16	0.16	0.16			
Sat Flow, veh/h	1015	1588	0	0	703	557	247	4295	55			
Grp Volume(v), veh/h	255	156	0	0	0	242	599	500	545			
Grp Sat Flow(s),veh/h/ln	1015	1588	0	0	0	1260	1576	1445	1576			
Q Serve(g_s), s	19.4	3.0	0.0	0.0	0.0	11.3	29.3	26.3	26.3			
Cycle Q Clear(g_c), s	30.7	3.0	0.0	0.0	0.0	11.3	29.3	26.3	26.3			
Prop In Lane	1.00		0.00	0.00		0.44	0.16		0.03			
Lane Grp Cap(c), veh/h	358	643	0	0	0	510	756	694	757			
V/C Ratio(X)	0.71	0.24	0.00	0.00	0.00	0.47	0.79	0.72	0.72			
Avail Cap(c_a), veh/h	358	643	0	0	0	510	756	694	757			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00			
Uniform Delay (d), s/veh	18.1	8.2	0.0	0.0	0.0	17.5	29.8	28.6	28.6			
Incr Delay (d2), s/veh	11.5	0.9	0.0	0.0	0.0	3.1	8.3	6.4	5.9			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.5	1.5	0.0	0.0	0.0	4.3	14.5	11.7	12.7			
LnGrp Delay(d),s/veh	29.6	9.1	0.0	0.0	0.0	20.7	38.1	34.9	34.4			
LnGrp LOS	C	A				C	D	C	C			
Approach Vol, veh/h		411			242			1644				
Approach Delay, s/veh		21.8			20.7			35.9				
Approach LOS		C			C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		37.0		43.0		37.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		32.4		38.4		32.4		
Max Q Clear Time (g_c+I1), s		32.7		31.3		13.3		
Green Ext Time (p_c), s		0.0		4.3		1.0		

Intersection Summary		
HCM 2010 Ctrl Delay		31.8
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	230	40	105	250	70	30	401	85	45	291	65
Future Volume (veh/h)	55	230	40	105	250	70	30	401	85	45	291	65
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.91	0.97		0.91	0.92		0.83	0.96		0.83
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1588	1525	1620	1588	1588	1620	1620	1588	1555	1620	1588	1555
Adj Flow Rate, veh/h	57	240	34	109	260	59	31	418	67	47	303	47
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	390	657	93	472	626	142	85	903	140	121	719	119
Arrive On Green	0.51	0.51	0.51	0.17	0.17	0.17	0.13	0.13	0.13	0.77	0.77	0.77
Sat Flow, veh/h	937	1288	182	960	1227	278	92	2345	363	169	1869	309
Grp Volume(v), veh/h	57	0	274	109	0	319	278	0	238	197	0	200
Grp Sat Flow(s),veh/h/ln	937	0	1471	960	0	1505	1509	0	1291	1030	0	1316
Q Serve(g_s), s	3.5	0.0	9.0	8.2	0.0	15.2	0.0	0.0	13.7	3.3	0.0	4.0
Cycle Q Clear(g_c), s	18.7	0.0	9.0	17.2	0.0	15.2	13.0	0.0	13.7	17.1	0.0	4.0
Prop In Lane	1.00		0.12	1.00		0.18	0.11		0.28	0.24		0.23
Lane Grp Cap(c), veh/h	390	0	750	472	0	768	631	0	497	452	0	507
V/C Ratio(X)	0.15	0.00	0.37	0.23	0.00	0.42	0.44	0.00	0.48	0.43	0.00	0.40
Avail Cap(c_a), veh/h	390	0	750	472	0	768	631	0	497	452	0	507
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.87	0.00	0.87	0.85	0.00	0.85
Uniform Delay (d), s/veh	19.7	0.0	11.8	27.5	0.0	22.6	27.1	0.0	27.5	7.0	0.0	6.1
Incr Delay (d2), s/veh	0.8	0.0	1.4	1.1	0.0	1.5	1.9	0.0	2.9	2.6	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	3.9	2.3	0.0	6.7	6.0	0.0	5.3	1.5	0.0	1.6
LnGrp Delay(d),s/veh	20.5	0.0	13.2	28.5	0.0	24.1	29.1	0.0	30.3	9.6	0.0	8.1
LnGrp LOS	C		B	C		C	C		C	A		A
Approach Vol, veh/h		331			428			516			397	
Approach Delay, s/veh		14.4			25.3			29.7			8.8	
Approach LOS		B			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		45.0		35.0		45.0		35.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 41		* 31		* 41		* 31
Max Q Clear Time (g_c+I1), s		20.7		15.7		19.2		19.1
Green Ext Time (p_c), s		2.9		4.0		4.1		2.7

Intersection Summary	
HCM 2010 Ctrl Delay	20.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	370	380	65	0	55
Future Volume (vph)	0	370	380	65	0	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0	6.0			5.6
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	0.97			0.78
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	0.98			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1588	1516			1074
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1588	1516			1074
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	385	396	68	0	57
RTOR Reduction (vph)	0	0	7	0	0	48
Lane Group Flow (vph)	0	385	457	0	0	9
Confl. Peds. (#/hr)				59		78
Confl. Bikes (#/hr)				14		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		55.1	56.1			12.3
Effective Green, g (s)		55.1	56.1			12.3
Actuated g/C Ratio		0.69	0.70			0.15
Clearance Time (s)						5.6
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1093	1063			165
v/s Ratio Prot		c0.24	c0.30			
v/s Ratio Perm						0.01
v/c Ratio		0.35	0.43			0.05
Uniform Delay, d1		5.1	5.1			28.9
Progression Factor		0.96	0.17			1.00
Incremental Delay, d2		0.2	0.2			0.1
Delay (s)		5.1	1.1			29.0
Level of Service		A	A			C
Approach Delay (s)		5.1	1.1		29.0	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	4.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	270	110	80	240	0	0	0	0	125	968	230
Future Volume (vph)	0	270	110	80	240	0	0	0	0	125	968	230
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.93	1.00	1.00						1.00	0.92
Flpb, ped/bikes		1.00	1.00	0.97	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1173	1605	1535						4143	1102
Flt Permitted		1.00	1.00	0.52	1.00						0.99	1.00
Satd. Flow (perm)		1641	1173	874	1535						4143	1102
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	281	115	83	250	0	0	0	0	130	1008	240
RTOR Reduction (vph)	0	0	28	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	281	87	83	250	0	0	0	0	0	1138	240
Confl. Peds. (#/hr)			51	51		28			11	11		19
Confl. Bikes (#/hr)			10			16			1			1
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		34.8	34.8	34.8	34.8						36.4	29.4
Effective Green, g (s)		34.8	34.8	34.8	34.8						36.4	29.4
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.45	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		713	510	380	667						1885	404
v/s Ratio Prot		c0.17			0.16							
v/s Ratio Perm			0.07	0.10							0.27	0.22
v/c Ratio		0.39	0.17	0.22	0.37						0.60	0.59
Uniform Delay, d1		15.4	13.8	14.1	15.3						16.4	20.5
Progression Factor		0.52	0.39	0.89	0.92						0.38	0.49
Incremental Delay, d2		1.6	0.7	1.2	1.5						1.1	4.9
Delay (s)		9.6	6.0	13.7	15.5						7.4	14.9
Level of Service		A	A	B	B						A	B
Approach Delay (s)		8.6			15.1			0.0			8.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	210	0	0	195	90	125	1320	160	0	0	0
Future Volume (veh/h)	175	210	0	0	195	90	125	1320	160	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	0.99		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1525	1588	1620			
Adj Flow Rate, veh/h	182	219	0	0	203	72	130	1375	147			
Adj No. of Lanes	1	1	0	0	1	0	1	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	234	552	0	0	333	118	795	2176	233			
Arrive On Green	0.11	0.11	0.00	0.00	0.11	0.11	0.18	0.18	0.18			
Sat Flow, veh/h	985	1588	0	0	959	340	1452	3974	425			
Grp Volume(v), veh/h	182	219	0	0	0	275	130	1000	522			
Grp Sat Flow(s),veh/h/ln	985	1588	0	0	0	1299	1452	1445	1508			
Q Serve(g_s), s	11.7	10.2	0.0	0.0	0.0	16.1	6.0	25.6	25.6			
Cycle Q Clear(g_c), s	27.8	10.2	0.0	0.0	0.0	16.1	6.0	25.6	25.6			
Prop In Lane	1.00		0.00	0.00		0.26	1.00		0.28			
Lane Grp Cap(c), veh/h	234	552	0	0	0	451	795	1583	825			
V/C Ratio(X)	0.78	0.40	0.00	0.00	0.00	0.61	0.16	0.63	0.63			
Avail Cap(c_a), veh/h	234	552	0	0	0	451	795	1583	825			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.92	0.92	0.00	0.00	0.00	1.00	0.28	0.28	0.28			
Uniform Delay (d), s/veh	44.7	27.6	0.0	0.0	0.0	30.2	17.3	25.3	25.3			
Incr Delay (d2), s/veh	20.7	2.0	0.0	0.0	0.0	6.0	0.1	0.5	1.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.4	4.8	0.0	0.0	0.0	6.6	2.5	10.4	10.9			
LnGrp Delay(d),s/veh	65.4	29.6	0.0	0.0	0.0	36.3	17.4	25.9	26.4			
LnGrp LOS	E	C				D	B	C	C			
Approach Vol, veh/h		401			275			1652				
Approach Delay, s/veh		45.9			36.3			25.4				
Approach LOS		D			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		32.0		48.0		32.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 28		* 44		* 28		
Max Q Clear Time (g_c+I1), s		29.8		27.6		18.1		
Green Ext Time (p_c), s		0.0		7.9		0.8		

Intersection Summary		
HCM 2010 Ctrl Delay		30.2
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	300	1496	0	0	0	0	0	280	50
Future Volume (veh/h)	0	0	0	300	1496	0	0	0	0	0	280	50
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.95
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.82
Adj Sat Flow, veh/h/ln				1530	1500	0				0	1500	1530
Adj Flow Rate, veh/h				312	1558	0				0	292	33
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				452	1997	0				0	626	70
Arrive On Green				0.21	0.21	0.00				0.00	0.27	0.27
Sat Flow, veh/h				621	3331	0				0	2415	261
Grp Volume(v), veh/h				675	1195	0				0	176	149
Grp Sat Flow(s),veh/h/ln				1345	1242	0				0	1425	1176
Q Serve(g_s), s				38.3	36.3	0.0				0.0	8.3	8.5
Cycle Q Clear(g_c), s				38.3	36.3	0.0				0.0	8.3	8.5
Prop In Lane				0.46		0.00				0.00		0.22
Lane Grp Cap(c), veh/h				903	1546	0				0	381	315
V/C Ratio(X)				0.75	0.77	0.00				0.00	0.46	0.47
Avail Cap(c_a), veh/h				903	1546	0				0	381	315
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				27.2	26.4	0.0				0.0	24.5	24.6
Incr Delay (d2), s/veh				5.6	3.8	0.0				0.0	4.0	5.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.7	13.3	0.0				0.0	3.7	3.2
LnGrp Delay(d),s/veh				32.8	30.2	0.0				0.0	28.5	29.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1870						325	
Approach Delay, s/veh					31.2						29.0	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.0		26.0				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 50		21.4				
Max Q Clear Time (g_c+I1), s		40.3		10.5				
Green Ext Time (p_c), s		6.3		1.0				

Intersection Summary	
HCM 2010 Ctrl Delay	30.9
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1666	150	140	310	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1666	150	140	310	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1412	1412	1440	1412	0			
Adj Flow Rate, veh/h				0	1735	120	146	323	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	2	2	0			
Cap, veh/h				0	2351	717	266	507	0			
Arrive On Green				0.00	0.20	0.20	0.09	0.09	0.00			
Sat Flow, veh/h				0	3981	1175	683	1842	0			
Grp Volume(v), veh/h				0	1735	120	253	216	0			
Grp Sat Flow(s),veh/h/ln				0	1285	1175	1241	1220	0			
Q Serve(g_s), s				0.0	33.8	6.8	14.8	13.6	0.0			
Cycle Q Clear(g_c), s				0.0	33.8	6.8	15.8	13.6	0.0			
Prop In Lane				0.00		1.00	0.58		0.00			
Lane Grp Cap(c), veh/h				0	2351	717	425	348	0			
V/C Ratio(X)				0.00	0.74	0.17	0.60	0.62	0.00			
Avail Cap(c_a), veh/h				0	2351	717	425	348	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	26.0	15.2	33.0	32.1	0.0			
Incr Delay (d2), s/veh				0.0	2.1	0.5	6.0	8.1	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	12.5	2.3	6.1	5.4	0.0			
LnGrp Delay(d),s/veh				0.0	28.1	15.7	39.0	40.2	0.0			
LnGrp LOS					C	B	D	D				
Approach Vol, veh/h					1855			469				
Approach Delay, s/veh					27.3			39.6				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		53.0		27.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 49		* 23				
Max Q Clear Time (g_c+I1), s		35.8		17.8				
Green Ext Time (p_c), s		8.2		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	29.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	180	1731	0	0	0	0	0	275	90
Future Volume (veh/h)	0	0	0	180	1731	0	0	0	0	0	275	90
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1412	0				0	1412	1440
Adj Flow Rate, veh/h				188	1803	0				0	286	77
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				263	2124	0				0	499	129
Arrive On Green				0.21	0.21	0.00				0.00	0.26	0.26
Sat Flow, veh/h				324	3460	0				0	1988	496
Grp Volume(v), veh/h				733	1258	0				0	196	167
Grp Sat Flow(s),veh/h/ln				1331	1169	0				0	1341	1072
Q Serve(g_s), s				40.2	41.3	0.0				0.0	10.2	10.9
Cycle Q Clear(g_c), s				42.6	41.3	0.0				0.0	10.2	10.9
Prop In Lane				0.26		0.00				0.00		0.46
Lane Grp Cap(c), veh/h				902	1485	0				0	349	279
V/C Ratio(X)				0.81	0.85	0.00				0.00	0.56	0.60
Avail Cap(c_a), veh/h				902	1485	0				0	349	279
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				28.3	27.9	0.0				0.0	25.7	25.9
Incr Delay (d2), s/veh				8.0	6.2	0.0				0.0	6.4	9.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.7	14.7	0.0				0.0	4.4	3.9
LnGrp Delay(d),s/veh				36.3	34.0	0.0				0.0	32.1	35.1
LnGrp LOS				D	C						C	D
Approach Vol, veh/h					1991						363	
Approach Delay, s/veh					34.9						33.5	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		55.0		25.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 51		* 21				
Max Q Clear Time (g_c+I1), s		44.6		12.9				
Green Ext Time (p_c), s		4.7		1.0				

Intersection Summary	
HCM 2010 Ctrl Delay	34.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	70	1581	90	240	155	0	0	170	50
Future Volume (veh/h)	0	0	0	70	1581	90	240	155	0	0	170	50
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				73	1647	87	250	161	0	0	177	38
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				105	2506	137	299	649	0	0	299	64
Arrive On Green				0.18	0.18	0.18	0.10	0.58	0.00	0.00	0.23	0.23
Sat Flow, veh/h				192	4610	251	1765	1853	0	0	1294	278
Grp Volume(v), veh/h				666	555	586	250	161	0	0	0	215
Grp Sat Flow(s),veh/h/ln				1755	1606	1692	1765	1853	0	0	0	1571
Q Serve(g_s), s				28.5	25.6	25.7	2.1	3.4	0.0	0.0	0.0	9.7
Cycle Q Clear(g_c), s				28.5	25.6	25.7	2.1	3.4	0.0	0.0	0.0	9.7
Prop In Lane				0.11		0.15	1.00		0.00	0.00		0.18
Lane Grp Cap(c), veh/h				954	873	920	299	649	0	0	0	363
V/C Ratio(X)				0.70	0.64	0.64	0.84	0.25	0.00	0.00	0.00	0.59
Avail Cap(c_a), veh/h				954	873	920	299	649	0	0	0	363
HCM Platoon Ratio				0.33	0.33	0.33	1.67	1.67	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				26.7	25.5	25.5	32.4	11.5	0.0	0.0	0.0	27.4
Incr Delay (d2), s/veh				4.2	3.5	3.4	23.3	0.9	0.0	0.0	0.0	6.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.0	12.2	12.9	7.0	1.9	0.0	0.0	0.0	4.9
LnGrp Delay(d),s/veh				30.9	29.0	28.9	55.7	12.4	0.0	0.0	0.0	34.3
LnGrp LOS				C	C	C	E	B				C
Approach Vol, veh/h					1807			411			215	
Approach Delay, s/veh					29.7			38.7			34.3	
Approach LOS					C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			9.0	23.0		48.0		32.0
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			5.0	18.5		43.5		28.0
Max Q Clear Time (g_c+I1), s			4.1	11.7		30.5		5.4
Green Ext Time (p_c), s			0.2	0.8		10.9		1.2

Intersection Summary			
HCM 2010 Ctrl Delay			31.6
HCM 2010 LOS			C

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **Baseline Plus Project Buildout Conditions (Updated)**
Volume and Delay by Movement **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	40	94.2%	12.5	3.8	B
	Through	5	3	69.1%	11.1	12.7	B
	Right Turn						
	Subtotal	47	43	91.5%	13.3	3.4	B
SB	Left Turn						
	Through	10	11	111.4%	25.8	13.0	D
	Right Turn	5	4	76.8%	7.7	11.6	A
	Subtotal	15	15	99.8%	22.1	9.8	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	88	86	97.3%	3.2	0.3	A
	Through	1,699	1,705	100.4%	2.4	0.2	A
	Right Turn	5	6	115.2%	1.9	0.2	A
	Subtotal	1,792	1,797	100.3%	2.4	0.2	A
Total		1,854	1,855	100.0%	2.9	0.3	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	122	118	96.6%	26.0	2.9	C
	Through	20	17	84.5%	26.7	5.1	C
	Right Turn						
	Subtotal	142	135	94.9%	25.8	2.6	C
SB	Left Turn						
	Through	50	48	96.0%	21.3	5.9	C
	Right Turn	10	8	76.8%	11.9	9.5	B
	Subtotal	60	56	92.8%	20.8	4.7	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	232	222	95.7%	13.6	6.8	B
	Through	1,747	1,739	99.5%	10.8	2.1	B
	Right Turn	40	42	105.6%	9.2	3.5	A
	Subtotal	2,019	2,003	99.2%	11.1	2.4	B
Total		2,221	2,193	98.8%	12.2	2.3	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	100	1717	130	41	331	0	0	265	151
Future Volume (veh/h)	0	0	0	100	1717	130	41	331	0	0	265	151
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.97		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1620	1588	1620	1620	1588	0	0	1525	1555
Adj Flow Rate, veh/h				104	1789	125	43	345	0	0	276	150
Adj No. of Lanes				0	3	0	0	2	0	0	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				125	2288	164	101	733	0	0	550	280
Arrive On Green				0.19	0.19	0.19	0.64	0.64	0.00	0.00	0.11	0.11
Sat Flow, veh/h				220	4023	289	144	2371	0	0	1802	878
Grp Volume(v), veh/h				745	620	653	194	194	0	0	229	197
Grp Sat Flow(s),veh/h/ln				1577	1445	1510	1070	1373	0	0	1448	1155
Q Serve(g_s), s				36.4	32.5	32.8	2.6	5.7	0.0	0.0	11.9	13.0
Cycle Q Clear(g_c), s				36.4	32.5	32.8	15.5	5.7	0.0	0.0	11.9	13.0
Prop In Lane				0.14		0.19	0.22		0.00	0.00		0.76
Lane Grp Cap(c), veh/h				897	822	859	396	438	0	0	462	368
V/C Ratio(X)				0.83	0.75	0.76	0.49	0.44	0.00	0.00	0.50	0.54
Avail Cap(c_a), veh/h				897	822	859	396	438	0	0	462	368
HCM Platoon Ratio				0.33	0.33	0.33	2.00	2.00	1.00	1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				28.8	27.2	27.3	11.4	10.9	0.0	0.0	29.7	30.2
Incr Delay (d2), s/veh				8.8	6.4	6.3	4.3	3.2	0.0	0.0	3.8	5.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				18.1	14.4	15.2	2.4	2.4	0.0	0.0	5.3	4.7
LnGrp Delay(d),s/veh				37.6	33.6	33.6	15.7	14.2	0.0	0.0	33.5	35.7
LnGrp LOS				D	C	C	B	B			C	D
Approach Vol, veh/h					2018			388			426	
Approach Delay, s/veh					35.1			14.9			34.5	
Approach LOS					D			B			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs				4		6		8				
Phs Duration (G+Y+Rc), s				30.0		50.0		30.0				
Change Period (Y+Rc), s				4.5		4.5		4.5				
Max Green Setting (Gmax), s				25.5		45.5		25.5				
Max Q Clear Time (g_c+I1), s				17.5		38.4		15.0				
Green Ext Time (p_c), s				1.0		5.2		1.5				
Intersection Summary												
HCM 2010 Ctrl Delay			32.2									
HCM 2010 LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	300	1792	30	110	50	0	0	30	30
Future Volume (vph)	0	0	0	300	1792	30	110	50	0	0	30	30
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6			7.6	
Lane Util. Factor					0.91		1.00	1.00			1.00	
Frpb, ped/bikes					1.00		1.00	1.00			0.97	
Flpb, ped/bikes					0.97		0.96	1.00			1.00	
Frt					1.00		1.00	1.00			0.93	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3684		1100	1249			1128	
Flt Permitted					0.99		0.72	1.00			1.00	
Satd. Flow (perm)					3684		830	1249			1128	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	312	1867	31	115	52	0	0	31	31
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	0	0	0	2209	0	115	52	0	0	54	0
Confl. Peds. (#/hr)			106	106		44	30		69			30
Confl. Bikes (#/hr)						2			3			8
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			4			8	
Permitted Phases				6			4					
Actuated Green, G (s)					51.4		19.4	19.4			19.4	
Effective Green, g (s)					51.4		19.4	19.4			19.4	
Actuated g/C Ratio					0.57		0.22	0.22			0.22	
Clearance Time (s)					11.6		7.6	7.6			7.6	
Lane Grp Cap (vph)					2103		178	269			243	
v/s Ratio Prot								0.04			0.05	
v/s Ratio Perm					0.60		c0.14					
v/c Ratio					1.05		0.65	0.19			0.22	
Uniform Delay, d1					19.3		32.2	28.9			29.1	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					34.5		16.7	1.6			2.1	
Delay (s)					53.8		48.9	30.5			31.2	
Level of Service					D		D	C			C	
Approach Delay (s)		0.0			53.8			43.2			31.2	
Approach LOS		A			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	52.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	158.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	480	1604	0	0	0	0	0	665	493
Future Volume (veh/h)	0	0	0	480	1604	0	0	0	0	0	665	493
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.85
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1560	1588	0				0	1588	1500
Adj Flow Rate, veh/h				500	1671	0				0	693	506
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				740	2085	0				0	1951	489
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1486	4765	0				0	4479	1088
Grp Volume(v), veh/h				500	1671	0				0	693	506
Grp Sat Flow(s),veh/h/ln				1486	1588	0				0	1445	1088
Q Serve(g_s), s				25.9	27.1	0.0				0.0	11.5	36.0
Cycle Q Clear(g_c), s				25.9	27.1	0.0				0.0	11.5	36.0
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				740	2085	0				0	1951	489
V/C Ratio(X)				0.68	0.80	0.00				0.00	0.36	1.03
Avail Cap(c_a), veh/h				740	2085	0				0	1951	489
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				30.3	30.9	0.0				0.0	23.6	34.1
Incr Delay (d2), s/veh				4.9	3.4	0.0				0.0	0.5	49.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.7	12.6	0.0				0.0	4.7	17.6
LnGrp Delay(d),s/veh				35.2	34.2	0.0				0.0	24.1	83.8
LnGrp LOS				D	C						C	F
Approach Vol, veh/h					2171						1199	
Approach Delay, s/veh					34.5						49.3	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						39.0		41.0
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						35.0		36.0
Max Q Clear Time (g_c+I1), s						29.1		38.0
Green Ext Time (p_c), s						4.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	39.7
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1151	195	928	1410	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1151	195	928	1410	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1500	1500	1398	1398	0			
Adj Flow Rate, veh/h				0	1199	189	1061	1337	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	3	3	0			
Cap, veh/h				0	1510	441	1381	1450	0			
Arrive On Green				0.00	0.37	0.37	0.17	0.17	0.00			
Sat Flow, veh/h				0	4230	1195	2663	2796	0			
Grp Volume(v), veh/h				0	1199	189	1061	1337	0			
Grp Sat Flow(s),veh/h/ln				0	1365	1195	1331	1398	0			
Q Serve(g_s), s				0.0	20.9	9.5	30.4	37.6	0.0			
Cycle Q Clear(g_c), s				0.0	20.9	9.5	30.4	37.6	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1510	441	1381	1450	0			
V/C Ratio(X)				0.00	0.79	0.43	0.77	0.92	0.00			
Avail Cap(c_a), veh/h				0	1510	441	1381	1450	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	22.5	18.9	28.6	31.6	0.0			
Incr Delay (d2), s/veh				0.0	4.4	3.0	4.1	11.1	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	8.4	3.5	12.0	16.8	0.0			
LnGrp Delay(d),s/veh				0.0	26.9	22.0	32.7	42.7	0.0			
LnGrp LOS					C	C	C	D				
Approach Vol, veh/h					1388			2398				
Approach Delay, s/veh					26.3			38.3				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				46.0		34.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				41.5		29.5		
Max Q Clear Time (g_c+I1), s				39.6		22.9		
Green Ext Time (p_c), s				1.7		3.8		

Intersection Summary			
HCM 2010 Ctrl Delay			33.9
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1527	100	0	0	0	0	0	400	170	430	0
Future Volume (veh/h)	0	1527	100	0	0	0	0	0	400	170	430	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1676	1710				0	1588	1620	1765	1765	0
Adj Flow Rate, veh/h	0	1591	95				0	0	402	177	448	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1145	992	1526	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.86	0.29	0.29	0.00
Sat Flow, veh/h		0					0	0	1324	969	1765	0
Grp Volume(v), veh/h		0.0					0	0	402	177	448	0
Grp Sat Flow(s),veh/h/ln							0	0	1324	969	1765	0
Q Serve(g_s), s							0.0	0.0	2.0	4.9	6.7	0.0
Cycle Q Clear(g_c), s							0.0	0.0	2.0	6.9	6.7	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1145	992	1526	0
V/C Ratio(X)							0.00	0.00	0.35	0.18	0.29	0.00
Avail Cap(c_a), veh/h							0	0	1145	992	1526	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.9	4.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.8	0.4	0.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.9	1.4	3.6	0.0
LnGrp Delay(d),s/veh							0.0	0.0	1.3	5.3	4.5	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								402			625	
Approach Delay, s/veh								1.3			4.7	
Approach LOS								A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				34.0				34.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				29.4				29.4
Max Q Clear Time (g_c+I1), s				8.9				4.0
Green Ext Time (p_c), s				1.8				1.2

Intersection Summary	
HCM 2010 Ctrl Delay	3.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	1917	0	0	0	0	0	245	120	0	0	0
Future Volume (veh/h)	185	1917	0	0	0	0	0	245	120	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1500	0				0	1500	1440			
Adj Flow Rate, veh/h	193	1997	0				0	255	120			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	251	2157	0				0	626	284			
Arrive On Green	0.19	0.19	0.00				0.00	0.32	0.32			
Sat Flow, veh/h	343	3801	0				0	1940	881			
Grp Volume(v), veh/h	763	1427	0				0	195	180			
Grp Sat Flow(s),veh/h/ln	1414	1365	0				0	1500	1322			
Q Serve(g_s), s	41.0	41.1	0.0				0.0	8.1	8.5			
Cycle Q Clear(g_c), s	42.7	41.1	0.0				0.0	8.1	8.5			
Prop In Lane	0.25		0.00				0.00		0.67			
Lane Grp Cap(c), veh/h	859	1549	0				0	484	426			
V/C Ratio(X)	0.89	0.92	0.00				0.00	0.40	0.42			
Avail Cap(c_a), veh/h	859	1549	0				0	484	426			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	31.4	30.7	0.0				0.0	21.1	21.3			
Incr Delay (d2), s/veh	13.2	10.5	0.0				0.0	2.5	3.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	19.9	17.8	0.0				0.0	3.7	3.5			
LnGrp Delay(d),s/veh	44.6	41.2	0.0				0.0	23.6	24.3			
LnGrp LOS	D	D						C	C			
Approach Vol, veh/h		2190						375				
Approach Delay, s/veh		42.4						23.9				
Approach LOS		D						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				30.0		50.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 26		45.4		
Max Q Clear Time (g_c+I1), s				10.5		44.7		
Green Ext Time (p_c), s				2.8		0.7		

Intersection Summary		
HCM 2010 Ctrl Delay		39.7
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1962	80	0	0	0	0	0	230	200	270	0
Future Volume (veh/h)	0	1962	80	0	0	0	0	0	230	200	270	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1382				0	1588	1591	1560	1500	0
Adj Flow Rate, veh/h	0	2044	78				0	0	224	208	281	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	1101	1057	1282	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.85	0.28	0.28	0.00
Sat Flow, veh/h		0					0	0	1288	1001	1500	0
Grp Volume(v), veh/h		0.0					0	0	224	208	281	0
Grp Sat Flow(s),veh/h/ln							0	0	1288	1001	1500	0
Q Serve(g_s), s							0.0	0.0	0.9	5.0	4.4	0.0
Cycle Q Clear(g_c), s							0.0	0.0	0.9	6.0	4.4	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	1101	1057	1282	0
V/C Ratio(X)							0.00	0.00	0.20	0.20	0.22	0.00
Avail Cap(c_a), veh/h							0	0	1101	1057	1282	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh							0.0	0.0	0.4	4.1	3.2	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.4	0.4	0.4	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	0.4	1.5	2.0	0.0
LnGrp Delay(d),s/veh							0.0	0.0	0.8	4.5	3.6	0.0
LnGrp LOS									A	A	A	
Approach Vol, veh/h								224			489	
Approach Delay, s/veh								0.8			4.0	
Approach LOS								A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs				4				8				
Phs Duration (G+Y+Rc), s				31.0				31.0				
Change Period (Y+Rc), s				4.5				4.5				
Max Green Setting (Gmax), s				26.5				26.5				
Max Q Clear Time (g_c+I1), s				8.0				2.9				
Green Ext Time (p_c), s				1.4				0.6				
Intersection Summary												
HCM 2010 Ctrl Delay			3.0									
HCM 2010 LOS			A									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	2117	175	0	0	0	0	305	30	110	130	0
Future Volume (veh/h)	100	2117	175	0	0	0	0	305	30	110	130	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.92	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	104	2205	171				0	318	22	115	135	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	116	2597	205				0	629	43	255	543	0
Arrive On Green	0.19	0.19	0.19				0.00	0.21	0.21	0.03	0.21	0.00
Sat Flow, veh/h	200	4488	354				0	3088	206	1597	1744	0
Grp Volume(v), veh/h	911	757	812				0	167	173	115	135	0
Grp Sat Flow(s),veh/h/ln	1755	1606	1682				0	1593	1618	1597	1744	0
Q Serve(g_s), s	40.7	36.2	37.2				0.0	7.4	7.6	0.0	5.2	0.0
Cycle Q Clear(g_c), s	40.7	36.2	37.2				0.0	7.4	7.6	0.0	5.2	0.0
Prop In Lane	0.11		0.21				0.00		0.13	1.00		0.00
Lane Grp Cap(c), veh/h	1015	929	973				0	334	339	255	543	0
V/C Ratio(X)	0.90	0.81	0.83				0.00	0.50	0.51	0.45	0.25	0.00
Avail Cap(c_a), veh/h	1015	929	973				0	334	339	255	543	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.67	0.67	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.1	28.3	28.7				0.0	28.0	28.1	34.1	23.9	0.0
Incr Delay (d2), s/veh	12.3	7.8	8.3				0.0	5.3	5.4	5.7	1.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	23.3	18.1	19.6				0.0	3.7	3.9	2.9	2.7	0.0
LnGrp Delay(d),s/veh	42.4	36.1	37.1				0.0	33.3	33.4	39.8	25.0	0.0
LnGrp LOS	D	D	D					C	C	D	C	
Approach Vol, veh/h		2480						340			250	
Approach Delay, s/veh		38.8						33.4			31.8	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		51.0		29.2			8.2	21.0
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		46.4		* 25			* 4	* 17
Max Q Clear Time (g_c+I1), s		42.7		7.2			2.0	9.6
Green Ext Time (p_c), s		3.6		0.9			0.1	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	37.6
HCM 2010 LOS	D

Notes

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	110	102	92.9%	27.8	5.4	D
	Through						
	Right Turn						
	Subtotal	110	102	92.9%	27.8	5.4	D
EB	Left Turn	45	43	94.7%	3.2	0.5	A
	Through	2,247	2,266	100.8%	2.8	0.2	A
	Right Turn						
	Subtotal	2,292	2,309	100.7%	2.8	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,402	2,411	100.4%	3.9	0.5	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	82	89.9%	20.0	5.0	B
	Right Turn	413	421	102.0%	36.4	12.9	D
	Subtotal	504	503	99.8%	34.0	11.5	C
SB	Left Turn	107	108	100.8%	33.0	21.5	C
	Through	180	164	91.1%	20.2	10.6	C
	Right Turn						
	Subtotal	287	272	94.7%	25.6	15.7	C
EB	Left Turn	51	52	101.6%	16.9	3.3	B
	Through	2,232	2,223	99.6%	16.1	1.8	B
	Right Turn	44	41	94.3%	11.9	3.8	B
	Subtotal	2,327	2,316	99.5%	16.0	1.8	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,118	3,091	99.1%	19.8	2.6	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	221	2419	52	0	0	0	0	201	130	130	180	0
Future Volume (veh/h)	221	2419	52	0	0	0	0	201	130	130	180	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1412	1382	1355	0
Adj Flow Rate, veh/h	230	2520	32				0	209	125	135	188	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	215	2541	642				0	491	404	256	438	0
Arrive On Green	0.18	0.18	0.18				0.00	0.35	0.35	0.69	0.69	0.00
Sat Flow, veh/h	393	4642	1172				0	1412	1162	495	1323	0
Grp Volume(v), veh/h	815	1935	32				0	209	125	155	168	0
Grp Sat Flow(s),veh/h/ln	1392	1214	1172				0	1412	1162	585	1172	0
Q Serve(g_s), s	43.8	42.2	1.8				0.0	9.1	6.3	11.6	4.9	0.0
Cycle Q Clear(g_c), s	43.8	42.2	1.8				0.0	9.1	6.3	20.7	4.9	0.0
Prop In Lane	0.28		1.00				0.00		1.00	0.87		0.00
Lane Grp Cap(c), veh/h	762	1994	642				0	491	404	287	407	0
V/C Ratio(X)	1.07	0.97	0.05				0.00	0.43	0.31	0.54	0.41	0.00
Avail Cap(c_a), veh/h	762	1994	642				0	491	404	287	407	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	1.00	1.00				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.8	32.1	15.6				0.0	20.0	19.1	14.4	8.7	0.0
Incr Delay (d2), s/veh	52.7	14.3	0.1				0.0	2.7	2.0	7.1	3.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.0	16.9	0.6				0.0	3.9	2.2	3.3	1.8	0.0
LnGrp Delay(d),s/veh	85.4	46.4	15.7				0.0	22.7	21.1	21.5	11.8	0.0
LnGrp LOS	F	D	B					C	C	C	B	
Approach Vol, veh/h		2782						334			323	
Approach Delay, s/veh		57.5						22.1			16.4	
Approach LOS		E						C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		48.0		32.0				32.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 44		* 28				* 28
Max Q Clear Time (g_c+I1), s		45.8		11.1				22.7
Green Ext Time (p_c), s		0.0		1.3				0.7

Intersection Summary	
HCM 2010 Ctrl Delay	50.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	2529	120	0	0	0	0	140	340	85	235	0
Future Volume (veh/h)	30	2529	120	0	0	0	0	140	340	85	235	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1468	1412	1412	0
Adj Flow Rate, veh/h	31	2634	78				0	146	319	89	245	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	30	2740	614				0	408	351	243	408	0
Arrive On Green	0.18	0.18	0.18				0.00	0.29	0.29	0.58	0.58	0.00
Sat Flow, veh/h	55	4996	1119				0	1412	1216	738	1412	0
Grp Volume(v), veh/h	795	1870	78				0	146	319	89	245	0
Grp Sat Flow(s),veh/h/ln	1409	1214	1119				0	1412	1216	738	1412	0
Q Serve(g_s), s	43.9	40.5	4.7				0.0	6.6	20.2	7.4	9.0	0.0
Cycle Q Clear(g_c), s	43.9	40.5	4.7				0.0	6.6	20.2	14.0	9.0	0.0
Prop In Lane	0.04		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	773	1998	614				0	408	351	243	408	0
V/C Ratio(X)	1.03	0.94	0.13				0.00	0.36	0.91	0.37	0.60	0.00
Avail Cap(c_a), veh/h	773	1998	614				0	468	403	274	468	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	32.8	31.4	16.7				0.0	22.6	27.4	17.5	13.9	0.0
Incr Delay (d2), s/veh	18.3	1.1	0.0				0.0	0.5	22.1	0.9	1.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.1	13.9	1.5				0.0	2.6	8.9	1.5	3.6	0.0
LnGrp Delay(d),s/veh	51.1	32.5	16.7				0.0	23.1	49.5	18.4	15.5	0.0
LnGrp LOS	F	C	B					C	D	B	B	
Approach Vol, veh/h		2743						465			334	
Approach Delay, s/veh		37.4						41.2			16.3	
Approach LOS		D						D			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		50.4		29.6				29.6
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		40.5		26.5				26.5
Max Q Clear Time (g_c+I1), s		45.9		22.2				16.0
Green Ext Time (p_c), s		0.0		0.9				1.2

Intersection Summary			
HCM 2010 Ctrl Delay			35.9
HCM 2010 LOS			D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1856	1093	0	0	0	0	0	0	365	780	0
Future Volume (veh/h)	0	1856	1093	0	0	0	0	0	0	365	780	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1500							1500	1500	0
Adj Flow Rate, veh/h	0	1919	1079							380	812	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.96	0.96	0.96							0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2							2	2	0
Cap, veh/h	0	2268	1285							476	1000	0
Arrive On Green	0.00	0.17	0.17							0.11	0.11	0.00
Sat Flow, veh/h	0	4500	2550							1429	3000	0
Grp Volume(v), veh/h	0	1919	1079							380	812	0
Grp Sat Flow(s),veh/h/ln	0	1500	1275							1429	1500	0
Q Serve(g_s), s	0.0	33.1	32.8							20.8	21.2	0.0
Cycle Q Clear(g_c), s	0.0	33.1	32.8							20.8	21.2	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2268	1285							476	1000	0
V/C Ratio(X)	0.00	0.85	0.84							0.80	0.81	0.00
Avail Cap(c_a), veh/h	0	2268	1285							545	1144	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.88	0.88	0.00
Uniform Delay (d), s/veh	0.0	30.3	30.2							33.0	33.1	0.0
Incr Delay (d2), s/veh	0.0	0.4	0.7							6.5	3.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	13.8	11.7							9.1	9.3	0.0
LnGrp Delay(d),s/veh	0.0	30.7	30.9							39.4	36.7	0.0
LnGrp LOS		C	C							D	D	
Approach Vol, veh/h		2998									1192	
Approach Delay, s/veh		30.8									37.6	
Approach LOS		C									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		48.8		31.2				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		36.5		30.5				
Max Q Clear Time (g_c+I1), s		35.1		23.2				
Green Ext Time (p_c), s		1.3		3.5				

Intersection Summary		
HCM 2010 Ctrl Delay		32.7
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	960	1311	0	0	0	0	0	1398	560	0	0	0
Future Volume (veh/h)	960	1311	0	0	0	0	0	1398	560	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1468	1500	0				0	1412	1412			
Adj Flow Rate, veh/h	1033	1319	0				0	1545	505			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	1473	1388	0				0	1779	492			
Arrive On Green	0.15	0.15	0.00				0.00	0.42	0.42			
Sat Flow, veh/h	2797	3000	0				0	4235	1172			
Grp Volume(v), veh/h	1033	1319	0				0	1545	505			
Grp Sat Flow(s),veh/h/ln	1398	1500	0				0	1412	1172			
Q Serve(g_s), s	28.5	34.9	0.0				0.0	26.6	33.6			
Cycle Q Clear(g_c), s	28.5	34.9	0.0				0.0	26.6	33.6			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1473	1388	0				0	1779	492			
V/C Ratio(X)	0.70	0.95	0.00				0.00	0.87	1.03			
Avail Cap(c_a), veh/h	1473	1388	0				0	1779	492			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	30.3	33.0	0.0				0.0	21.2	23.2			
Incr Delay (d2), s/veh	2.8	14.9	0.0				0.0	6.1	47.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	11.6	17.4	0.0				0.0	11.3	17.3			
LnGrp Delay(d),s/veh	33.1	47.9	0.0				0.0	27.2	70.6			
LnGrp LOS	C	D						C	F			
Approach Vol, veh/h		2352						2050				
Approach Delay, s/veh		41.4						37.9				
Approach LOS		D						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		41.2		38.8				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 37		* 34				
Max Q Clear Time (g_c+I1), s		36.9		35.6				
Green Ext Time (p_c), s		0.1		0.0				

Intersection Summary			
HCM 2010 Ctrl Delay			39.8
HCM 2010 LOS			D

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	280	40	70	280	52	60	222	170	103	140	30
Future Volume (veh/h)	20	280	40	70	280	52	60	222	170	103	140	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		0.96	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2039	2039	2000	1961	1961	2000	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	21	292	35	73	292	47	62	231	146	107	146	23
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	57	388	46	154	444	71	267	302	191	222	408	64
Arrive On Green	0.03	0.22	0.22	0.08	0.27	0.27	0.15	0.29	0.29	0.13	0.26	0.26
Sat Flow, veh/h	1942	1778	213	1867	1638	264	1774	1048	663	1774	1552	245
Grp Volume(v), veh/h	21	0	327	73	0	339	62	0	377	107	0	169
Grp Sat Flow(s),veh/h/ln	1942	0	1991	1867	0	1902	1774	0	1711	1774	0	1797
Q Serve(g_s), s	0.6	0.0	9.2	2.2	0.0	9.5	1.8	0.0	12.0	3.4	0.0	4.6
Cycle Q Clear(g_c), s	0.6	0.0	9.2	2.2	0.0	9.5	1.8	0.0	12.0	3.4	0.0	4.6
Prop In Lane	1.00		0.11	1.00		0.14	1.00		0.39	1.00		0.14
Lane Grp Cap(c), veh/h	57	0	434	154	0	515	267	0	493	222	0	472
V/C Ratio(X)	0.37	0.00	0.75	0.48	0.00	0.66	0.23	0.00	0.76	0.48	0.00	0.36
Avail Cap(c_a), veh/h	260	0	829	312	0	856	297	0	658	297	0	692
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.4	0.0	21.9	26.2	0.0	19.3	22.3	0.0	19.4	24.3	0.0	17.9
Incr Delay (d2), s/veh	1.4	0.0	2.7	0.8	0.0	1.4	0.2	0.0	3.8	0.6	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	5.3	1.2	0.0	5.1	0.9	0.0	6.2	1.7	0.0	2.3
LnGrp Delay(d),s/veh	29.9	0.0	24.5	27.0	0.0	20.8	22.5	0.0	23.2	24.9	0.0	18.4
LnGrp LOS	C		C	C		C	C		C	C		B
Approach Vol, veh/h		348			412			439			276	
Approach Delay, s/veh		24.9			21.9			23.1			20.9	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.9	17.9	13.0	19.9	5.8	21.1	11.5	21.4
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	24.9	10.0	* 23	8.0	26.9	10.0	* 23
Max Q Clear Time (g_c+I1), s	4.2	11.2	3.8	6.6	2.6	11.5	5.4	14.0
Green Ext Time (p_c), s	0.0	1.1	0.0	0.5	0.0	1.2	0.1	1.2

Intersection Summary		
HCM 2010 Ctrl Delay		22.8
HCM 2010 LOS		C

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	490	50	0	635	10	25
Future Volume (vph)	490	50	0	635	10	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			3.0	5.6	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	0.99	
Frt	0.99			1.00	0.90	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1561			1588	1401	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1561			1588	1401	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	510	52	0	661	10	26
RTOR Reduction (vph)	5	0	0	0	21	0
Lane Group Flow (vph)	557	0	0	661	15	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA	Perm	
Protected Phases	2			3 4 6		
Permitted Phases					8	
Actuated Green, G (s)	34.1			54.9	13.9	
Effective Green, g (s)	34.1			48.9	13.9	
Actuated g/C Ratio	0.43			0.61	0.17	
Clearance Time (s)	6.0				5.6	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	665			970	243	
v/s Ratio Prot	c0.36			c0.42		
v/s Ratio Perm					c0.01	
v/c Ratio	0.84			0.68	0.06	
Uniform Delay, d1	20.5			10.4	27.6	
Progression Factor	0.64			0.35	0.72	
Incremental Delay, d2	10.7			0.5	0.1	
Delay (s)	23.8			4.2	20.0	
Level of Service	C			A	C	
Approach Delay (s)	23.8			4.2	20.0	
Approach LOS	C			A	C	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	455	5	0	290	15	30	25	20	10	20	20
Future Volume (vph)	0	455	5	0	290	15	30	25	20	10	20	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			1.00			0.98	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		1.00			0.99			0.96			0.95	
Flt Protected		1.00			1.00			0.98			0.99	
Satd. Flow (prot)		1585			1574			1487			1461	
Flt Permitted		1.00			1.00			0.85			0.92	
Satd. Flow (perm)		1585			1574			1285			1356	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	474	5	0	302	16	31	26	21	10	21	21
RTOR Reduction (vph)	0	0	0	0	2	0	0	19	0	0	19	0
Lane Group Flow (vph)	0	479	0	0	316	0	0	59	0	0	33	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			4 6			8			8	
Permitted Phases							8			8		
Actuated Green, G (s)		43.0			58.8			9.2			9.2	
Effective Green, g (s)		43.0			58.8			9.2			9.2	
Actuated g/C Ratio		0.54			0.73			0.11			0.11	
Clearance Time (s)		6.0						6.0			6.0	
Vehicle Extension (s)		3.0						1.5			1.5	
Lane Grp Cap (vph)		851			1156			147			155	
v/s Ratio Prot		c0.30			c0.20							
v/s Ratio Perm								c0.05			0.02	
v/c Ratio		0.56			0.27			0.40			0.22	
Uniform Delay, d1		12.3			3.5			32.9			32.1	
Progression Factor		0.58			0.05			0.38			0.84	
Incremental Delay, d2		2.3			0.0			0.6			0.1	
Delay (s)		9.4			0.2			13.0			27.1	
Level of Service		A			A			B			C	
Approach Delay (s)		9.4			0.2			13.0			27.1	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	515	0	0	625	10	25
Future Volume (vph)	515	0	0	625	10	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			6.0	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.90	
Flt Protected	1.00			1.00	0.99	
Satd. Flow (prot)	1588			1588	1414	
Flt Permitted	1.00			1.00	0.99	
Satd. Flow (perm)	1588			1588	1414	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	536	0	0	651	10	26
RTOR Reduction (vph)	0	0	0	0	21	0
Lane Group Flow (vph)	536	0	0	651	15	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	53.6			34.1	14.8	
Effective Green, g (s)	48.0			34.1	14.8	
Actuated g/C Ratio	0.60			0.43	0.19	
Clearance Time (s)				6.0		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	952			676	261	
v/s Ratio Prot	c0.34			c0.41	c0.01	
v/s Ratio Perm						
v/c Ratio	0.56			0.96	0.06	
Uniform Delay, d1	9.7			22.3	26.9	
Progression Factor	0.29			1.04	1.83	
Incremental Delay, d2	0.4			20.9	0.0	
Delay (s)	3.3			44.0	49.1	
Level of Service	A			D	D	
Approach Delay (s)	3.3			44.0	49.1	
Approach LOS	A			D	D	

Intersection Summary			
HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	485	0	0	285	15	20	20	20	0	0	0
Future Volume (vph)	0	485	0	0	285	15	20	20	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1573			1470				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1573			1470				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	505	0	0	297	16	21	21	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	505	0	0	311	0	0	45	0	0	0	0
Confl. Peds. (#/hr)	10		10			10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		58.2			43.0			9.8				
Effective Green, g (s)		58.2			43.0			9.8				
Actuated g/C Ratio		0.73			0.54			0.12				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1155			845			180				
v/s Ratio Prot		c0.32			0.20			c0.03				
v/s Ratio Perm												
v/c Ratio		0.44			0.37			0.25				
Uniform Delay, d1		4.4			10.7			31.8				
Progression Factor		0.09			0.51			1.01				
Incremental Delay, d2		0.1			1.2			0.2				
Delay (s)		0.5			6.6			32.2				
Level of Service		A			A			C				
Approach Delay (s)		0.5			6.6			32.2			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	370	0	0	425	50	20	5	20	0	0	0
Future Volume (vph)	0	370	0	0	425	50	20	5	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1537			1442				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1537			1442				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	385	0	0	443	52	21	5	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	385	0	0	490	0	0	29	0	0	0	0
Confl. Peds. (#/hr)	59		21			59			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		55.1			36.8			13.3				
Effective Green, g (s)		55.1			36.8			13.3				
Actuated g/C Ratio		0.69			0.46			0.17				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1093			707			239				
v/s Ratio Prot		c0.24			c0.32			c0.02				
v/s Ratio Perm												
v/c Ratio		0.35			0.69			0.12				
Uniform Delay, d1		5.1			17.1			28.4				
Progression Factor		0.21			0.78			1.00				
Incremental Delay, d2		0.2			5.0			0.2				
Delay (s)		1.3			18.4			28.7				
Level of Service		A			B			C				
Approach Delay (s)		1.3			18.4			28.7			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	28.9	47.0	0.07	5.2	F
C	IV	25	18.9	11.8	30.7	0.07	8.4	E
B	IV	25	17.9	45.6	63.5	0.07	3.8	F
A	IV	25	18.5	13.7	32.2	0.07	7.8	E
Lindaro	IV	25	25.3	22.5	47.8	0.14	10.6	D
Lincoln	IV	25	21.4	62.3	83.7	0.10	4.2	F
Francisco W.	IV	25	12.2	35.5	47.7	0.05	3.5	F
101 SBOn 2nd	IV	25	14.2	23.6	37.8	0.05	5.1	F
Total	IV		146.5	243.9	390.4	0.61	5.7	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	50.4	69.4	0.07	3.7	F
Tamalpais	IV	25	14.4	56.9	71.3	0.05	2.7	F
Lincoln	IV	25	13.2	20.4	33.6	0.05	5.4	F
Lindaro	IV	25	21.4	2.9	24.3	0.10	14.4	C
A	IV	25	25.3	14.7	40.0	0.14	12.6	D
B	IV	25	17.9	8.8	26.7	0.07	9.1	D
C	IV	25	19.0	4.5	23.5	0.07	11.0	D
D	IV	25	18.7	2.6	21.3	0.07	11.9	D
Total	IV		148.9	161.2	310.1	0.62	7.2	E

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	29	24.0	56.4	80.4	0.16	7.2	E
5th	IV	25	16.3	3.1	19.4	0.06	11.4	D
4th	IV	25	14.6	6.2	20.8	0.05	9.5	D
3rd	IV	25	17.7	9.6	27.3	0.07	8.8	E
2nd	IV	25	15.6	75.8	91.4	0.06	2.3	F
Total	IV		88.2	151.1	239.3	0.40	6.0	F

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	30	25.2	32.9	58.1	0.17	10.4	D
3rd St	IV	25	14.8	20.9	35.7	0.06	5.6	F
4th	IV	25	18.3	17.3	35.6	0.07	7.0	F
5th	IV	25	14.6	10.0	24.6	0.06	8.1	E
Mission	IV	25	15.7	5.9	21.6	0.06	9.9	D
Total	IV		88.6	87.0	175.6	0.41	8.3	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	14.6	43.1	0.16	13.2	C
Tamalpais	IV	25	16.0	49.8	65.8	0.06	3.3	F
Tamalpais	IV	25	3.1	5.7	8.8	0.01	4.8	F
Hetherton	IV	25	8.7	10.3	19.0	0.03	6.2	F
Irwin	IV	25	18.9	14.8	33.7	0.07	7.6	E
Total	IV		75.2	95.2	170.4	0.33	7.1	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	27.6	49.2	0.10	7.2	E
Hetherton	IV	25	18.9	23.3	42.2	0.07	6.1	F
Tamalpais	IV	25	8.7	115.6	124.3	0.03	1.0	F
Tamalpais	IV	25	3.1	4.7	7.8	0.01	5.4	F
Lincoln	IV	25	16.0	80.8	96.8	0.06	2.2	F
Total	IV		68.3	252.0	320.3	0.27	3.1	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	17.6	35.7	0.07	6.9	F
C	IV	25	18.9	13.8	32.7	0.07	7.9	E
B	IV	25	17.9	15.0	32.9	0.07	7.4	E
A	IV	25	18.5	12.1	30.6	0.07	8.2	E
Lindaro	IV	25	25.3	14.7	40.0	0.14	12.6	D
Lincoln	IV	25	21.4	66.3	87.7	0.10	4.0	F
Francisco W.	IV	25	12.2	38.3	50.5	0.05	3.3	F
101 SBOn Hetherton	IV	25	14.2	83.6	97.8	0.05	2.0	F
Total	IV		146.5	261.4	407.9	0.61	5.4	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	44.6	63.6	0.07	4.1	F
Tamalpais	IV	25	14.4	55.2	69.6	0.05	2.8	F
Lincoln	IV	25	13.2	18.4	31.6	0.05	5.7	F
Lindaro	IV	25	21.4	4.7	26.1	0.10	13.4	C
A	IV	25	25.3	6.3	31.6	0.14	16.0	C
B	IV	25	17.9	7.2	25.1	0.07	9.7	D
C	IV	25	19.0	4.3	23.3	0.07	11.1	D
D	IV	25	18.7	2.9	21.6	0.07	11.7	D
Total	IV		148.9	143.6	292.5	0.62	7.7	E

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	35	22.2	37.3	59.5	0.16	9.6	D
5th	IV	25	16.3	6.8	23.1	0.06	9.6	D
4th	IV	25	14.6	7.4	22.0	0.05	9.0	E
3rd	IV	25	17.7	22.8	40.5	0.07	5.9	F
2nd	IV	25	15.6	25.7	41.3	0.06	5.1	F
Total	IV		86.4	100.0	186.4	0.40	7.7	E

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	38	19.3	59.6	78.9	0.17	7.7	E
3rd St	IV	25	14.8	20.9	35.7	0.06	5.6	F
4th	IV	25	18.9	3.7	22.6	0.07	11.4	D
5th	IV	25	14.0	12.6	26.6	0.05	7.2	E
Mission	IV	25	15.7	3.0	18.7	0.06	11.4	D
Total	IV		82.7	99.8	182.5	0.41	8.0	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	12.1	40.6	0.16	14.0	C
Tamalpais	IV	25	16.1	25.9	42.0	0.06	5.2	F
Tamalpais	IV	25	4.3	3.1	7.4	0.02	7.9	E
Hetherton	IV	25	7.5	8.0	15.5	0.03	6.6	F
Irwin	IV	25	18.9	14.4	33.3	0.07	7.7	E
Total	IV		75.3	63.5	138.8	0.33	8.7	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	30.4	52.0	0.10	6.8	F
Hetherton	IV	25	18.9	8.1	27.0	0.07	9.5	D
Tamalpais	IV	25	7.5	46.6	54.1	0.03	1.9	F
Tamalpais	IV	25	4.3	2.7	7.0	0.02	8.4	E
Lincoln	IV	25	16.1	31.9	48.0	0.06	4.6	F
Total	IV		68.4	119.7	188.1	0.27	5.3	F

Leisch Method for Weaving Analysis

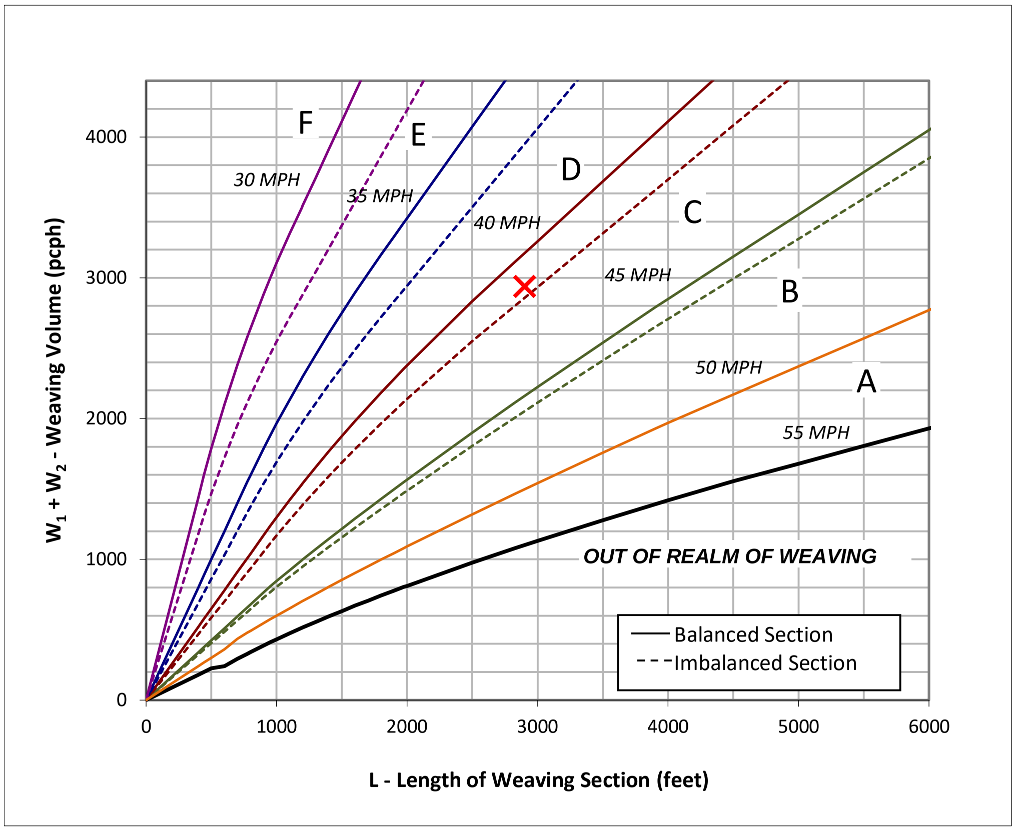
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

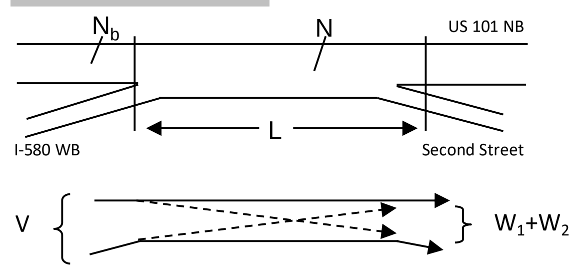
Project Information

Project	BioMarin
Scenario	Baseline + Project AM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,796	Volume (vph)*	1,754	Volume (vph)*	1,064
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	4%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	6,051	Volume (pcph)	1,831	Volume (pcph)	1,108



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 39.6
4. Weaving Intensity Factor (k) 2.55
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 1,553

6. Level of Service (LOS) D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline + Project Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3833	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1404
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	23.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	718	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	820
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	13.7
Speed 2 (S_3), mi/h	1.4	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline + Project Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5621	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1597
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	26.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Baseline + Project Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5863	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	2119
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.92
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	55.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	38.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	3/17/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	Baseline + Project, AM Peak Hour
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5863	1508
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	4.40	3.72
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.958
Flow Rate (v_i), pc/h	6356	1711
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.92	0.81

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	65103.7	Density in Ramp Influence Area (D_R), pc/mi/ln	38.3
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	0.387
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2220
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	53.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.522	Outer Lanes Freeway Speed (S_O), mi/h	61.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	4136	Ramp Junction Speed (S), mi/h	55.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	38.1
Level of Service (LOS)	E		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0

Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	Baseline + Project, AM Peak Hour
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4355	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1628
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.71
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	27.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	998	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1104
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.0
Speed 2 (S_2), mi/h	1.0	Density (D_{ML}), pc/mi/ln	18.7
Speed 2 (S_3), mi/h	5.0	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

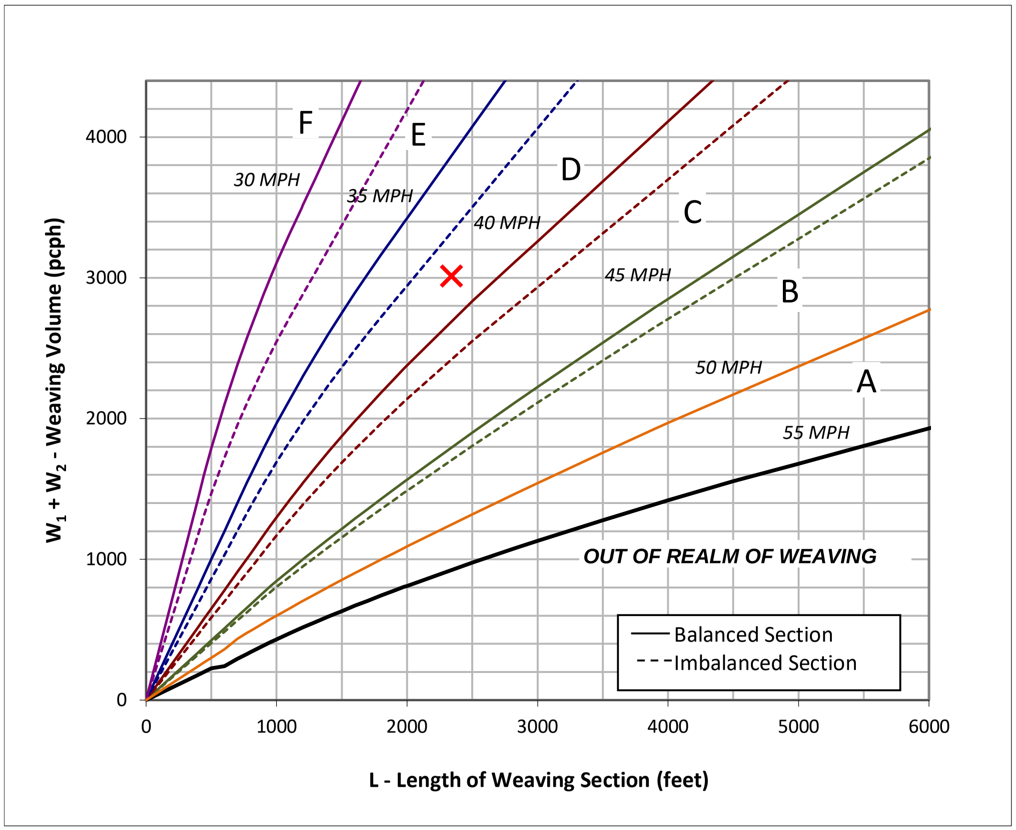
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

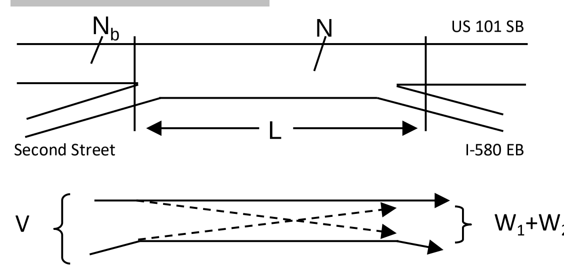
Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,712	Volume (vph)*	1,719	Volume (vph)*	1,179
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	2%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	7,007	Volume (pcph)	1,765	Volume (pcph)	1,249

Project Information

Project	BioMarin
Scenario	Baseline + Project AM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 38.6
4. Weaving Intensity Factor (k) 2.61
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,255
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

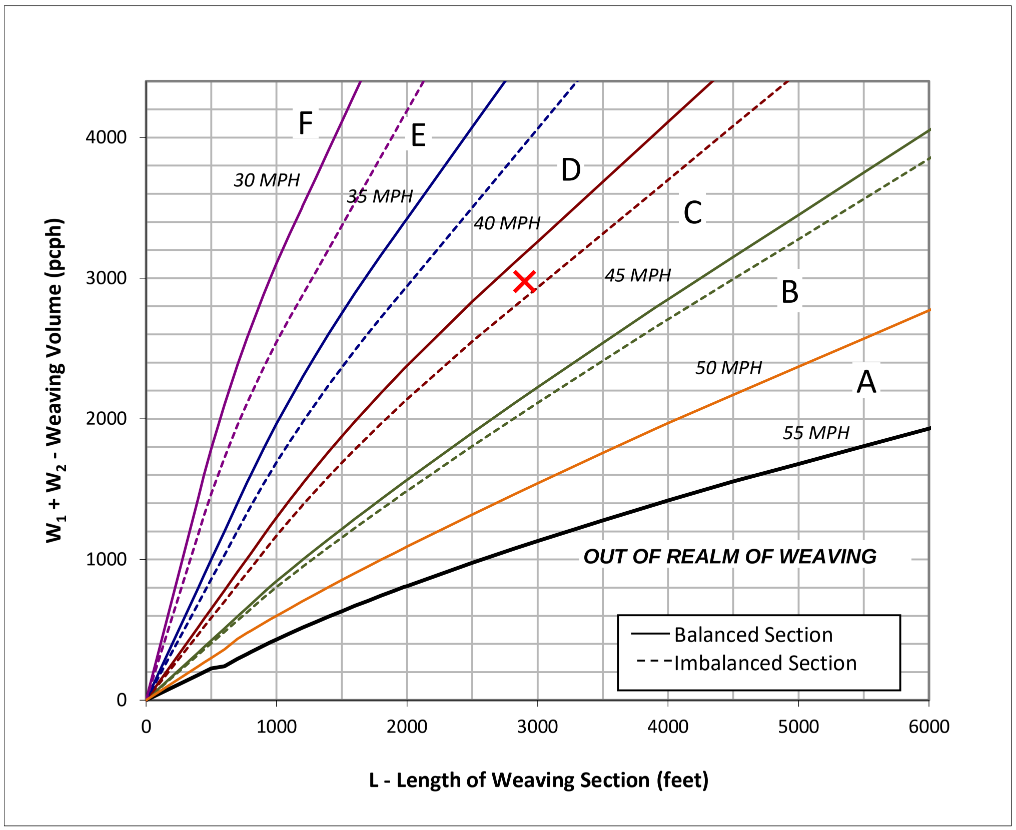
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

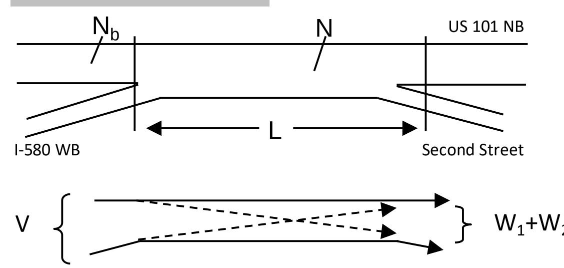
Project Information

Project	BioMarin
Scenario	Baseline + Project PM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,756	Volume (vph)*	1,548	Volume (vph)*	1,326
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	7,053	Volume (pcph)	1,616	Volume (pcph)	1,361



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

35 MPH and **40 MPH**

If left of the 30 MPH curve, LOS is F. Select "-".

If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 39.5
4. Weaving Intensity Factor (k) — 2.55
5. Service Volume (SV, pcph)

$SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,834

6. Level of Service (LOS) — E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4799	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1776
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	29.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	848	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	890
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.7
Speed 2 (S_2), mi/h	0.3	Density (D_{ML}), pc/mi/ln	14.9
Speed 2 (S_3), mi/h	2.1	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	7017	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	2014
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.88
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	56.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	35.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1217	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	1342
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	5.597		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	47.9
Speed 2 (S_2), mi/h	2.3	Density (D_{ML}), pc/mi/ln	28.0
Speed 2 (S_3), mi/h	9.8	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5084	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1837
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	31.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1377	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1555
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	56.0
Speed 2 (S_2), mi/h	4.0	Density (D_{ML}), pc/mi/ln	27.8
Speed 2 (S_3), mi/h	15.4	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5084	1749
Peak Hour Factor (PHF)	0.97	0.96
Total Trucks, %	4.40	2.00
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.973
Flow Rate (v_i), pc/h	5511	1872
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.80	0.89

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	102267.7	Density in Ramp Influence Area (D_R), pc/mi/ln	35.6
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_s)	0.401
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1688
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	52.8
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.536	Outer Lanes Freeway Speed (S_O), mi/h	63.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3823	Ramp Junction Speed (S), mi/h	55.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	33.0
Level of Service (LOS)	E		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1380	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1559
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	55.9
Speed 2 (S_2), mi/h	4.1	Density (D_{ML}), pc/mi/ln	27.9
Speed 2 (S_3), mi/h	15.5	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline + Project Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3335	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1247
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	20.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	918	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1049
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.2
Speed 2 (S_2), mi/h	0.8	Density (D_{ML}), pc/mi/ln	17.7
Speed 2 (S_3), mi/h	4.2	Level of Service (LOS)	B

Leisch Method for Weaving Analysis

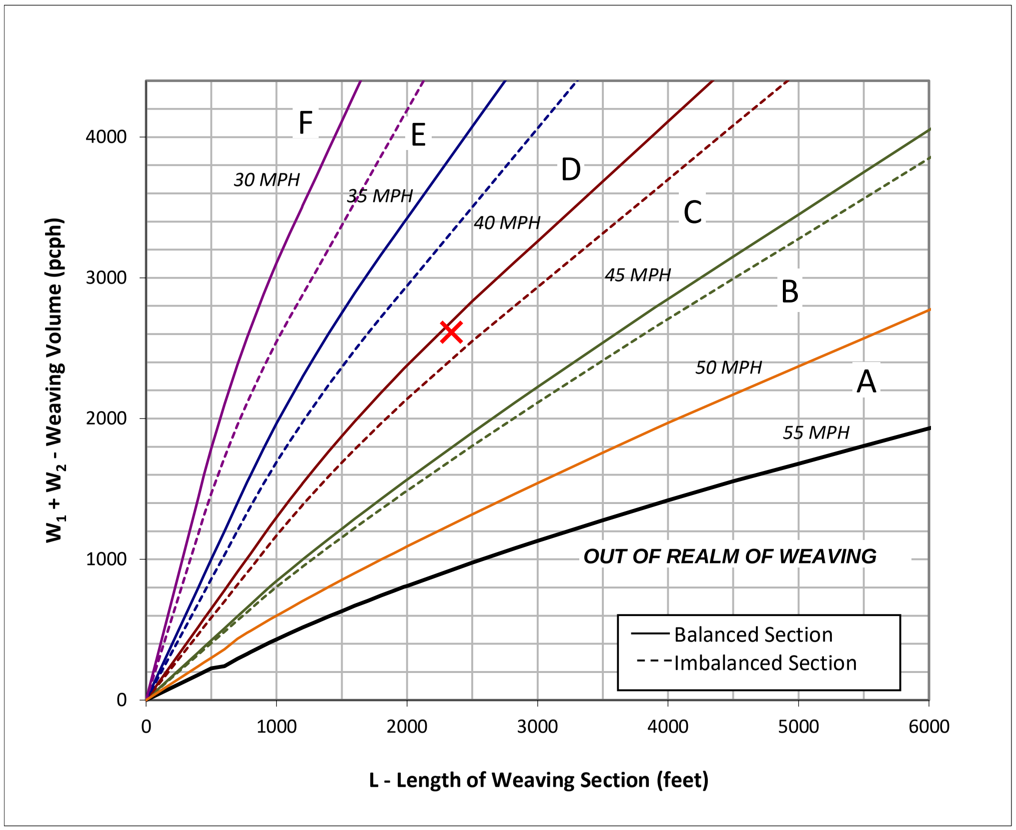
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

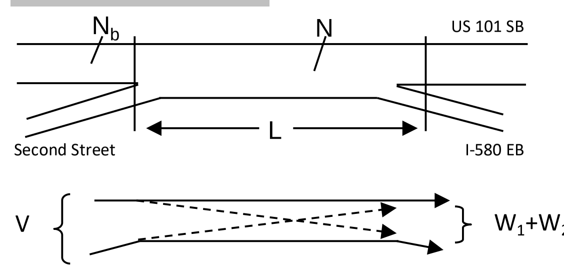
Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,139	Volume (vph)*	1,040	Volume (vph)*	1,411
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	5,365	Volume (pcph)	1,066	Volume (pcph)	1,548

Project Information

Project	BioMarin
Scenario	Baseline + Project PM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)?	Y
If optional exit lane, then "Y". Otherwise "N".	
2. In the chart to the left, which two speed curves is the red "x" between?	40 MPH and 45 MPH
If left of the 30 MPH curve, LOS is F. Select "-".	
If below the 55 MPH curve, out of the realm of weaving.	
3. Interpolated Weaving Speed (S_w, mph)	40.4
4. Weaving Intensity Factor (k)	2.50
5. Service Volume (SV, pcph) $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$	1,740
6. Level of Service (LOS)	E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Appendix E:
Cumulative Conditions –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

April 5, 2019

FEHR PEERS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	500	20	80	585	50	20	230	90	60	415	380
Future Volume (veh/h)	120	500	20	80	585	50	20	230	90	60	415	380
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	0.99		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1710	1660	1660	1710	1800	1678	1728	1800	1748	1728
Adj Flow Rate, veh/h	130	543	20	87	636	50	22	250	80	65	451	204
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	148	868	32	341	626	49	68	439	134	137	831	363
Arrive On Green	0.09	0.55	0.55	0.55	0.55	0.55	0.85	0.85	0.85	0.43	0.43	0.43
Sat Flow, veh/h	1581	1588	59	787	1515	119	39	1029	314	189	1947	851
Grp Volume(v), veh/h	130	0	563	87	0	686	352	0	0	390	0	330
Grp Sat Flow(s),veh/h/ln	1581	0	1647	787	0	1634	1382	0	0	1612	0	1376
Q Serve(g_s), s	6.1	0.0	17.7	5.7	0.0	31.0	0.0	0.0	0.0	4.2	0.0	13.6
Cycle Q Clear(g_c), s	6.1	0.0	17.7	13.4	0.0	31.0	5.3	0.0	0.0	12.9	0.0	13.6
Prop In Lane	1.00		0.04	1.00		0.07	0.06		0.23	0.17		0.62
Lane Grp Cap(c), veh/h	148	0	900	341	0	676	641	0	0	744	0	587
V/C Ratio(X)	0.88	0.00	0.63	0.26	0.00	1.02	0.55	0.00	0.00	0.52	0.00	0.56
Avail Cap(c_a), veh/h	148	0	900	341	0	676	641	0	0	744	0	587
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.64	0.00	0.64	0.84	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.6	0.0	11.7	15.5	0.0	16.9	3.5	0.0	0.0	15.9	0.0	16.2
Incr Delay (d2), s/veh	47.7	0.0	3.3	1.1	0.0	31.5	2.8	0.0	0.0	2.6	0.0	3.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	8.8	1.3	0.0	19.5	2.3	0.0	0.0	6.5	0.0	5.8
LnGrp Delay(d),s/veh	81.3	0.0	15.0	16.7	0.0	48.4	6.4	0.0	0.0	18.6	0.0	20.1
LnGrp LOS	F		B	B		F	A			B		C
Approach Vol, veh/h		693			773			352			720	
Approach Delay, s/veh		27.4			44.8			6.4			19.3	
Approach LOS		C			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		45.2		36.8	10.0	35.2		36.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 41		25.4	7.0	* 31		25.4
Max Q Clear Time (g_c+I1), s		19.7		7.3	8.1	33.0		15.6
Green Ext Time (p_c), s		5.5		3.1	0.0	0.0		4.4

Intersection Summary		
HCM 2010 Ctrl Delay		27.5
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	515	90	40	230	0	0	0	0	245	1035	500
Future Volume (vph)	0	515	90	40	230	0	0	0	0	245	1035	500
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.97
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2711			1767						2960	1303
Flt Permitted		1.00			0.80						0.99	1.00
Satd. Flow (perm)		2711			1421						2960	1303
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	560	98	43	250	0	0	0	0	266	1125	543
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	639	0	0	293	0	0	0	0	0	1391	543
Confl. Peds. (#/hr)	15		22	22		15			16			1
Confl. Bikes (#/hr)			3			2			1			3
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		23.8			23.8						42.4	35.4
Effective Green, g (s)		23.8			23.8						42.4	35.4
Actuated g/C Ratio		0.32			0.32						0.57	0.47
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		860			450						1673	615
v/s Ratio Prot		c0.24									c0.47	
v/s Ratio Perm					0.21							0.42
v/c Ratio		0.74			0.65						0.83	0.88
Uniform Delay, d1		22.9			22.0						13.4	17.9
Progression Factor		0.74			1.33						1.00	1.00
Incremental Delay, d2		4.8			5.6						5.0	16.7
Delay (s)		21.8			34.9						18.3	34.7
Level of Service		C			C						B	C
Approach Delay (s)		21.8			34.9			0.0			22.9	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	400	30	330	170	340	10	110	1140	140	40
Future Volume (vph)	400	30	330	170	340	10	110	1140	140	40
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1494	1794	1615	1471			3430	1294	
Flt Permitted		0.58	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		919	1794	1615	1471			3430	1294	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	435	33	359	185	370	11	120	1239	152	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	46	0
Lane Group Flow (vph)	0	468	359	185	381	0	0	1359	149	0
Confl. Peds. (#/hr)							13			6
Confl. Bikes (#/hr)					2	2				2
Parking (#/hr)				0				2		
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		34.8	34.8	19.8	19.8			31.8	31.8	
Effective Green, g (s)		34.8	34.8	19.8	19.8			31.8	31.8	
Actuated g/C Ratio		0.46	0.46	0.26	0.26			0.42	0.42	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0	
Lane Grp Cap (vph)		509	832	426	388			1454	548	
v/s Ratio Prot		c0.13	0.20	0.11	0.26					
v/s Ratio Perm		c0.29						0.40	0.12	
v/c Ratio		0.92	0.43	0.43	0.98			0.93	0.27	
Uniform Delay, d1		19.1	13.5	22.9	27.4			20.6	14.1	
Progression Factor		0.89	0.79	1.00	1.00			0.75	0.71	
Incremental Delay, d2		14.9	0.2	0.7	40.7			5.7	0.5	
Delay (s)		32.0	10.8	23.7	68.1			21.2	10.5	
Level of Service		C	B	C	E			C	B	
Approach Delay (s)			22.8	53.6				19.9		
Approach LOS			C	D				B		

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	320	40	70	290	70	20	240	70	50	415	50
Future Volume (veh/h)	40	320	40	70	290	70	20	240	70	50	415	50
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	0.99		0.95	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1398	1545	1530	1398	1485	1530	1440	1485	1469	1440	1485	1469
Adj Flow Rate, veh/h	43	348	36	76	315	63	22	261	62	54	451	49
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	126	409	42	143	356	71	72	563	128	97	610	64
Arrive On Green	0.30	0.30	0.30	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00
Sat Flow, veh/h	792	1370	142	785	1193	239	37	973	221	77	1054	110
Grp Volume(v), veh/h	43	0	384	76	0	378	345	0	0	554	0	0
Grp Sat Flow(s),veh/h/ln	792	0	1512	785	0	1432	1231	0	0	1241	0	0
Q Serve(g_s), s	2.9	0.0	17.9	4.5	0.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	22.4	0.0	17.9	22.4	0.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.09	1.00		0.17	0.06		0.18	0.10		0.09
Lane Grp Cap(c), veh/h	126	0	452	143	0	428	764	0	0	771	0	0
V/C Ratio(X)	0.34	0.00	0.85	0.53	0.00	0.88	0.45	0.00	0.00	0.72	0.00	0.00
Avail Cap(c_a), veh/h	126	0	452	143	0	428	764	0	0	771	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.94	0.00	0.94	0.86	0.00	0.00	0.39	0.00	0.00
Uniform Delay (d), s/veh	36.5	0.0	24.7	43.6	0.0	32.5	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	7.2	0.0	17.9	12.7	0.0	21.4	1.7	0.0	0.0	2.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	9.7	2.1	0.0	10.3	0.4	0.0	0.0	0.5	0.0	0.0
LnGrp Delay(d),s/veh	43.7	0.0	42.6	56.3	0.0	54.0	1.7	0.0	0.0	2.3	0.0	0.0
LnGrp LOS	D		D	E		D	A			A		
Approach Vol, veh/h		427			454			345			554	
Approach Delay, s/veh		42.7			54.3			1.7			2.3	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.0		48.0		27.0		48.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		22.4		43.4		22.4		43.4
Max Q Clear Time (g_c+I1), s		24.4		2.0		24.4		2.0
Green Ext Time (p_c), s		0.0		1.7		0.0		2.9

Intersection Summary		
HCM 2010 Ctrl Delay		25.2
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	260	180	40	245	0	0	0	0	50	990	125
Future Volume (vph)	0	260	180	40	245	0	0	0	0	50	990	125
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.94			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1665			1769						4118	1127
Flt Permitted		1.00			0.90						1.00	1.00
Satd. Flow (perm)		1665			1605						4118	1127
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	283	196	43	266	0	0	0	0	54	1076	136
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	466	0	0	309	0	0	0	0	0	1130	136
Confl. Peds. (#/hr)			15	15		14			22	22		10
Confl. Bikes (#/hr)			4			2			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		36.8			36.8						29.4	22.4
Effective Green, g (s)		36.8			36.8						29.4	22.4
Actuated g/C Ratio		0.49			0.49						0.39	0.30
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		816			787						1614	336
v/s Ratio Prot		c0.28										
v/s Ratio Perm					0.19						0.27	0.12
v/c Ratio		0.57			0.39						0.70	0.40
Uniform Delay, d1		13.5			12.0						19.1	21.0
Progression Factor		0.46			1.32						0.62	0.69
Incremental Delay, d2		2.8			0.8						1.4	2.0
Delay (s)		8.9			16.8						13.2	16.5
Level of Service		A			B						B	B
Approach Delay (s)		8.9			16.8			0.0			13.6	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	110	0	0	160	130	150	1180	20	0	0	0
Future Volume (veh/h)	150	110	0	0	160	130	150	1180	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	0.89	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1620	1573	1620			
Adj Flow Rate, veh/h	163	120	0	0	174	102	163	1283	21			
Adj No. of Lanes	1	1	0	0	1	0	0	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	0	3	0			
Cap, veh/h	219	491	0	0	256	150	166	1380	24			
Arrive On Green	0.10	0.10	0.00	0.00	0.31	0.31	0.19	0.19	0.19			
Sat Flow, veh/h	977	1573	0	0	819	480	294	2441	42			
Grp Volume(v), veh/h	163	120	0	0	0	276	767	0	700			
Grp Sat Flow(s),veh/h/ln	977	1573	0	0	0	1299	1385	0	1392			
Q Serve(g_s), s	9.5	5.3	0.0	0.0	0.0	13.9	41.3	0.0	36.8			
Cycle Q Clear(g_c), s	23.4	5.3	0.0	0.0	0.0	13.9	41.3	0.0	36.8			
Prop In Lane	1.00		0.00	0.00		0.37	0.21		0.03			
Lane Grp Cap(c), veh/h	219	491	0	0	0	405	783	0	787			
V/C Ratio(X)	0.74	0.24	0.00	0.00	0.00	0.68	0.98	0.00	0.89			
Avail Cap(c_a), veh/h	219	491	0	0	0	405	783	0	787			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	0.79	0.79	0.00	0.00	0.00	1.00	0.09	0.00	0.09			
Uniform Delay (d), s/veh	41.7	25.5	0.0	0.0	0.0	22.5	30.1	0.0	28.2			
Incr Delay (d2), s/veh	10.3	0.2	0.0	0.0	0.0	4.6	5.9	0.0	1.6			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	2.3	0.0	0.0	0.0	5.5	17.1	0.0	14.6			
LnGrp Delay(d),s/veh	52.0	25.7	0.0	0.0	0.0	27.1	36.0	0.0	29.8			
LnGrp LOS	D	C				C	D		C			
Approach Vol, veh/h		283			276			1467				
Approach Delay, s/veh		40.9			27.1			33.1				
Approach LOS		D			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		28.0		47.0		28.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		23.4		42.4		23.4		
Max Q Clear Time (g_c+I1), s		25.4		43.3		15.9		
Green Ext Time (p_c), s		0.0		0.0		0.7		

Intersection Summary		
HCM 2010 Ctrl Delay		33.3
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	265	20	80	340	60	20	240	70	85	365	80
Future Volume (veh/h)	40	265	20	80	340	60	20	240	70	85	365	80
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.90	0.97		0.91	0.97		0.92	0.99		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1573	1510	1620	1573	1573	1620	1620	1573	1555	1620	1573	1555
Adj Flow Rate, veh/h	43	288	19	87	370	56	22	261	62	92	397	77
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	117	423	28	209	400	60	74	598	136	145	540	99
Arrive On Green	0.30	0.30	0.30	0.10	0.10	0.10	0.19	0.19	0.19	1.00	1.00	1.00
Sat Flow, veh/h	853	1390	92	925	1314	199	39	1024	233	153	924	170
Grp Volume(v), veh/h	43	0	307	87	0	426	345	0	0	566	0	0
Grp Sat Flow(s),veh/h/ln	853	0	1482	925	0	1513	1296	0	0	1247	0	0
Q Serve(g_s), s	1.9	0.0	13.6	7.0	0.0	20.9	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	22.8	0.0	13.6	20.6	0.0	20.9	17.1	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.06	1.00		0.13	0.06		0.18	0.16		0.14
Lane Grp Cap(c), veh/h	117	0	450	209	0	460	808	0	0	784	0	0
V/C Ratio(X)	0.37	0.00	0.68	0.42	0.00	0.93	0.43	0.00	0.00	0.72	0.00	0.00
Avail Cap(c_a), veh/h	117	0	450	209	0	460	808	0	0	784	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.84	0.00	0.00	0.50	0.00	0.00
Uniform Delay (d), s/veh	37.0	0.0	22.9	39.5	0.0	32.9	19.5	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	8.7	0.0	8.1	5.5	0.0	25.5	1.4	0.0	0.0	2.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	6.6	2.1	0.0	12.1	6.6	0.0	0.0	0.6	0.0	0.0
LnGrp Delay(d),s/veh	45.7	0.0	31.0	45.1	0.0	58.4	20.9	0.0	0.0	2.9	0.0	0.0
LnGrp LOS	D		C	D		E	C			A		
Approach Vol, veh/h		350			513			345			566	
Approach Delay, s/veh		32.8			56.1			20.9			2.9	
Approach LOS		C			E			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.0		48.0		27.0		48.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 23		* 44		* 23		* 44
Max Q Clear Time (g_c+I1), s		24.8		19.1		22.9		2.0
Green Ext Time (p_c), s		0.0		3.3		0.0		7.2

Intersection Summary	
HCM 2010 Ctrl Delay	27.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	500	430	0	0	55
Future Volume (vph)	0	500	430	0	0	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6	5.6			5.2
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00			0.87
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1573	1573			1188
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1573	1573			1188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	543	467	0	0	60
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	0	543	467	0	0	11
Confl. Peds. (#/hr)				39		46
Confl. Bikes (#/hr)				4		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		50.3	50.4			13.8
Effective Green, g (s)		50.3	50.4			13.8
Actuated g/C Ratio		0.67	0.67			0.18
Clearance Time (s)						5.2
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1054	1057			218
v/s Ratio Prot		c0.35	c0.30			
v/s Ratio Perm						0.01
v/c Ratio		0.52	0.44			0.05
Uniform Delay, d1		6.2	5.7			25.2
Progression Factor		1.32	0.48			1.00
Incremental Delay, d2		0.3	0.2			0.1
Delay (s)		8.6	2.9			25.3
Level of Service		A	A			C
Approach Delay (s)		8.6	2.9		25.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	7.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	305	200	200	305	0	0	0	0	110	910	190
Future Volume (vph)	0	305	200	200	305	0	0	0	0	110	910	190
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00						1.00	0.89
Flpb, ped/bikes		1.00	1.00	0.98	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1625	1181	1607	1520						4263	1184
Flt Permitted		1.00	1.00	0.49	1.00						0.99	1.00
Satd. Flow (perm)		1625	1181	824	1520						4263	1184
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	332	217	217	332	0	0	0	0	120	989	207
RTOR Reduction (vph)	0	0	27	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	332	190	217	332	0	0	0	0	0	1109	207
Confl. Peds. (#/hr)			40	40		22			9	9		30
Confl. Bikes (#/hr)			8			4						2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		35.8	35.8	35.8	35.8						30.4	23.4
Effective Green, g (s)		35.8	35.8	35.8	35.8						30.4	23.4
Actuated g/C Ratio		0.48	0.48	0.48	0.48						0.41	0.31
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		775	563	393	725						1727	369
v/s Ratio Prot		0.20			0.22							
v/s Ratio Perm			0.16	c0.26							0.26	0.17
v/c Ratio		0.43	0.34	0.55	0.46						0.64	0.56
Uniform Delay, d1		12.9	12.2	13.9	13.1						17.9	21.5
Progression Factor		0.49	0.42	1.04	1.07						0.34	0.45
Incremental Delay, d2		1.5	1.4	3.8	1.4						1.4	4.5
Delay (s)		7.9	6.6	18.2	15.4						7.5	14.1
Level of Service		A	A	B	B						A	B
Approach Delay (s)		7.4			16.5			0.0			8.5	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	170	240	0	0	380	70	130	1140	50	0	0	0
Future Volume (veh/h)	170	240	0	0	380	70	130	1140	50	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1510	1573	1620			
Adj Flow Rate, veh/h	185	261	0	0	413	66	141	1239	50			
Adj No. of Lanes	1	1	0	0	1	0	1	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	137	625	0	0	465	74	706	1355	55			
Arrive On Green	0.79	0.79	0.00	0.00	0.13	0.13	0.16	0.16	0.16			
Sat Flow, veh/h	813	1573	0	0	1170	187	1438	2762	111			
Grp Volume(v), veh/h	185	261	0	0	0	479	141	670	619			
Grp Sat Flow(s),veh/h/ln	813	1573	0	0	0	1357	1438	1494	1379			
Q Serve(g_s), s	3.8	3.8	0.0	0.0	0.0	26.0	6.4	33.1	33.1			
Cycle Q Clear(g_c), s	29.8	3.8	0.0	0.0	0.0	26.0	6.4	33.1	33.1			
Prop In Lane	1.00		0.00	0.00		0.14	1.00		0.08			
Lane Grp Cap(c), veh/h	137	625	0	0	0	539	706	733	677			
V/C Ratio(X)	1.35	0.42	0.00	0.00	0.00	0.89	0.20	0.91	0.91			
Avail Cap(c_a), veh/h	137	625	0	0	0	539	706	733	677			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.91	0.91	0.00	0.00	0.00	1.00	0.24	0.24	0.24			
Uniform Delay (d), s/veh	22.0	5.0	0.0	0.0	0.0	31.0	18.7	29.9	29.9			
Incr Delay (d2), s/veh	196.0	1.9	0.0	0.0	0.0	19.3	0.1	5.4	5.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	10.2	1.8	0.0	0.0	0.0	12.7	2.6	14.8	13.8			
LnGrp Delay(d),s/veh	218.1	6.9	0.0	0.0	0.0	50.2	18.8	35.2	35.7			
LnGrp LOS	F	A				D	B	D	D			
Approach Vol, veh/h		446			479			1430				
Approach Delay, s/veh		94.5			50.2			33.8				
Approach LOS		F			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		34.0		41.0		34.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 30		* 37		* 30		
Max Q Clear Time (g_c+I1), s		31.8		35.1		28.0		
Green Ext Time (p_c), s		0.0		1.1		0.4		

Intersection Summary			
HCM 2010 Ctrl Delay			48.6
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	320	1220	0	0	0	0	0	240	30
Future Volume (veh/h)	0	0	0	320	1220	0	0	0	0	0	240	30
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.98
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1530	1485	0				0	1485	1530
Adj Flow Rate, veh/h				348	1326	0				0	261	17
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				586	2028	0				0	525	34
Arrive On Green				0.22	0.22	0.00				0.00	0.21	0.21
Sat Flow, veh/h				755	3123	0				0	2611	164
Grp Volume(v), veh/h				598	1076	0				0	144	134
Grp Sat Flow(s),veh/h/ln				1297	1230	0				0	1411	1290
Q Serve(g_s), s				31.7	29.8	0.0				0.0	6.8	6.9
Cycle Q Clear(g_c), s				31.7	29.8	0.0				0.0	6.8	6.9
Prop In Lane				0.58		0.00				0.00		0.13
Lane Grp Cap(c), veh/h				952	1662	0				0	292	267
V/C Ratio(X)				0.63	0.65	0.00				0.00	0.49	0.50
Avail Cap(c_a), veh/h				952	1662	0				0	440	402
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.68	0.68	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				21.8	21.0	0.0				0.0	26.3	26.3
Incr Delay (d2), s/veh				2.1	1.3	0.0				0.0	1.3	1.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.9	10.5	0.0				0.0	2.8	2.6
LnGrp Delay(d),s/veh				23.9	22.4	0.0				0.0	27.6	27.8
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1674						278	
Approach Delay, s/veh					22.9						27.6	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.9		20.1				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 43		23.4				
Max Q Clear Time (g_c+I1), s		33.7		8.9				
Green Ext Time (p_c), s		5.6		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	23.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1415	120	110	250	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1415	120	110	250	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1398	1398	1440	1398	0			
Adj Flow Rate, veh/h				0	1538	97	120	272	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	2536	774	218	404	0			
Arrive On Green				0.00	0.22	0.22	0.07	0.07	0.00			
Sat Flow, veh/h				0	3943	1164	640	1870	0			
Grp Volume(v), veh/h				0	1538	97	216	176	0			
Grp Sat Flow(s),veh/h/ln				0	1272	1164	1238	1209	0			
Q Serve(g_s), s				0.0	27.2	5.0	11.7	10.7	0.0			
Cycle Q Clear(g_c), s				0.0	27.2	5.0	12.8	10.7	0.0			
Prop In Lane				0.00		1.00	0.56		0.00			
Lane Grp Cap(c), veh/h				0	2536	774	351	270	0			
V/C Ratio(X)				0.00	0.61	0.13	0.61	0.65	0.00			
Avail Cap(c_a), veh/h				0	2536	774	421	338	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	0.57	0.57	0.79	0.79	0.00			
Uniform Delay (d), s/veh				0.0	20.4	11.8	32.8	31.9	0.0			
Incr Delay (d2), s/veh				0.0	0.6	0.2	1.5	2.5	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	9.8	1.7	4.6	3.7	0.0			
LnGrp Delay(d),s/veh				0.0	21.1	12.0	34.3	34.4	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1635			392				
Approach Delay, s/veh					20.5			34.3				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.0		21.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 46		* 21				
Max Q Clear Time (g_c+I1), s		29.2		14.8				
Green Ext Time (p_c), s		8.4		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	23.2
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	90	1470	0	0	0	0	0	200	60
Future Volume (veh/h)	0	0	0	90	1470	0	0	0	0	0	200	60
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1398	0				0	1398	1440
Adj Flow Rate, veh/h				98	1598	0				0	217	45
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				165	2266	0				0	486	97
Arrive On Green				0.21	0.21	0.00				0.00	0.24	0.24
Sat Flow, veh/h				170	3616	0				0	2091	401
Grp Volume(v), veh/h				630	1066	0				0	139	123
Grp Sat Flow(s),veh/h/ln				1356	1158	0				0	1328	1094
Q Serve(g_s), s				23.1	32.0	0.0				0.0	6.7	7.2
Cycle Q Clear(g_c), s				32.3	32.0	0.0				0.0	6.7	7.2
Prop In Lane				0.16		0.00				0.00		0.37
Lane Grp Cap(c), veh/h				933	1499	0				0	320	263
V/C Ratio(X)				0.68	0.71	0.00				0.00	0.44	0.47
Avail Cap(c_a), veh/h				933	1499	0				0	411	338
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.69	0.69	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.0	23.0	0.0				0.0	24.2	24.3
Incr Delay (d2), s/veh				2.7	2.0	0.0				0.0	0.9	1.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.9	10.7	0.0				0.0	2.5	2.3
LnGrp Delay(d),s/veh				25.7	25.0	0.0				0.0	25.1	25.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1696						262	
Approach Delay, s/veh					25.3						25.3	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		52.7		22.3				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 43		* 23				
Max Q Clear Time (g_c+I1), s		34.3		9.2				
Green Ext Time (p_c), s		5.6		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	25.3
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	1310	80	210	135	0	0	140	30
Future Volume (veh/h)	0	0	0	40	1310	80	210	135	0	0	140	30
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				43	1424	78	228	147	0	0	152	21
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				73	2568	145	303	606	0	0	302	42
Arrive On Green				0.18	0.18	0.18	0.02	0.11	0.00	0.00	0.22	0.22
Sat Flow, veh/h				131	4617	262	1748	1835	0	0	1389	192
Grp Volume(v), veh/h				570	474	500	228	147	0	0	0	173
Grp Sat Flow(s),veh/h/ln				1741	1590	1678	1748	1835	0	0	0	1581
Q Serve(g_s), s				22.5	20.2	20.3	0.6	5.5	0.0	0.0	0.0	7.2
Cycle Q Clear(g_c), s				22.5	20.2	20.3	0.6	5.5	0.0	0.0	0.0	7.2
Prop In Lane				0.08		0.16	1.00		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				968	885	934	303	606	0	0	0	344
V/C Ratio(X)				0.59	0.54	0.54	0.75	0.24	0.00	0.00	0.00	0.50
Avail Cap(c_a), veh/h				968	885	934	443	807	0	0	0	390
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.84	0.84	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				22.8	21.9	21.9	33.1	24.8	0.0	0.0	0.0	25.8
Incr Delay (d2), s/veh				2.6	2.3	2.2	6.8	0.4	0.0	0.0	0.0	2.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.5	9.5	10.0	5.2	2.9	0.0	0.0	0.0	3.4
LnGrp Delay(d),s/veh				25.4	24.2	24.1	40.0	25.2	0.0	0.0	0.0	28.2
LnGrp LOS				C	C	C	D	C				C
Approach Vol, veh/h					1545			375			173	
Approach Delay, s/veh					24.6			34.2			28.2	
Approach LOS					C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.0	20.8		46.2		28.8
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			10.0	18.5		33.5		33.0
Max Q Clear Time (g_c+I1), s			2.6	9.2		24.5		7.5
Green Ext Time (p_c), s			1.0	0.8		7.2		1.1

Intersection Summary		
HCM 2010 Ctrl Delay		26.6
HCM 2010 LOS		C

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	20	20	97.5%	13.5	7.9	B
	Through						
	Right Turn						
	Subtotal	20	20	97.5%	13.5	7.9	B
SB	Left Turn						
	Through						
	Right Turn	10	11	106.7%	13.4	6.9	B
	Subtotal	10	11	106.7%	13.4	6.9	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	30	26	87.1%	2.4	0.5	A
	Through	1,400	1,346	96.2%	1.6	0.2	A
	Right Turn	10	13	128.8%	1.1	0.1	A
	Subtotal	1,440	1,385	96.2%	1.6	0.2	A
Total		1,470	1,415	96.3%	1.8	0.1	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	80	80	99.8%	27.3	6.9	C
	Through	10	10	95.7%	26.2	15.1	C
	Right Turn						
	Subtotal	90	89	99.4%	27.6	7.2	C
SB	Left Turn						
	Through	40	42	104.0%	35.3	11.1	D
	Right Turn	10	10	99.4%	13.4	10.6	B
	Subtotal	50	52	103.0%	31.3	10.2	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	340	324	95.2%	9.0	2.8	A
	Through	1,365	1,312	96.1%	5.8	0.9	A
	Right Turn	30	30	99.4%	6.1	2.5	A
	Subtotal	1,735	1,666	96.0%	6.4	1.1	A
Total		1,875	1,807	96.3%	8.2	0.9	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	175	1615	75	40	195	0	0	290	160
Future Volume (veh/h)	0	0	0	175	1615	75	40	195	0	0	290	160
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	1.00		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1620	1573	1620	1620	1573	0	0	1510	1555
Adj Flow Rate, veh/h				190	1755	75	43	212	0	0	315	172
Adj No. of Lanes				0	3	0	0	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				178	1757	77	67	249	0	0	342	187
Arrive On Green				0.15	0.15	0.15	0.14	0.14	0.00	0.00	0.29	0.29
Sat Flow, veh/h				399	3934	173	24	574	0	0	788	431
Grp Volume(v), veh/h				740	619	661	255	0	0	0	0	487
Grp Sat Flow(s),veh/h/ln				1553	1431	1521	598	0	0	0	0	1219
Q Serve(g_s), s				33.5	32.3	32.5	3.2	0.0	0.0	0.0	0.0	29.0
Cycle Q Clear(g_c), s				33.5	32.3	32.5	32.3	0.0	0.0	0.0	0.0	29.0
Prop In Lane				0.26		0.11	0.17		0.00	0.00		0.35
Lane Grp Cap(c), veh/h				694	639	679	315	0	0	0	0	528
V/C Ratio(X)				1.07	0.97	0.97	0.81	0.00	0.00	0.00	0.00	0.92
Avail Cap(c_a), veh/h				694	639	679	315	0	0	0	0	528
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	0.67	0.67
Upstream Filter(I)				0.37	0.37	0.37	1.00	0.00	0.00	0.00	0.00	0.45
Uniform Delay (d), s/veh				32.0	31.4	31.5	26.5	0.0	0.0	0.0	0.0	25.4
Incr Delay (d2), s/veh				41.1	15.0	15.2	19.7	0.0	0.0	0.0	0.0	13.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				22.3	15.4	16.5	7.0	0.0	0.0	0.0	0.0	11.7
LnGrp Delay(d),s/veh				73.1	46.4	46.8	46.2	0.0	0.0	0.0	0.0	38.5
LnGrp LOS				F	D	D	D					D
Approach Vol, veh/h					2020			255			487	
Approach Delay, s/veh					56.3			46.2			38.5	
Approach LOS					E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				37.0		38.0		37.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				32.5		33.5		32.5
Max Q Clear Time (g_c+I1), s				34.3		35.5		31.0
Green Ext Time (p_c), s				0.0		0.0		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	52.2
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	295	1800	30	50	50	0	0	0	0
Future Volume (vph)	0	0	0	295	1800	30	50	50	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6				
Lane Util. Factor					0.91		1.00	1.00				
Frpb, ped/bikes					1.00		1.00	1.00				
Flpb, ped/bikes					0.98		0.93	1.00				
Frt					1.00		1.00	1.00				
Flt Protected					0.99		0.95	1.00				
Satd. Flow (prot)					3690		1057	1237				
Flt Permitted					0.99		0.95	1.00				
Satd. Flow (perm)					3690		1057	1237				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	321	1957	33	54	54	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2309	0	54	54	0	0	0	0
Confl. Peds. (#/hr)			73	73		38	49		63			49
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA				
Protected Phases					6			4				
Permitted Phases				6			4					
Actuated Green, G (s)					51.8		19.0	19.0				
Effective Green, g (s)					51.8		19.0	19.0				
Actuated g/C Ratio					0.58		0.21	0.21				
Clearance Time (s)					11.6		7.6	7.6				
Vehicle Extension (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					2123		223	261				
v/s Ratio Prot								0.04				
v/s Ratio Perm					0.63		c0.05					
v/c Ratio					1.09		0.24	0.21				
Uniform Delay, d1					19.1		29.5	29.3				
Progression Factor					1.00		1.00	1.00				
Incremental Delay, d2					48.1		1.2	0.8				
Delay (s)					67.2		30.7	30.1				
Level of Service					E		C	C				
Approach Delay (s)		0.0			67.2			30.4			0.0	
Approach LOS		A			E			C			A	

Intersection Summary			
HCM 2000 Control Delay	65.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	145.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	455	1590	0	0	0	0	0	825	485
Future Volume (veh/h)	0	0	0	455	1590	0	0	0	0	0	825	485
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.84
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1545	1573	0				0	1573	1485
Adj Flow Rate, veh/h				495	1728	0				0	897	518
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				730	2033	0				0	1929	474
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1471	4718	0				0	4435	1055
Grp Volume(v), veh/h				495	1728	0				0	897	518
Grp Sat Flow(s),veh/h/ln				1471	1573	0				0	1431	1055
Q Serve(g_s), s				24.3	26.8	0.0				0.0	14.3	33.7
Cycle Q Clear(g_c), s				24.3	26.8	0.0				0.0	14.3	33.7
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				730	2033	0				0	1929	474
V/C Ratio(X)				0.68	0.85	0.00				0.00	0.47	1.09
Avail Cap(c_a), veh/h				743	2076	0				0	1929	474
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				0.24	0.24	0.00				0.00	0.78	0.78
Uniform Delay (d), s/veh				28.8	29.8	0.0				0.0	23.7	31.9
Incr Delay (d2), s/veh				0.6	0.9	0.0				0.0	0.6	64.6
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				10.0	11.8	0.0				0.0	5.8	18.3
LnGrp Delay(d),s/veh				29.3	30.7	0.0				0.0	24.3	96.5
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2223						1415	
Approach Delay, s/veh					30.4						50.7	
Approach LOS					C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						36.3		38.7
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						33.0		33.0
Max Q Clear Time (g_c+I1), s						28.8		35.7
Green Ext Time (p_c), s						3.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	38.3
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1095	120	960	1205	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1095	120	960	1205	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1485	1485	1398	1398	0			
Adj Flow Rate, veh/h				0	1190	104	1043	1310	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	1329	388	1470	1544	0			
Arrive On Green				0.00	0.33	0.33	0.18	0.18	0.00			
Sat Flow, veh/h				0	4189	1184	2663	2796	0			
Grp Volume(v), veh/h				0	1190	104	1043	1310	0			
Grp Sat Flow(s),veh/h/ln				0	1352	1184	1331	1398	0			
Q Serve(g_s), s				0.0	20.9	4.9	27.6	34.0	0.0			
Cycle Q Clear(g_c), s				0.0	20.9	4.9	27.6	34.0	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1329	388	1470	1544	0			
V/C Ratio(X)				0.00	0.90	0.27	0.71	0.85	0.00			
Avail Cap(c_a), veh/h				0	1379	403	1470	1544	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	0.09	0.09	0.00			
Uniform Delay (d), s/veh				0.0	24.0	18.6	25.0	27.6	0.0			
Incr Delay (d2), s/veh				0.0	7.8	0.4	0.3	0.6	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	8.8	1.6	10.3	13.3	0.0			
LnGrp Delay(d),s/veh				0.0	31.8	18.9	25.3	28.2	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1294			2353				
Approach Delay, s/veh					30.7			26.9				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				45.9		29.1		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				40.5		25.5		
Max Q Clear Time (g_c+I1), s				36.0		22.9		
Green Ext Time (p_c), s				3.9		1.6		

Intersection Summary	
HCM 2010 Ctrl Delay	28.3
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2050	90	0	0	0	0	0	270	80	475	0
Future Volume (veh/h)	0	2050	90	0	0	0	0	0	270	80	475	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1660	1710				0	1573	1620	1748	1748	0
Adj Flow Rate, veh/h	0	2228	91				0	0	277	87	516	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	420	246	565	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.32	0.11	0.11	0.00
Sat Flow, veh/h		0					0	0	1300	1072	1748	0
Grp Volume(v), veh/h		0.0					0	0	277	87	516	0
Grp Sat Flow(s),veh/h/ln							0	0	1300	1072	1748	0
Q Serve(g_s), s							0.0	0.0	13.7	6.0	21.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	13.7	19.7	21.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	420	246	565	0
V/C Ratio(X)							0.00	0.00	0.66	0.35	0.91	0.00
Avail Cap(c_a), veh/h							0	0	440	263	592	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.86	0.86	0.00
Uniform Delay (d), s/veh							0.0	0.0	21.8	38.2	32.5	0.0
Incr Delay (d2), s/veh							0.0	0.0	2.6	0.3	15.7	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	5.2	1.8	13.1	0.0
LnGrp Delay(d),s/veh							0.0	0.0	24.4	38.5	48.2	0.0
LnGrp LOS									C	D	D	
Approach Vol, veh/h								277			603	
Approach Delay, s/veh								24.4			46.8	
Approach LOS								C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				28.8				28.8
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				25.4				25.4
Max Q Clear Time (g_c+I1), s				23.9				15.7
Green Ext Time (p_c), s				0.3				0.6

Intersection Summary		
HCM 2010 Ctrl Delay		39.8
HCM 2010 LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2290	0	0	0	0	0	225	100	0	0	0
Future Volume (veh/h)	110	2290	0	0	0	0	0	225	100	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1485	0				0	1485	1440			
Adj Flow Rate, veh/h	120	2489	0				0	245	107			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	166	2789	0				0	361	152			
Arrive On Green	0.23	0.23	0.00				0.00	0.18	0.18			
Sat Flow, veh/h	160	3989	0				0	1966	827			
Grp Volume(v), veh/h	923	1686	0				0	183	169			
Grp Sat Flow(s),veh/h/ln	1445	1352	0				0	1485	1308			
Q Serve(g_s), s	39.1	45.3	0.0				0.0	8.6	9.1			
Cycle Q Clear(g_c), s	46.6	45.3	0.0				0.0	8.6	9.1			
Prop In Lane	0.13		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	1065	1890	0				0	273	240			
V/C Ratio(X)	0.87	0.89	0.00				0.00	0.67	0.70			
Avail Cap(c_a), veh/h	1065	1890	0				0	412	363			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.17	0.17	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	26.5	26.1	0.0				0.0	28.5	28.7			
Incr Delay (d2), s/veh	1.8	1.3	0.0				0.0	6.0	7.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	19.3	17.3	0.0				0.0	4.0	3.8			
LnGrp Delay(d),s/veh	28.3	27.4	0.0				0.0	34.5	36.5			
LnGrp LOS	C	C						C	D			
Approach Vol, veh/h		2609						352				
Approach Delay, s/veh		27.7						35.5				
Approach LOS		C						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				18.0		57.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		45.4		
Max Q Clear Time (g_c+I1), s				11.1		48.6		
Green Ext Time (p_c), s				2.0		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	28.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2315	70	0	0	0	0	0	170	70	230	0
Future Volume (veh/h)	0	2315	70	0	0	0	0	0	170	70	230	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.93	0.97		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1382				0	1573	1591	1545	1485	0
Adj Flow Rate, veh/h	0	2516	72				0	0	165	76	250	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	291	216	346	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.23	0.08	0.08	0.00
Sat Flow, veh/h		0					0	0	1247	1036	1485	0
Grp Volume(v), veh/h		0.0					0	0	165	76	250	0
Grp Sat Flow(s),veh/h/ln							0	0	1247	1036	1485	0
Q Serve(g_s), s							0.0	0.0	8.8	5.4	12.3	0.0
Cycle Q Clear(g_c), s							0.0	0.0	8.8	14.2	12.3	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	291	216	346	0
V/C Ratio(X)							0.00	0.00	0.57	0.35	0.72	0.00
Avail Cap(c_a), veh/h							0	0	357	272	426	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.90	0.90	0.00
Uniform Delay (d), s/veh							0.0	0.0	25.4	37.4	32.2	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.7	0.3	2.8	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	3.1	1.6	5.3	0.0
LnGrp Delay(d),s/veh							0.0	0.0	26.1	37.7	35.1	0.0
LnGrp LOS									C	D	D	
Approach Vol, veh/h								165			326	
Approach Delay, s/veh								26.1			35.7	
Approach LOS								C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				22.0				22.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				21.5				21.5
Max Q Clear Time (g_c+I1), s				16.2				10.8
Green Ext Time (p_c), s				0.4				0.3

Intersection Summary	
HCM 2010 Ctrl Delay	32.5
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	2240	205	0	0	0	0	260	20	50	125	0
Future Volume (veh/h)	100	2240	205	0	0	0	0	260	20	50	125	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	109	2435	210				0	283	13	54	136	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	124	2928	255				0	448	20	156	366	0
Arrive On Green	0.22	0.22	0.22				0.00	0.15	0.15	0.01	0.07	0.00
Sat Flow, veh/h	188	4420	384				0	3147	140	1581	1660	0
Grp Volume(v), veh/h	1009	836	909				0	145	151	54	136	0
Grp Sat Flow(s),veh/h/ln	1738	1590	1664				0	1577	1627	1581	1660	0
Q Serve(g_s), s	42.1	37.3	39.1				0.0	6.5	6.6	0.0	5.9	0.0
Cycle Q Clear(g_c), s	42.1	37.3	39.1				0.0	6.5	6.6	0.0	5.9	0.0
Prop In Lane	0.11		0.23				0.00		0.09	1.00		0.00
Lane Grp Cap(c), veh/h	1152	1054	1102				0	231	238	156	366	0
V/C Ratio(X)	0.88	0.79	0.82				0.00	0.63	0.64	0.35	0.37	0.00
Avail Cap(c_a), veh/h	1152	1054	1102				0	336	347	170	487	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.81	0.81	0.00
Uniform Delay (d), s/veh	26.3	24.5	25.1				0.0	30.1	30.1	35.9	29.8	0.0
Incr Delay (d2), s/veh	1.0	0.6	0.7				0.0	5.9	5.9	2.3	1.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.6	16.6	18.3				0.0	3.2	3.3	1.2	2.8	0.0
LnGrp Delay(d),s/veh	27.3	25.0	25.8				0.0	36.0	36.0	38.2	30.9	0.0
LnGrp LOS	C	C	C					D	D	D	C	
Approach Vol, veh/h		2754						296			190	
Approach Delay, s/veh		26.1						36.0			33.0	
Approach LOS		C						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		54.3		20.7			5.6	15.2
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		44.2		* 22			* 2	* 16
Max Q Clear Time (g_c+I1), s		44.1		7.9			2.0	8.6
Green Ext Time (p_c), s		0.1		0.8			0.0	1.3

Intersection Summary			
HCM 2010 Ctrl Delay			27.4
HCM 2010 LOS			C

Notes

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative Conditions**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	30	26	85.9%	21.2	10.6	C
	Through						
	Right Turn						
	Subtotal	30	26	85.9%	21.2	10.6	C
EB	Left Turn	20	19	95.7%	3.0	0.8	A
	Through	2,295	2,253	98.1%	2.4	0.2	A
	Right Turn						
	Subtotal	2,315	2,272	98.1%	2.4	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,345	2,297	98.0%	2.6	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	50	53	106.7%	20.7	3.7	C
	Right Turn	270	272	100.6%	22.7	4.6	C
	Subtotal	320	325	101.5%	22.5	4.0	C
SB	Left Turn	70	69	98.3%	33.1	3.2	C
	Through	310	300	96.6%	29.9	4.2	C
	Right Turn						
	Subtotal	380	368	96.9%	30.6	3.4	C
EB	Left Turn	40	37	92.9%	12.3	3.7	B
	Through	2,275	2,222	97.7%	10.5	1.0	B
	Right Turn	50	52	104.5%	9.0	2.3	A
	Subtotal	2,365	2,311	97.7%	10.5	1.1	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,065	3,004	98.0%	14.3	1.4	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	2435	40	0	0	0	0	110	50	140	270	0
Future Volume (veh/h)	140	2435	40	0	0	0	0	110	50	140	270	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1398	1382	1342	0
Adj Flow Rate, veh/h	152	2647	26				0	120	41	152	293	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	147	2755	657				0	429	352	245	458	0
Arrive On Green	0.19	0.19	0.19				0.00	0.31	0.31	0.10	0.10	0.00
Sat Flow, veh/h	253	4739	1130				0	1398	1149	539	1556	0
Grp Volume(v), veh/h	832	1967	26				0	120	41	230	215	0
Grp Sat Flow(s),veh/h/ln	1385	1202	1130				0	1398	1149	874	1160	0
Q Serve(g_s), s	43.6	40.3	1.4				0.0	4.9	1.9	15.1	13.3	0.0
Cycle Q Clear(g_c), s	43.6	40.3	1.4				0.0	4.9	1.9	20.0	13.3	0.0
Prop In Lane	0.18		1.00				0.00		1.00	0.66		0.00
Lane Grp Cap(c), veh/h	805	2097	657				0	429	352	348	356	0
V/C Ratio(X)	1.03	0.94	0.04				0.00	0.28	0.12	0.66	0.61	0.00
Avail Cap(c_a), veh/h	805	2097	657				0	500	411	400	415	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.26	0.26	0.26				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	29.0	13.3				0.0	19.7	18.7	33.8	29.4	0.0
Incr Delay (d2), s/veh	25.4	3.0	0.0				0.0	0.4	0.1	3.3	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.4	14.0	0.4				0.0	1.9	0.6	5.0	4.5	0.0
LnGrp Delay(d),s/veh	55.7	32.0	13.3				0.0	20.1	18.8	37.1	31.3	0.0
LnGrp LOS	F	C	B					C	B	D	C	
Approach Vol, veh/h		2825						161			445	
Approach Delay, s/veh		38.8						19.8			34.3	
Approach LOS		D						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		47.8		27.2				27.2
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 40		* 27				* 27
Max Q Clear Time (g_c+I1), s		45.6		6.9				22.0
Green Ext Time (p_c), s		0.0		0.6				0.9

Intersection Summary	
HCM 2010 Ctrl Delay	37.3
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	2490	70	0	0	0	0	50	270	100	200	0
Future Volume (veh/h)	50	2490	70	0	0	0	0	50	270	100	200	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1454	1398	1398	0
Adj Flow Rate, veh/h	54	2707	48				0	54	254	109	217	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	53	2866	633				0	339	292	275	339	0
Arrive On Green	0.19	0.19	0.19				0.00	0.24	0.24	0.08	0.08	0.00
Sat Flow, veh/h	91	4909	1084				0	1398	1204	845	1398	0
Grp Volume(v), veh/h	823	1938	48				0	54	254	109	217	0
Grp Sat Flow(s),veh/h/ln	1393	1202	1084				0	1398	1204	845	1398	0
Q Serve(g_s), s	43.8	39.5	2.7				0.0	2.3	15.2	9.4	11.3	0.0
Cycle Q Clear(g_c), s	43.8	39.5	2.7				0.0	2.3	15.2	11.7	11.3	0.0
Prop In Lane	0.07		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	814	2106	633				0	339	292	275	339	0
V/C Ratio(X)	1.01	0.92	0.08				0.00	0.16	0.87	0.40	0.64	0.00
Avail Cap(c_a), veh/h	814	2106	633				0	513	441	380	513	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	28.6	13.7				0.0	22.4	27.3	32.6	31.3	0.0
Incr Delay (d2), s/veh	12.5	0.9	0.0				0.0	0.2	11.5	0.9	2.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	19.7	13.4	0.8				0.0	0.9	5.9	2.3	4.6	0.0
LnGrp Delay(d),s/veh	42.8	29.4	13.7				0.0	22.6	38.7	33.5	33.3	0.0
LnGrp LOS	F	C	B					C	D	C	C	
Approach Vol, veh/h		2809						308			326	
Approach Delay, s/veh		33.1						35.9			33.4	
Approach LOS		C						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		50.3		24.7				24.7
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		34.5		27.5				27.5
Max Q Clear Time (g_c+I1), s		45.8		17.2				13.7
Green Ext Time (p_c), s		0.0		1.0				1.4

Intersection Summary		
HCM 2010 Ctrl Delay		33.4
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1260	1440	0	0	0	0	0	0	220	1060	0
Future Volume (veh/h)	0	1260	1440	0	0	0	0	0	0	220	1060	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1485							1485	1485	0
Adj Flow Rate, veh/h	0	1370	1552							239	1152	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.92	0.92	0.92							0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3							3	3	0
Cap, veh/h	0	2406	1364							406	852	0
Arrive On Green	0.00	0.18	0.18							0.09	0.09	0.00
Sat Flow, veh/h	0	4456	2525							1415	2971	0
Grp Volume(v), veh/h	0	1370	1552							239	1152	0
Grp Sat Flow(s),veh/h/ln	0	1485	1263							1415	1485	0
Q Serve(g_s), s	0.0	21.1	40.5							12.1	21.5	0.0
Cycle Q Clear(g_c), s	0.0	21.1	40.5							12.1	21.5	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2406	1364							406	852	0
V/C Ratio(X)	0.00	0.57	1.14							0.59	1.35	0.00
Avail Cap(c_a), veh/h	0	2406	1364							406	852	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.76	0.76	0.00
Uniform Delay (d), s/veh	0.0	22.8	30.8							29.7	34.0	0.0
Incr Delay (d2), s/veh	0.0	0.1	63.1							1.7	164.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.7	26.1							5.0	28.3	0.0
LnGrp Delay(d),s/veh	0.0	22.9	93.9							31.4	198.6	0.0
LnGrp LOS		C	F							C	F	
Approach Vol, veh/h		2922									1391	
Approach Delay, s/veh		60.6									169.8	
Approach LOS		E									F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		49.0		26.0				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		40.5		21.5				
Max Q Clear Time (g_c+I1), s		42.5		23.5				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary		
HCM 2010 Ctrl Delay		95.9
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	770	880	0	0	0	0	0	1405	500	0	0	0
Future Volume (veh/h)	770	880	0	0	0	0	0	1405	500	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1454	1485	0				0	1398	1398			
Adj Flow Rate, veh/h	837	957	0				0	1527	509			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	1334	1225	0				0	1939	549			
Arrive On Green	0.14	0.14	0.00				0.00	0.46	0.46			
Sat Flow, veh/h	2769	2971	0				0	4194	1188			
Grp Volume(v), veh/h	837	957	0				0	1527	509			
Grp Sat Flow(s),veh/h/ln	1385	1485	0				0	1398	1188			
Q Serve(g_s), s	21.8	23.4	0.0				0.0	23.1	30.2			
Cycle Q Clear(g_c), s	21.8	23.4	0.0				0.0	23.1	30.2			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1334	1225	0				0	1939	549			
V/C Ratio(X)	0.63	0.78	0.00				0.00	0.79	0.93			
Avail Cap(c_a), veh/h	1334	1225	0				0	1946	551			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.36	0.36	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	28.4	29.1	0.0				0.0	17.1	19.0			
Incr Delay (d2), s/veh	0.8	1.8	0.0				0.0	2.6	22.5			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.5	9.9	0.0				0.0	9.2	13.2			
LnGrp Delay(d),s/veh	29.2	31.0	0.0				0.0	19.6	41.5			
LnGrp LOS	C	C						B	D			
Approach Vol, veh/h		1794						2036				
Approach Delay, s/veh		30.2						25.1				
Approach LOS		C						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		35.1		39.9				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 31		* 35				
Max Q Clear Time (g_c+I1), s		25.4		32.2				
Green Ext Time (p_c), s		4.9		2.5				

Intersection Summary	
HCM 2010 Ctrl Delay	27.5
HCM 2010 LOS	C

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	20	330	50	10	80	220	50	60	290	160	70	220
Future Volume (veh/h)	20	330	50	10	80	220	50	60	290	160	70	220
Number	5	2	12		1	6	16	3	8	18	7	4
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94		1.00		0.97	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2019	2019	2000		1942	1942	2000	1845	1845	1900	1845	1845
Adj Flow Rate, veh/h	22	359	46		87	239	44	65	315	149	76	239
Adj No. of Lanes	1	1	0		1	1	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3		3	3	3	3	3	3	3	3
Cap, veh/h	58	434	56		154	480	88	165	368	174	177	541
Arrive On Green	0.03	0.25	0.25		0.08	0.30	0.30	0.09	0.31	0.31	0.10	0.32
Sat Flow, veh/h	1923	1741	223		1849	1588	292	1757	1172	554	1757	1682
Grp Volume(v), veh/h	22	0	405		87	0	283	65	0	464	76	0
Grp Sat Flow(s),veh/h/ln	1923	0	1965		1849	0	1880	1757	0	1726	1757	0
Q Serve(g_s), s	0.8	0.0	13.2		3.1	0.0	8.4	2.4	0.0	17.1	2.8	0.0
Cycle Q Clear(g_c), s	0.8	0.0	13.2		3.1	0.0	8.4	2.4	0.0	17.1	2.8	0.0
Prop In Lane	1.00		0.11		1.00		0.16	1.00		0.32	1.00	
Lane Grp Cap(c), veh/h	58	0	490		154	0	569	165	0	542	177	0
V/C Ratio(X)	0.38	0.00	0.83		0.57	0.00	0.50	0.39	0.00	0.86	0.43	0.00
Avail Cap(c_a), veh/h	227	0	640		273	0	668	233	0	682	233	0
HCM Platoon Ratio	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00		1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.3	0.0	24.1		29.9	0.0	19.4	28.9	0.0	21.8	28.7	0.0
Incr Delay (d2), s/veh	1.5	0.0	6.8		1.2	0.0	0.7	0.6	0.0	8.6	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	8.0		1.6	0.0	4.4	1.2	0.0	9.4	1.4	0.0
LnGrp Delay(d),s/veh	33.8	0.0	30.9		31.1	0.0	20.1	29.5	0.0	30.5	29.3	0.0
LnGrp LOS	C		C		C		C	C		C	C	
Approach Vol, veh/h		427				370			529			333
Approach Delay, s/veh		31.0				22.7			30.3			21.1
Approach LOS		C				C			C			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.6	21.8	10.4	26.0	6.0	25.4	10.9	25.5
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	22.1	9.0	* 27	8.0	24.1	9.0	* 27
Max Q Clear Time (g_c+I1), s	5.1	15.2	4.4	9.6	2.8	10.4	4.8	19.1
Green Ext Time (p_c), s	0.1	1.0	0.0	0.9	0.0	0.9	0.0	1.4

Intersection Summary	
HCM 2010 Ctrl Delay	27.0
HCM 2010 LOS	C

Notes

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	20
Future Volume (veh/h)	20
Number	14
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.91
Parking Bus, Adj	1.00
Adj Sat Flow, veh/h/ln	1900
Adj Flow Rate, veh/h	18
Adj No. of Lanes	0
Peak Hour Factor	0.92
Percent Heavy Veh, %	3
Cap, veh/h	41
Arrive On Green	0.32
Sat Flow, veh/h	127
Grp Volume(v), veh/h	257
Grp Sat Flow(s),veh/h/ln	1808
Q Serve(g_s), s	7.6
Cycle Q Clear(g_c), s	7.6
Prop In Lane	0.07
Lane Grp Cap(c), veh/h	582
V/C Ratio(X)	0.44
Avail Cap(c_a), veh/h	714
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	18.2
Incr Delay (d2), s/veh	0.5
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	3.9
LnGrp Delay(d),s/veh	18.7
LnGrp LOS	B
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	585	75	0	740	0	0
Future Volume (vph)	585	75	0	740	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			3.0		
Lane Util. Factor	1.00			1.00		
Frpb, ped/bikes	0.99			1.00		
Flpb, ped/bikes	1.00			1.00		
Frt	0.98			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	1540			1573		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	1540			1573		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	636	82	0	804	0	0
RTOR Reduction (vph)	6	0	0	0	0	0
Lane Group Flow (vph)	712	0	0	804	0	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA		
Protected Phases	2			3 4 6		
Permitted Phases						
Actuated Green, G (s)	34.4			51.8		
Effective Green, g (s)	34.4			46.2		
Actuated g/C Ratio	0.46			0.62		
Clearance Time (s)	5.6					
Vehicle Extension (s)	3.0					
Lane Grp Cap (vph)	706			968		
v/s Ratio Prot	c0.46			c0.51		
v/s Ratio Perm						
v/c Ratio	1.01			0.83		
Uniform Delay, d1	20.3			11.3		
Progression Factor	0.97			0.51		
Incremental Delay, d2	30.7			0.6		
Delay (s)	50.4			6.3		
Level of Service	D			A		
Approach Delay (s)	50.4			6.3	0.0	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	390	50	0	380	0	0	0	0	20	20	30
Future Volume (vph)	0	390	50	0	380	0	0	0	0	20	20	30
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6						5.6	
Lane Util. Factor		1.00			1.00						1.00	
Frpb, ped/bikes		0.99			1.00						0.98	
Flpb, ped/bikes		1.00			1.00						1.00	
Frt		0.98			1.00						0.94	
Flt Protected		1.00			1.00						0.99	
Satd. Flow (prot)		1541			1573						1432	
Flt Permitted		1.00			1.00						0.99	
Satd. Flow (perm)		1541			1573						1432	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	424	54	0	413	0	0	0	0	22	22	33
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	29	0
Lane Group Flow (vph)	0	473	0	0	413	0	0	0	0	0	48	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA					Perm	NA	
Protected Phases		2			4 6						8	
Permitted Phases										8		
Actuated Green, G (s)		39.3			55.7						8.1	
Effective Green, g (s)		39.3			55.7						8.1	
Actuated g/C Ratio		0.52			0.74						0.11	
Clearance Time (s)		5.6									5.6	
Vehicle Extension (s)		3.0									1.5	
Lane Grp Cap (vph)		807			1168						154	
v/s Ratio Prot		c0.31			c0.26							
v/s Ratio Perm											0.03	
v/c Ratio		0.59			0.35						0.31	
Uniform Delay, d1		12.3			3.4						30.9	
Progression Factor		0.57			0.09						0.85	
Incremental Delay, d2		1.8			0.1						0.0	
Delay (s)		8.8			0.4						26.2	
Level of Service		A			A						C	
Approach Delay (s)		8.8			0.4			0.0			26.2	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	6.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	585	0	0	730	10	20
Future Volume (vph)	585	0	0	730	10	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			5.6	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1573			1573	1408	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1573			1573	1408	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	636	0	0	793	11	22
RTOR Reduction (vph)	0	0	0	0	19	0
Lane Group Flow (vph)	636	0	0	793	14	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	52.4			34.4	11.8	
Effective Green, g (s)	47.2			34.4	11.8	
Actuated g/C Ratio	0.63			0.46	0.16	
Clearance Time (s)				5.6		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	989			721	221	
v/s Ratio Prot	c0.40			c0.50	c0.01	
v/s Ratio Perm						
v/c Ratio	0.64			1.10	0.07	
Uniform Delay, d1	8.7			20.3	26.9	
Progression Factor	0.44			1.16	1.06	
Incremental Delay, d2	0.1			57.1	0.0	
Delay (s)	4.0			80.6	28.5	
Level of Service	A			F	C	
Approach Delay (s)	4.0			80.6	28.5	
Approach LOS	A			F	C	

Intersection Summary			
HCM 2000 Control Delay	46.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	410	0	0	350	20	30	10	30	0	0	0
Future Volume (vph)	0	410	0	0	350	20	30	10	30	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.98				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1557			1422				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1557			1422				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	0	0	380	22	33	11	33	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	28	0	0	0	0
Lane Group Flow (vph)	0	446	0	0	400	0	0	49	0	0	0	0
Confl. Peds. (#/hr)	10					10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		53.0			39.3			10.8				
Effective Green, g (s)		53.0			39.3			10.8				
Actuated g/C Ratio		0.71			0.52			0.14				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1111			815			204				
v/s Ratio Prot		c0.28			c0.26			c0.03				
v/s Ratio Perm												
v/c Ratio		0.40			0.49			0.24				
Uniform Delay, d1		4.5			11.4			28.5				
Progression Factor		0.02			0.68			1.26				
Incremental Delay, d2		0.1			2.0			0.1				
Delay (s)		0.1			9.7			36.1				
Level of Service		A			A			D				
Approach Delay (s)		0.1			9.7			36.1			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	500	0	0	420	70	10	10	10	0	0	0
Future Volume (vph)	0	500	0	0	420	70	10	10	10	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1517			1464				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1517			1464				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	543	0	0	457	76	11	11	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	543	0	0	525	0	0	24	0	0	0	0
Confl. Peds. (#/hr)	39		22			39			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		50.3			30.9			13.9				
Effective Green, g (s)		50.3			30.9			13.9				
Actuated g/C Ratio		0.67			0.41			0.19				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1054			625			271				
v/s Ratio Prot		c0.35			c0.35			c0.02				
v/s Ratio Perm												
v/c Ratio		0.52			0.84			0.09				
Uniform Delay, d1		6.2			19.8			25.3				
Progression Factor		0.07			0.98			1.02				
Incremental Delay, d2		0.4			11.5			0.1				
Delay (s)		0.8			31.0			25.9				
Level of Service		A			C			C				
Approach Delay (s)		0.8			31.0			25.9			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	16.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	495	20	70	550	70	40	520	60	0	400	320
Future Volume (veh/h)	280	495	20	70	550	70	40	520	60	0	400	320
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.97	0.99		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1676	1676	1710	1676	1676	1710	1800	1694	1728	0	1765	1728
Adj Flow Rate, veh/h	292	516	19	73	573	67	42	542	52	0	417	144
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	2	2
Cap, veh/h	279	943	35	397	551	64	97	1034	97	0	937	319
Arrive On Green	0.17	0.59	0.59	0.75	0.75	0.75	0.77	0.77	0.77	0.00	0.39	0.39
Sat Flow, veh/h	1597	1606	59	819	1469	172	120	2668	250	0	2506	823
Grp Volume(v), veh/h	292	0	535	73	0	640	329	0	307	0	287	274
Grp Sat Flow(s),veh/h/ln	1597	0	1665	819	0	1641	1562	0	1477	0	1676	1565
Q Serve(g_s), s	14.0	0.0	15.6	2.2	0.0	30.0	0.0	0.0	6.4	0.0	10.1	10.4
Cycle Q Clear(g_c), s	14.0	0.0	15.6	2.2	0.0	30.0	5.7	0.0	6.4	0.0	10.1	10.4
Prop In Lane	1.00		0.04	1.00		0.10	0.13		0.17	0.00		0.53
Lane Grp Cap(c), veh/h	279	0	978	397	0	615	656	0	572	0	650	606
V/C Ratio(X)	1.05	0.00	0.55	0.18	0.00	1.04	0.50	0.00	0.54	0.00	0.44	0.45
Avail Cap(c_a), veh/h	279	0	978	397	0	615	656	0	572	0	650	606
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.76	0.00	0.76	0.74	0.00	0.74	0.00	1.00	1.00
Uniform Delay (d), s/veh	33.0	0.0	10.0	6.5	0.0	10.0	6.2	0.0	6.2	0.0	18.1	18.2
Incr Delay (d2), s/veh	66.1	0.0	2.2	0.8	0.0	42.5	2.0	0.0	2.6	0.0	2.2	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.3	0.0	7.7	0.6	0.0	19.9	2.9	0.0	2.8	0.0	5.1	4.9
LnGrp Delay(d),s/veh	99.1	0.0	12.2	7.3	0.0	52.5	8.2	0.0	8.9	0.0	20.3	20.6
LnGrp LOS	F		B	A		F	A		A		C	C
Approach Vol, veh/h		827			713			636			561	
Approach Delay, s/veh		42.9			47.9			8.5			20.4	
Approach LOS		D			D			A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		51.2		35.8	17.0	34.2		35.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 47		24.4	14.0	* 30		24.4
Max Q Clear Time (g_c+I1), s		17.6		8.4	16.0	32.0		12.4
Green Ext Time (p_c), s		5.8		5.2	0.0	0.0		3.8

Intersection Summary	
HCM 2010 Ctrl Delay	31.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	50	40	180	0	0	0	0	250	1220	495
Future Volume (vph)	0	490	50	40	180	0	0	0	0	250	1220	495
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.98
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.99			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2769			1781						2992	1321
Flt Permitted		1.00			0.82						0.99	1.00
Satd. Flow (perm)		2769			1474						2992	1321
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	510	52	42	188	0	0	0	0	260	1271	516
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	230	0	0	0	0	0	1531	516
Confl. Peds. (#/hr)			15	15		4			11			
Confl. Bikes (#/hr)			3			3			3			2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		23.8			23.8						47.4	40.4
Effective Green, g (s)		23.8			23.8						47.4	40.4
Actuated g/C Ratio		0.30			0.30						0.59	0.50
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		823			438						1772	667
v/s Ratio Prot		c0.20									c0.51	
v/s Ratio Perm					0.16							0.39
v/c Ratio		0.67			0.53						0.86	0.77
Uniform Delay, d1		24.7			23.4						13.6	16.1
Progression Factor		0.46			0.42						1.00	1.00
Incremental Delay, d2		3.8			3.8						5.9	8.5
Delay (s)		15.2			13.6						19.5	24.6
Level of Service		B			B						B	C
Approach Delay (s)		15.2			13.6			0.0			20.8	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	400	20	320	145	320	20	70	1570	200	60
Future Volume (vph)	400	20	320	145	320	20	70	1570	200	60
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1509	1812	1812	1485			3678	1316	
Flt Permitted		0.62	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		986	1812	1812	1485			3678	1316	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	417	21	333	151	333	21	73	1635	208	62
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	39	0
Lane Group Flow (vph)	0	438	333	151	354	0	0	1708	232	0
Confl. Peds. (#/hr)							8			3
Confl. Bikes (#/hr)					4	4				
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		33.8	33.8	18.8	18.8			37.8	37.8	
Effective Green, g (s)		33.8	33.8	18.8	18.8			37.8	37.8	
Actuated g/C Ratio		0.42	0.42	0.24	0.24			0.47	0.47	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0	
Lane Grp Cap (vph)		487	765	425	348			1737	621	
v/s Ratio Prot		c0.12	0.18	0.08	c0.24					
v/s Ratio Perm		0.26						0.46	0.18	
v/c Ratio		0.90	0.44	0.36	1.02			0.98	0.37	
Uniform Delay, d1		21.5	16.3	25.5	30.6			20.8	13.5	
Progression Factor		0.68	0.77	1.00	1.00			0.54	0.27	
Incremental Delay, d2		13.7	0.3	0.5	52.7			12.4	0.9	
Delay (s)		28.4	12.9	26.1	83.3			23.5	4.6	
Level of Service		C	B	C	F			C	A	
Approach Delay (s)			21.7	66.2				20.9		
Approach LOS			C	E				C		

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	101.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	400	40	30	245	65	60	465	90	90	360	40
Future Volume (veh/h)	90	400	40	30	245	65	60	465	90	90	360	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	1.00		0.97	0.98		0.93	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1412	1560	1530	1412	1500	1530	1440	1500	1469	1440	1500	1469
Adj Flow Rate, veh/h	94	417	38	31	255	56	62	484	76	94	375	33
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	448	641	58	259	541	119	135	902	139	213	783	71
Arrive On Green	0.46	0.46	0.46	0.91	0.91	0.91	0.86	0.86	0.86	0.86	0.86	0.86
Sat Flow, veh/h	846	1405	128	745	1186	260	189	2105	324	351	1826	165
Grp Volume(v), veh/h	94	0	455	31	0	311	322	0	300	238	0	264
Grp Sat Flow(s),veh/h/ln	846	0	1533	745	0	1446	1339	0	1279	1020	0	1321
Q Serve(g_s), s	5.8	0.0	18.4	2.0	0.0	2.6	0.0	0.0	5.0	1.7	0.0	3.8
Cycle Q Clear(g_c), s	8.4	0.0	18.4	20.3	0.0	2.6	4.3	0.0	5.0	6.7	0.0	3.8
Prop In Lane	1.00		0.08	1.00		0.18	0.19		0.25	0.40		0.12
Lane Grp Cap(c), veh/h	448	0	700	259	0	660	628	0	548	500	0	567
V/C Ratio(X)	0.21	0.00	0.65	0.12	0.00	0.47	0.51	0.00	0.55	0.48	0.00	0.47
Avail Cap(c_a), veh/h	448	0	700	259	0	660	628	0	548	500	0	567
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.97	0.00	0.97	0.83	0.00	0.83	0.68	0.00	0.68
Uniform Delay (d), s/veh	15.0	0.0	16.8	8.3	0.0	2.0	3.6	0.0	3.6	3.5	0.0	3.5
Incr Delay (d2), s/veh	1.1	0.0	4.6	0.9	0.0	2.3	2.5	0.0	3.2	2.2	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	8.6	0.5	0.0	1.3	2.0	0.0	2.0	1.2	0.0	1.5
LnGrp Delay(d),s/veh	16.0	0.0	21.5	9.2	0.0	4.3	6.0	0.0	6.9	5.7	0.0	5.4
LnGrp LOS	B		C	A		A	A		A	A		A
Approach Vol, veh/h		549			342			622			502	
Approach Delay, s/veh		20.5			4.8			6.4			5.6	
Approach LOS		C			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		41.1		38.9		41.1		38.9
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		36.5		34.3		36.5		34.3
Max Q Clear Time (g_c+I1), s		20.4		7.0		22.3		8.7
Green Ext Time (p_c), s		2.5		3.0		1.3		2.5

Intersection Summary			
HCM 2010 Ctrl Delay			9.8
HCM 2010 LOS			A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	160	0	0	140	120	100	1495	20	0	0	0
Future Volume (veh/h)	270	160	0	0	140	120	100	1495	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.96			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1620	1588	1620			
Adj Flow Rate, veh/h	281	167	0	0	146	120	104	1557	19			
Adj No. of Lanes	1	1	0	0	1	0	0	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	0	2	0			
Cap, veh/h	381	703	0	0	306	251	118	1892	24			
Arrive On Green	0.74	0.74	0.00	0.00	0.44	0.44	0.15	0.15	0.15			
Sat Flow, veh/h	994	1588	0	0	691	568	268	4275	54			
Grp Volume(v), veh/h	281	167	0	0	0	266	612	511	557			
Grp Sat Flow(s),veh/h/ln	994	1588	0	0	0	1259	1575	1445	1576			
Q Serve(g_s), s	21.9	2.7	0.0	0.0	0.0	11.9	30.4	27.3	27.3			
Cycle Q Clear(g_c), s	33.8	2.7	0.0	0.0	0.0	11.9	30.4	27.3	27.3			
Prop In Lane	1.00		0.00	0.00		0.45	0.17		0.03			
Lane Grp Cap(c), veh/h	381	703	0	0	0	557	697	640	698			
V/C Ratio(X)	0.74	0.24	0.00	0.00	0.00	0.48	0.88	0.80	0.80			
Avail Cap(c_a), veh/h	381	703	0	0	0	557	697	640	698			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	0.69	0.69	0.00	0.00	0.00	1.00	0.51	0.51	0.51			
Uniform Delay (d), s/veh	16.0	6.2	0.0	0.0	0.0	15.8	32.0	30.7	30.7			
Incr Delay (d2), s/veh	5.1	0.1	0.0	0.0	0.0	0.6	8.2	5.3	4.9			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.4	1.2	0.0	0.0	0.0	4.2	14.8	11.9	12.9			
LnGrp Delay(d),s/veh	21.1	6.3	0.0	0.0	0.0	16.4	40.2	36.0	35.6			
LnGrp LOS	C	A				B	D	D	D			
Approach Vol, veh/h		448			266			1680				
Approach Delay, s/veh		15.6			16.4			37.4				
Approach LOS		B			B			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		40.0		40.0		40.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		35.4		35.4		35.4		
Max Q Clear Time (g_c+I1), s		35.8		32.4		13.9		
Green Ext Time (p_c), s		0.0		2.1		1.1		

Intersection Summary			
HCM 2010 Ctrl Delay			31.0
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	245	40	115	280	155	30	425	90	50	310	70
Future Volume (veh/h)	50	245	40	115	280	155	30	425	90	50	310	70
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91	0.97		0.90	0.93		0.83	0.97		0.83
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1588	1525	1620	1588	1588	1620	1620	1588	1555	1620	1588	1555
Adj Flow Rate, veh/h	52	255	34	120	292	135	31	443	73	52	323	52
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	284	647	86	446	493	228	83	931	148	123	721	125
Arrive On Green	0.50	0.50	0.50	0.16	0.16	0.16	0.13	0.13	0.13	0.80	0.80	0.80
Sat Flow, veh/h	861	1300	173	949	991	458	85	2343	373	169	1814	316
Grp Volume(v), veh/h	52	0	289	120	0	427	295	0	252	210	0	217
Grp Sat Flow(s),veh/h/ln	861	0	1473	949	0	1450	1512	0	1289	982	0	1316
Q Serve(g_s), s	4.0	0.0	9.8	9.3	0.0	21.8	0.0	0.0	14.5	4.3	0.0	4.0
Cycle Q Clear(g_c), s	25.8	0.0	9.8	19.1	0.0	21.8	13.7	0.0	14.5	18.8	0.0	4.0
Prop In Lane	1.00		0.12	1.00		0.32	0.11		0.29	0.25		0.24
Lane Grp Cap(c), veh/h	284	0	733	446	0	721	651	0	513	447	0	523
V/C Ratio(X)	0.18	0.00	0.39	0.27	0.00	0.59	0.45	0.00	0.49	0.47	0.00	0.41
Avail Cap(c_a), veh/h	284	0	733	446	0	721	651	0	513	447	0	523
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.93	0.00	0.93	0.81	0.00	0.81	0.78	0.00	0.78
Uniform Delay (d), s/veh	25.6	0.0	12.6	29.3	0.0	25.9	26.9	0.0	27.3	6.6	0.0	5.4
Incr Delay (d2), s/veh	1.4	0.0	1.6	1.4	0.0	3.3	1.8	0.0	2.7	2.8	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	4.3	2.6	0.0	9.4	6.4	0.0	5.6	1.6	0.0	1.6
LnGrp Delay(d),s/veh	27.0	0.0	14.2	30.6	0.0	29.2	28.7	0.0	30.0	9.4	0.0	7.2
LnGrp LOS	C		B	C		C	C		C	A		A
Approach Vol, veh/h		341			547			547			427	
Approach Delay, s/veh		16.1			29.5			29.3			8.3	
Approach LOS		B			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		44.0		36.0		44.0		36.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 40		* 32		* 40		* 32
Max Q Clear Time (g_c+I1), s		27.8		16.5		23.8		20.8
Green Ext Time (p_c), s		2.3		4.3		4.8		2.8

Intersection Summary	
HCM 2010 Ctrl Delay	22.1
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	465	440	0	0	120
Future Volume (vph)	0	465	440	0	0	120
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0	6.0			5.6
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00			0.78
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1588	1588			1074
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1588	1588			1074
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	484	458	0	0	125
RTOR Reduction (vph)	0	0	0	0	0	104
Lane Group Flow (vph)	0	484	458	0	0	21
Confl. Peds. (#/hr)				59		78
Confl. Bikes (#/hr)				14		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		54.9	55.1			13.3
Effective Green, g (s)		54.9	55.1			13.3
Actuated g/C Ratio		0.69	0.69			0.17
Clearance Time (s)						5.6
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1089	1093			178
v/s Ratio Prot		c0.30	c0.29			
v/s Ratio Perm						0.02
v/c Ratio		0.44	0.42			0.12
Uniform Delay, d1		5.7	5.4			28.4
Progression Factor		0.95	0.15			1.00
Incremental Delay, d2		0.3	0.2			0.3
Delay (s)		5.6	1.0			28.6
Level of Service		A	A			C
Approach Delay (s)		5.6	1.0		28.6	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	285	190	80	260	0	0	0	0	135	1040	205
Future Volume (vph)	0	285	190	80	260	0	0	0	0	135	1040	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.93	1.00	1.00						1.00	0.92
Flpb, ped/bikes		1.00	1.00	0.97	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1172	1609	1535						4142	1102
Flt Permitted		1.00	1.00	0.47	1.00						0.99	1.00
Satd. Flow (perm)		1641	1172	792	1535						4142	1102
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	297	198	83	271	0	0	0	0	141	1083	214
RTOR Reduction (vph)	0	0	38	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	297	160	83	271	0	0	0	0	0	1224	214
Confl. Peds. (#/hr)			51	51		28			11	11		19
Confl. Bikes (#/hr)			10			16			1			1
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		29.8	29.8	29.8	29.8						41.4	34.4
Effective Green, g (s)		29.8	29.8	29.8	29.8						41.4	34.4
Actuated g/C Ratio		0.37	0.37	0.37	0.37						0.52	0.43
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		611	436	295	571						2143	473
v/s Ratio Prot		c0.18			0.18							
v/s Ratio Perm			0.14	0.10							0.30	0.19
v/c Ratio		0.49	0.37	0.28	0.47						0.57	0.45
Uniform Delay, d1		19.2	18.3	17.6	19.1						13.2	16.1
Progression Factor		0.56	0.39	0.94	0.95						0.36	0.50
Incremental Delay, d2		2.5	2.2	2.2	2.6						0.8	2.1
Delay (s)		13.2	9.4	18.7	20.9						5.5	10.2
Level of Service		B	A	B	C						A	B
Approach Delay (s)		11.7			20.4			0.0			6.2	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	230	0	0	210	90	120	1350	170	0	0	0
Future Volume (veh/h)	180	230	0	0	210	90	120	1350	170	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1525	1588	1620			
Adj Flow Rate, veh/h	188	240	0	0	219	82	125	1406	156			
Adj No. of Lanes	1	1	0	0	1	0	1	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	276	651	0	0	387	145	704	1919	213			
Arrive On Green	0.14	0.14	0.00	0.00	0.14	0.14	0.16	0.16	0.16			
Sat Flow, veh/h	964	1588	0	0	944	354	1452	3956	439			
Grp Volume(v), veh/h	188	240	0	0	0	301	125	1027	535			
Grp Sat Flow(s),veh/h/ln	964	1588	0	0	0	1298	1452	1445	1504			
Q Serve(g_s), s	15.4	11.0	0.0	0.0	0.0	17.4	6.0	27.1	27.1			
Cycle Q Clear(g_c), s	32.8	11.0	0.0	0.0	0.0	17.4	6.0	27.1	27.1			
Prop In Lane	1.00		0.00	0.00		0.27	1.00		0.29			
Lane Grp Cap(c), veh/h	276	651	0	0	0	532	704	1402	730			
V/C Ratio(X)	0.68	0.37	0.00	0.00	0.00	0.57	0.18	0.73	0.73			
Avail Cap(c_a), veh/h	276	651	0	0	0	532	704	1402	730			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.87	0.87	0.00	0.00	0.00	1.00	0.41	0.41	0.41			
Uniform Delay (d), s/veh	43.4	25.2	0.0	0.0	0.0	27.9	19.8	28.7	28.7			
Incr Delay (d2), s/veh	11.2	1.4	0.0	0.0	0.0	4.3	0.2	1.4	2.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.0	5.1	0.0	0.0	0.0	6.9	2.4	11.1	11.8			
LnGrp Delay(d),s/veh	54.6	26.6	0.0	0.0	0.0	32.2	20.0	30.1	31.4			
LnGrp LOS	D	C				C	C	C	C			
Approach Vol, veh/h		428			301			1687				
Approach Delay, s/veh		38.9			32.2			29.7				
Approach LOS		D			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		37.0		43.0		37.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 33		* 39		* 33		
Max Q Clear Time (g_c+I1), s		34.8		29.1		19.4		
Green Ext Time (p_c), s		0.0		5.8		1.1		

Intersection Summary	
HCM 2010 Ctrl Delay	31.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	335	1580	0	0	0	0	0	300	60
Future Volume (veh/h)	0	0	0	335	1580	0	0	0	0	0	300	60
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.94
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.82
Adj Sat Flow, veh/h/ln				1530	1500	0				0	1500	1530
Adj Flow Rate, veh/h				349	1646	0				0	312	42
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				512	2181	0				0	464	61
Arrive On Green				0.23	0.23	0.00				0.00	0.20	0.20
Sat Flow, veh/h				648	3297	0				0	2359	303
Grp Volume(v), veh/h				721	1274	0				0	193	161
Grp Sat Flow(s),veh/h/ln				1338	1242	0				0	1425	1162
Q Serve(g_s), s				40.5	38.2	0.0				0.0	10.0	10.3
Cycle Q Clear(g_c), s				40.5	38.2	0.0				0.0	10.0	10.3
Prop In Lane				0.48		0.00				0.00		0.26
Lane Grp Cap(c), veh/h				986	1707	0				0	289	236
V/C Ratio(X)				0.73	0.75	0.00				0.00	0.67	0.68
Avail Cap(c_a), veh/h				986	1707	0				0	417	340
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.46	0.46	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				25.4	24.5	0.0				0.0	29.4	29.5
Incr Delay (d2), s/veh				2.2	1.4	0.0				0.0	2.6	3.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.7	13.5	0.0				0.0	4.1	3.5
LnGrp Delay(d),s/veh				27.6	25.9	0.0				0.0	32.0	33.0
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1995						354	
Approach Delay, s/veh					26.5						32.4	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		59.2		20.8				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 48		23.4				
Max Q Clear Time (g_c+I1), s		42.5		12.3				
Green Ext Time (p_c), s		4.1		1.1				

Intersection Summary		
HCM 2010 Ctrl Delay		27.4
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1775	160	150	330	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1775	160	150	330	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1412	1412	1440	1412	0			
Adj Flow Rate, veh/h				0	1849	133	156	344	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	2	2	0			
Cap, veh/h				0	2481	757	247	442	0			
Arrive On Green				0.00	0.21	0.21	0.08	0.08	0.00			
Sat Flow, veh/h				0	3981	1175	700	1822	0			
Grp Volume(v), veh/h				0	1849	133	270	230	0			
Grp Sat Flow(s),veh/h/ln				0	1285	1175	1237	1220	0			
Q Serve(g_s), s				0.0	35.9	7.4	16.9	14.7	0.0			
Cycle Q Clear(g_c), s				0.0	35.9	7.4	17.3	14.7	0.0			
Prop In Lane				0.00		1.00	0.58		0.00			
Lane Grp Cap(c), veh/h				0	2481	757	382	307	0			
V/C Ratio(X)				0.00	0.75	0.18	0.71	0.75	0.00			
Avail Cap(c_a), veh/h				0	2481	757	408	333	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	0.28	0.28	0.74	0.74	0.00			
Uniform Delay (d), s/veh				0.0	25.4	14.1	35.4	34.2	0.0			
Incr Delay (d2), s/veh				0.0	0.6	0.1	3.9	6.3	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	13.0	2.4	6.3	5.5	0.0			
LnGrp Delay(d),s/veh				0.0	26.0	14.3	39.3	40.6	0.0			
LnGrp LOS					C	B	D	D				
Approach Vol, veh/h					1982			500				
Approach Delay, s/veh					25.2			39.9				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		55.7		24.3				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 50		* 22				
Max Q Clear Time (g_c+I1), s		37.9		19.3				
Green Ext Time (p_c), s		8.1		0.6				

Intersection Summary	
HCM 2010 Ctrl Delay	28.1
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	195	1840	0	0	0	0	0	290	100
Future Volume (veh/h)	0	0	0	195	1840	0	0	0	0	0	290	100
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.85
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1412	0				0	1412	1440
Adj Flow Rate, veh/h				203	1917	0				0	302	94
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				273	2175	0				0	446	133
Arrive On Green				0.22	0.22	0.00				0.00	0.24	0.24
Sat Flow, veh/h				332	3451	0				0	1909	548
Grp Volume(v), veh/h				782	1338	0				0	217	179
Grp Sat Flow(s),veh/h/ln				1329	1169	0				0	1341	1045
Q Serve(g_s), s				44.0	44.3	0.0				0.0	11.7	12.6
Cycle Q Clear(g_c), s				45.9	44.3	0.0				0.0	11.7	12.6
Prop In Lane				0.26		0.00				0.00		0.52
Lane Grp Cap(c), veh/h				923	1525	0				0	326	254
V/C Ratio(X)				0.85	0.88	0.00				0.00	0.67	0.71
Avail Cap(c_a), veh/h				923	1525	0				0	389	303
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.47	0.47	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				28.9	28.3	0.0				0.0	27.4	27.7
Incr Delay (d2), s/veh				4.7	3.7	0.0				0.0	3.3	5.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				18.1	15.2	0.0				0.0	4.6	4.0
LnGrp Delay(d),s/veh				33.6	32.0	0.0				0.0	30.6	33.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					2120						396	
Approach Delay, s/veh					32.6						32.0	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		56.4		23.6				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 48		* 23				
Max Q Clear Time (g_c+I1), s		47.9		14.6				
Green Ext Time (p_c), s		0.5		1.1				

Intersection Summary	
HCM 2010 Ctrl Delay	32.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	80	1685	100	260	175	0	0	180	50
Future Volume (veh/h)	0	0	0	80	1685	100	260	175	0	0	180	50
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				83	1755	96	271	182	0	0	188	38
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				109	2451	138	315	666	0	0	275	56
Arrive On Green				0.18	0.18	0.18	0.03	0.12	0.00	0.00	0.21	0.21
Sat Flow, veh/h				204	4587	259	1765	1853	0	0	1308	264
Grp Volume(v), veh/h				713	594	627	271	182	0	0	0	226
Grp Sat Flow(s),veh/h/ln				1754	1606	1690	1765	1853	0	0	0	1572
Q Serve(g_s), s				30.9	27.7	27.9	5.3	7.2	0.0	0.0	0.0	10.6
Cycle Q Clear(g_c), s				30.9	27.7	27.9	5.3	7.2	0.0	0.0	0.0	10.6
Prop In Lane				0.12		0.15	1.00		0.00	0.00		0.17
Lane Grp Cap(c), veh/h				937	858	903	315	666	0	0	0	330
V/C Ratio(X)				0.76	0.69	0.70	0.86	0.27	0.00	0.00	0.00	0.68
Avail Cap(c_a), veh/h				937	858	903	327	718	0	0	0	364
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.73	0.73	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				28.1	26.8	26.8	35.8	25.7	0.0	0.0	0.0	29.2
Incr Delay (d2), s/veh				5.8	4.6	4.4	16.4	0.3	0.0	0.0	0.0	6.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				16.6	13.4	14.2	7.4	3.7	0.0	0.0	0.0	5.2
LnGrp Delay(d),s/veh				33.9	31.3	31.2	52.2	26.1	0.0	0.0	0.0	35.9
LnGrp LOS				C	C	C	D	C				D
Approach Vol, veh/h					1934			453			226	
Approach Delay, s/veh					32.2			41.7			35.9	
Approach LOS					C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			11.5	21.3		47.2		32.8
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			8.0	18.5		40.5		31.0
Max Q Clear Time (g_c+I1), s			7.3	12.6		32.9		9.2
Green Ext Time (p_c), s			0.1	0.8		6.8		1.4

Intersection Summary			
HCM 2010 Ctrl Delay			34.2
HCM 2010 LOS			C

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative Conditions**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	40	36	90.2%	12.4	4.5	B
	Through	5	4	76.8%	19.2	17.7	C
	Right Turn						
	Subtotal	45	40	88.7%	13.9	6.8	B
SB	Left Turn						
	Through	15	13	89.6%	29.5	12.0	D
	Right Turn	10	8	84.5%	18.7	18.1	C
	Subtotal	25	22	87.6%	24.7	13.3	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	65	65	99.8%	3.3	0.5	A
	Through	1,820	1,787	98.2%	2.8	0.8	A
	Right Turn	10	10	96.0%	2.0	0.5	A
	Subtotal	1,895	1,861	98.2%	2.9	0.8	A
Total		1,965	1,923	97.9%	3.3	0.8	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	120	122	101.4%	33.1	3.6	C
	Through	20	25	122.9%	28.7	5.0	C
	Right Turn						
	Subtotal	140	146	104.5%	32.5	2.7	C
SB	Left Turn						
	Through	50	51	102.1%	27.7	6.2	C
	Right Turn	10	13	126.7%	15.0	10.3	B
	Subtotal	60	64	106.2%	26.2	5.1	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	230	253	110.2%	8.0	1.4	A
	Through	1,850	1,787	96.6%	7.1	1.9	A
	Right Turn	40	41	101.8%	6.1	3.4	A
	Subtotal	2,120	2,081	98.2%	7.2	1.7	A
Total		2,320	2,291	98.7%	9.4	1.5	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	110	1800	150	50	340	0	0	285	160
Future Volume (veh/h)	0	0	0	110	1800	150	50	340	0	0	285	160
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.98		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1620	1588	1620	1620	1588	0	0	1525	1555
Adj Flow Rate, veh/h				115	1875	145	52	354	0	0	297	160
Adj No. of Lanes				0	3	0	0	2	0	0	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				132	2285	181	103	670	0	0	541	274
Arrive On Green				0.19	0.19	0.19	0.63	0.63	0.00	0.00	0.10	0.10
Sat Flow, veh/h				230	3979	316	148	2209	0	0	1801	876
Grp Volume(v), veh/h				788	656	690	198	208	0	0	246	211
Grp Sat Flow(s),veh/h/ln				1577	1445	1503	912	1373	0	0	1448	1152
Q Serve(g_s), s				38.8	34.6	35.1	3.8	6.5	0.0	0.0	12.9	13.9
Cycle Q Clear(g_c), s				38.8	34.6	35.1	17.8	6.5	0.0	0.0	12.9	13.9
Prop In Lane				0.15		0.21	0.26		0.00	0.00		0.76
Lane Grp Cap(c), veh/h				905	830	863	343	430	0	0	454	361
V/C Ratio(X)				0.87	0.79	0.80	0.58	0.48	0.00	0.00	0.54	0.58
Avail Cap(c_a), veh/h				936	858	892	343	430	0	0	454	361
HCM Platoon Ratio				0.33	0.33	0.33	2.00	2.00	1.00	1.00	0.33	0.33
Upstream Filter(I)				0.30	0.30	0.30	1.00	1.00	0.00	0.00	0.88	0.88
Uniform Delay (d), s/veh				29.5	27.8	28.0	12.5	11.5	0.0	0.0	30.4	30.9
Incr Delay (d2), s/veh				2.9	1.5	1.6	6.9	3.9	0.0	0.0	4.1	6.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.7	14.2	15.0	2.7	2.9	0.0	0.0	5.7	5.0
LnGrp Delay(d),s/veh				32.4	29.4	29.6	19.4	15.3	0.0	0.0	34.5	36.8
LnGrp LOS				C	C	C	B	B			C	D
Approach Vol, veh/h					2135			406			457	
Approach Delay, s/veh					30.6			17.3			35.6	
Approach LOS					C			B			D	
Timer	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**				
Assigned Phs				4		6		8				
Phs Duration (G+Y+Rc), s				29.6		50.4		29.6				
Change Period (Y+Rc), s				4.5		4.5		4.5				
Max Green Setting (Gmax), s				23.5		47.5		23.5				
Max Q Clear Time (g_c+I1), s				19.8		40.8		15.9				
Green Ext Time (p_c), s				0.7		5.1		1.3				
Intersection Summary												
HCM 2010 Ctrl Delay			29.6									
HCM 2010 LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	350	1920	50	125	55	0	0	0	0
Future Volume (vph)	0	0	0	350	1920	50	125	55	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6				
Lane Util. Factor					0.91		1.00	1.00				
Frpb, ped/bikes					1.00		1.00	1.00				
Flpb, ped/bikes					0.96		0.96	1.00				
Frt					1.00		1.00	1.00				
Flt Protected					0.99		0.95	1.00				
Satd. Flow (prot)					3666		1098	1249				
Flt Permitted					0.99		0.95	1.00				
Satd. Flow (perm)					3666		1098	1249				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	365	2000	52	130	57	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2414	0	130	57	0	0	0	0
Confl. Peds. (#/hr)			106	106		44	30		69			30
Confl. Bikes (#/hr)						2			3			8
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA				
Protected Phases					6			4				
Permitted Phases				6			4					
Actuated Green, G (s)					51.8		19.0	19.0				
Effective Green, g (s)					51.8		19.0	19.0				
Actuated g/C Ratio					0.58		0.21	0.21				
Clearance Time (s)					11.6		7.6	7.6				
Vehicle Extension (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					2109		231	263				
v/s Ratio Prot								0.05				
v/s Ratio Perm					0.66		c0.12					
v/c Ratio					1.14		0.56	0.22				
Uniform Delay, d1					19.1		31.8	29.3				
Progression Factor					1.00		1.00	1.00				
Incremental Delay, d2					71.3		5.1	0.9				
Delay (s)					90.4		36.9	30.2				
Level of Service					F		D	C				
Approach Delay (s)		0.0			90.4			34.8			0.0	
Approach LOS		A			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	86.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	160.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	510	1720	0	0	0	0	0	725	585
Future Volume (veh/h)	0	0	0	510	1720	0	0	0	0	0	725	585
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1560	1588	0				0	1588	1500
Adj Flow Rate, veh/h				531	1792	0				0	755	601
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				716	2008	0				0	2021	510
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1486	4765	0				0	4479	1093
Grp Volume(v), veh/h				531	1792	0				0	755	601
Grp Sat Flow(s),veh/h/ln				1486	1588	0				0	1445	1093
Q Serve(g_s), s				27.9	29.6	0.0				0.0	12.5	37.3
Cycle Q Clear(g_c), s				27.9	29.6	0.0				0.0	12.5	37.3
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				716	2008	0				0	2021	510
V/C Ratio(X)				0.74	0.89	0.00				0.00	0.37	1.18
Avail Cap(c_a), veh/h				721	2025	0				0	2021	510
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				0.09	0.09	0.00				0.00	0.83	0.83
Uniform Delay (d), s/veh				31.9	32.7	0.0				0.0	23.4	33.8
Incr Delay (d2), s/veh				0.4	0.5	0.0				0.0	0.4	96.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.6	13.1	0.0				0.0	5.1	25.0
LnGrp Delay(d),s/veh				32.3	33.2	0.0				0.0	23.8	130.7
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2323						1356	
Approach Delay, s/veh					33.0						71.2	
Approach LOS					C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						37.7		42.3
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						34.0		37.0
Max Q Clear Time (g_c+I1), s						31.6		39.3
Green Ext Time (p_c), s						2.1		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	47.1
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1235	210	990	1430	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1235	210	990	1430	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.93	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1500	1500	1398	1398	0			
Adj Flow Rate, veh/h				0	1286	197	1100	1394	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	3	3	0			
Cap, veh/h				0	1254	363	1548	1625	0			
Arrive On Green				0.00	0.31	0.31	0.19	0.19	0.00			
Sat Flow, veh/h				0	4230	1184	2663	2796	0			
Grp Volume(v), veh/h				0	1286	197	1100	1394	0			
Grp Sat Flow(s),veh/h/ln				0	1365	1184	1331	1398	0			
Q Serve(g_s), s				0.0	24.5	11.1	30.9	38.6	0.0			
Cycle Q Clear(g_c), s				0.0	24.5	11.1	30.9	38.6	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1254	363	1548	1625	0			
V/C Ratio(X)				0.00	1.03	0.54	0.71	0.86	0.00			
Avail Cap(c_a), veh/h				0	1254	363	1548	1625	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	0.09	0.09	0.00			
Uniform Delay (d), s/veh				0.0	27.8	23.1	26.0	29.1	0.0			
Incr Delay (d2), s/veh				0.0	32.1	1.7	0.3	0.6	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	12.9	3.8	11.5	15.0	0.0			
LnGrp Delay(d),s/veh				0.0	59.8	24.8	26.3	29.7	0.0			
LnGrp LOS					F	C	C	C				
Approach Vol, veh/h					1483			2494				
Approach Delay, s/veh					55.2			28.2				
Approach LOS					E			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				51.0		29.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				46.5		24.5		
Max Q Clear Time (g_c+I1), s				40.6		26.5		
Green Ext Time (p_c), s				5.1		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	38.3
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1625	110	0	0	0	0	0	435	185	470	0
Future Volume (veh/h)	0	1625	110	0	0	0	0	0	435	185	470	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.96	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1676	1710				0	1588	1620	1765	1765	0
Adj Flow Rate, veh/h	0	1693	106				0	0	439	193	490	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	575	238	781	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.44	0.15	0.15	0.00
Sat Flow, veh/h		0					0	0	1300	933	1765	0
Grp Volume(v), veh/h		0.0					0	0	439	193	490	0
Grp Sat Flow(s),veh/h/ln							0	0	1300	933	1765	0
Q Serve(g_s), s							0.0	0.0	22.7	12.7	20.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	22.7	35.4	20.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	575	238	781	0
V/C Ratio(X)							0.00	0.00	0.76	0.81	0.63	0.00
Avail Cap(c_a), veh/h							0	0	575	238	781	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.74	0.74	0.00
Uniform Delay (d), s/veh							0.0	0.0	18.8	47.0	28.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	5.4	13.7	0.9	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	8.9	5.2	10.4	0.0
LnGrp Delay(d),s/veh							0.0	0.0	24.2	60.7	28.9	0.0
LnGrp LOS									C	E	C	
Approach Vol, veh/h								439			683	
Approach Delay, s/veh								24.2			37.9	
Approach LOS								C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				40.0				40.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				35.4				35.4
Max Q Clear Time (g_c+I1), s				37.4				24.7
Green Ext Time (p_c), s				0.0				1.1

Intersection Summary	
HCM 2010 Ctrl Delay	32.5
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	200	2050	0	0	0	0	0	260	120	0	0	0
Future Volume (veh/h)	200	2050	0	0	0	0	0	260	120	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1500	0				0	1500	1440			
Adj Flow Rate, veh/h	208	2135	0				0	271	117			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	299	2663	0				0	376	157			
Arrive On Green	0.23	0.23	0.00				0.00	0.19	0.19			
Sat Flow, veh/h	346	3798	0				0	1992	833			
Grp Volume(v), veh/h	818	1525	0				0	202	186			
Grp Sat Flow(s),veh/h/ln	1414	1365	0				0	1500	1325			
Q Serve(g_s), s	42.0	42.1	0.0				0.0	10.1	10.6			
Cycle Q Clear(g_c), s	43.9	42.1	0.0				0.0	10.1	10.6			
Prop In Lane	0.25		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	1048	1914	0				0	283	250			
V/C Ratio(X)	0.78	0.80	0.00				0.00	0.71	0.74			
Avail Cap(c_a), veh/h	1048	1914	0				0	390	344			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.37	0.37	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	26.0	25.4	0.0				0.0	30.4	30.6			
Incr Delay (d2), s/veh	2.2	1.3	0.0				0.0	7.2	9.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	17.8	16.3	0.0				0.0	4.7	4.6			
LnGrp Delay(d),s/veh	28.2	26.7	0.0				0.0	37.6	40.4			
LnGrp LOS	C	C						D	D			
Approach Vol, veh/h		2343						388				
Approach Delay, s/veh		27.2						39.0				
Approach LOS		C						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				19.3		60.7		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		50.4		
Max Q Clear Time (g_c+I1), s				12.6		45.9		
Green Ext Time (p_c), s				2.0		4.3		

Intersection Summary	
HCM 2010 Ctrl Delay	28.9
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2085	90	0	0	0	0	0	250	210	290	0
Future Volume (veh/h)	0	2085	90	0	0	0	0	0	250	210	290	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.90	0.97		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1382				0	1588	1591	1560	1500	0
Adj Flow Rate, veh/h	0	2172	88				0	0	243	219	302	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	359	205	441	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.29	0.10	0.10	0.00
Sat Flow, veh/h		0					0	0	1221	974	1500	0
Grp Volume(v), veh/h		0.0					0	0	243	219	302	0
Grp Sat Flow(s),veh/h/ln							0	0	1221	974	1500	0
Q Serve(g_s), s							0.0	0.0	14.0	9.5	15.6	0.0
Cycle Q Clear(g_c), s							0.0	0.0	14.0	23.5	15.6	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	359	205	441	0
V/C Ratio(X)							0.00	0.00	0.68	1.07	0.69	0.00
Avail Cap(c_a), veh/h							0	0	359	205	441	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.68	0.68	0.00
Uniform Delay (d), s/veh							0.0	0.0	24.9	45.2	32.5	0.0
Incr Delay (d2), s/veh							0.0	0.0	4.2	71.0	2.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	5.1	8.6	6.8	0.0
LnGrp Delay(d),s/veh							0.0	0.0	29.1	116.2	35.1	0.0
LnGrp LOS									C	F	D	
Approach Vol, veh/h								243			521	
Approach Delay, s/veh								29.1			69.2	
Approach LOS								C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				28.0				28.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				23.5				23.5
Max Q Clear Time (g_c+I1), s				25.5				16.0
Green Ext Time (p_c), s				0.0				0.4

Intersection Summary		
HCM 2010 Ctrl Delay		56.4
HCM 2010 LOS		E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2250	185	0	0	0	0	335	30	120	140	0
Future Volume (veh/h)	110	2250	185	0	0	0	0	335	30	120	140	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.90	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	115	2344	182				0	349	23	125	146	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	134	2881	227				0	516	34	161	431	0
Arrive On Green	0.21	0.21	0.21				0.00	0.17	0.17	0.01	0.08	0.00
Sat Flow, veh/h	208	4483	353				0	3096	197	1597	1744	0
Grp Volume(v), veh/h	969	804	869				0	183	189	125	146	0
Grp Sat Flow(s),veh/h/ln	1754	1606	1684				0	1593	1616	1597	1744	0
Q Serve(g_s), s	42.6	37.8	39.2				0.0	8.6	8.8	0.0	6.3	0.0
Cycle Q Clear(g_c), s	42.6	37.8	39.2				0.0	8.6	8.8	0.0	6.3	0.0
Prop In Lane	0.12		0.21				0.00		0.12	1.00		0.00
Lane Grp Cap(c), veh/h	1127	1032	1082				0	273	277	161	431	0
V/C Ratio(X)	0.86	0.78	0.80				0.00	0.67	0.68	0.77	0.34	0.00
Avail Cap(c_a), veh/h	1127	1032	1082				0	321	325	164	482	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.16	0.16	0.16				0.00	1.00	1.00	0.63	0.63	0.00
Uniform Delay (d), s/veh	28.0	26.1	26.7				0.0	31.0	31.1	38.4	30.6	0.0
Incr Delay (d2), s/veh	1.5	1.0	1.1				0.0	7.0	7.3	15.6	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.1	17.1	18.6				0.0	4.3	4.4	3.5	3.1	0.0
LnGrp Delay(d),s/veh	29.5	27.1	27.8				0.0	38.0	38.4	54.0	31.2	0.0
LnGrp LOS	C	C	C					D	D	D	C	
Approach Vol, veh/h		2641						372			271	
Approach Delay, s/veh		28.2						38.2			41.7	
Approach LOS		C						D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		56.0		24.0			6.1	17.9
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		49.1		* 22			* 2	* 16
Max Q Clear Time (g_c+I1), s		44.6		8.3			2.0	10.8
Green Ext Time (p_c), s		4.5		0.8			0.0	1.3

Intersection Summary		
HCM 2010 Ctrl Delay		30.5
HCM 2010 LOS		C

Notes

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative Conditions**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	80	73	91.7%	27.5	4.6	D
	Through						
	Right Turn						
	Subtotal	80	73	91.7%	27.5	4.6	D
EB	Left Turn	45	41	92.2%	3.0	0.3	A
	Through	2,390	2,380	99.6%	2.7	0.2	A
	Right Turn						
	Subtotal	2,435	2,422	99.4%	2.7	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,515	2,495	99.2%	3.4	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	80	75	93.6%	20.9	4.8	C
	Right Turn	310	312	100.6%	19.7	1.7	B
	Subtotal	390	387	99.2%	20.1	1.7	C
SB	Left Turn	110	129	117.3%	30.5	6.1	C
	Through	170	170	100.1%	24.3	3.6	C
	Right Turn						
	Subtotal	280	299	106.8%	26.8	3.6	C
EB	Left Turn	60	62	103.0%	13.8	2.3	B
	Through	2,340	2,301	98.3%	12.6	1.0	B
	Right Turn	40	35	86.4%	8.4	3.3	A
	Subtotal	2,440	2,397	98.2%	12.6	0.9	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,110	3,083	99.1%	14.9	1.0	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	230	2410	60	0	0	0	0	210	140	150	190	0
Future Volume (veh/h)	230	2410	60	0	0	0	0	210	140	150	190	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1412	1382	1355	0
Adj Flow Rate, veh/h	240	2510	40				0	219	134	156	198	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	230	2589	657				0	473	389	246	409	0
Arrive On Green	0.18	0.18	0.18				0.00	0.34	0.34	0.67	0.67	0.00
Sat Flow, veh/h	410	4624	1172				0	1412	1161	477	1281	0
Grp Volume(v), veh/h	815	1935	40				0	219	134	169	185	0
Grp Sat Flow(s),veh/h/ln	1391	1214	1172				0	1412	1161	525	1172	0
Q Serve(g_s), s	44.8	42.0	2.3				0.0	9.8	6.9	15.9	6.1	0.0
Cycle Q Clear(g_c), s	44.8	42.0	2.3				0.0	9.8	6.9	25.6	6.1	0.0
Prop In Lane	0.29		1.00				0.00		1.00	0.92		0.00
Lane Grp Cap(c), veh/h	779	2040	657				0	473	389	262	393	0
V/C Ratio(X)	1.05	0.95	0.06				0.00	0.46	0.34	0.64	0.47	0.00
Avail Cap(c_a), veh/h	779	2040	657				0	473	389	262	393	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.28	0.28	0.28				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.6	31.5	15.3				0.0	20.9	20.0	17.5	9.8	0.0
Incr Delay (d2), s/veh	30.6	4.0	0.1				0.0	0.7	0.5	5.3	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	23.9	14.9	0.7				0.0	3.9	2.3	4.0	1.9	0.0
LnGrp Delay(d),s/veh	63.2	35.4	15.3				0.0	21.6	20.5	22.8	10.7	0.0
LnGrp LOS	F	D	B					C	C	C	B	
Approach Vol, veh/h		2790						353			354	
Approach Delay, s/veh		43.3						21.2			16.4	
Approach LOS		D						C			B	

Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		49.0		31.0				31.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2				
Max Green Setting (Gmax), s		* 45		* 27				* 27				
Max Q Clear Time (g_c+I1), s		46.8		11.8				27.6				
Green Ext Time (p_c), s		0.0		1.3				0.0				

Intersection Summary			
HCM 2010 Ctrl Delay			38.3
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	2540	120	0	0	0	0	150	370	85	255	0
Future Volume (veh/h)	40	2540	120	0	0	0	0	150	370	85	255	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1468	1412	1412	0
Adj Flow Rate, veh/h	42	2646	77				0	156	351	89	266	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	39	2619	587				0	439	379	250	439	0
Arrive On Green	0.17	0.17	0.17				0.00	0.31	0.31	0.62	0.62	0.00
Sat Flow, veh/h	74	4977	1116				0	1412	1217	710	1412	0
Grp Volume(v), veh/h	802	1886	77				0	156	351	89	266	0
Grp Sat Flow(s),veh/h/ln	1408	1214	1116				0	1412	1217	710	1412	0
Q Serve(g_s), s	42.1	41.3	4.7				0.0	6.8	22.3	7.3	9.1	0.0
Cycle Q Clear(g_c), s	42.1	41.3	4.7				0.0	6.8	22.3	14.2	9.1	0.0
Prop In Lane	0.05		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	741	1917	587				0	439	379	250	439	0
V/C Ratio(X)	1.08	0.98	0.13				0.00	0.35	0.93	0.36	0.61	0.00
Avail Cap(c_a), veh/h	741	1917	587				0	468	403	265	468	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.21	0.21	0.21				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	33.1	32.7	17.6				0.0	21.3	26.7	15.6	12.1	0.0
Incr Delay (d2), s/veh	42.8	6.5	0.1				0.0	0.5	26.6	0.9	2.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.2	15.1	1.5				0.0	2.7	10.3	1.5	3.6	0.0
LnGrp Delay(d),s/veh	75.9	39.2	17.7				0.0	21.8	53.2	16.4	14.1	0.0
LnGrp LOS	F	D	B					C	D	B	B	
Approach Vol, veh/h		2765						507			355	
Approach Delay, s/veh		49.3						43.6			14.7	
Approach LOS		D						D			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		48.6		31.4				31.4
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		40.5		26.5				26.5
Max Q Clear Time (g_c+I1), s		44.1		24.3				16.2
Green Ext Time (p_c), s		0.0		0.6				1.3

Intersection Summary			
HCM 2010 Ctrl Delay			45.1
HCM 2010 LOS			D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1910	1080	0	0	0	0	0	0	390	845	0
Future Volume (veh/h)	0	1910	1080	0	0	0	0	0	0	390	845	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1500							1500	1500	0
Adj Flow Rate, veh/h	0	1966	1105							406	880	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.96	0.96	0.96							0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2							2	2	0
Cap, veh/h	0	2271	1287							475	998	0
Arrive On Green	0.00	0.17	0.17							0.11	0.11	0.00
Sat Flow, veh/h	0	4500	2550							1429	3000	0
Grp Volume(v), veh/h	0	1966	1105							406	880	0
Grp Sat Flow(s),veh/h/ln	0	1500	1275							1429	1500	0
Q Serve(g_s), s	0.0	34.0	33.7							22.3	23.1	0.0
Cycle Q Clear(g_c), s	0.0	34.0	33.7							22.3	23.1	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2271	1287							475	998	0
V/C Ratio(X)	0.00	0.87	0.86							0.85	0.88	0.00
Avail Cap(c_a), veh/h	0	2271	1287							491	1031	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.88	0.88	0.00
Uniform Delay (d), s/veh	0.0	30.7	30.6							33.7	34.1	0.0
Incr Delay (d2), s/veh	0.0	0.5	0.8							12.0	7.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	14.3	12.1							10.4	10.7	0.0
LnGrp Delay(d),s/veh	0.0	31.1	31.3							45.7	42.0	0.0
LnGrp LOS		C	C							D	D	
Approach Vol, veh/h		3071									1286	
Approach Delay, s/veh		31.2									43.1	
Approach LOS		C									D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4								
Phs Duration (G+Y+Rc), s		48.9		31.1								
Change Period (Y+Rc), s		8.5		4.5								
Max Green Setting (Gmax), s		39.5		27.5								
Max Q Clear Time (g_c+I1), s		36.0		25.1								
Green Ext Time (p_c), s		3.3		1.5								
Intersection Summary												
HCM 2010 Ctrl Delay			34.7									
HCM 2010 LOS			C									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	960	1390	0	0	0	0	0	1480	600	0	0	0
Future Volume (veh/h)	960	1390	0	0	0	0	0	1480	600	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1468	1500	0				0	1412	1412			
Adj Flow Rate, veh/h	1068	1353	0				0	1648	538			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	1466	1380	0				0	1789	495			
Arrive On Green	0.15	0.15	0.00				0.00	0.42	0.42			
Sat Flow, veh/h	2797	3000	0				0	4235	1172			
Grp Volume(v), veh/h	1068	1353	0				0	1648	538			
Grp Sat Flow(s),veh/h/ln	1398	1500	0				0	1412	1172			
Q Serve(g_s), s	29.6	36.0	0.0				0.0	29.4	33.8			
Cycle Q Clear(g_c), s	29.6	36.0	0.0				0.0	29.4	33.8			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1466	1380	0				0	1789	495			
V/C Ratio(X)	0.73	0.98	0.00				0.00	0.92	1.09			
Avail Cap(c_a), veh/h	1466	1380	0				0	1789	495			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.09	0.09	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	30.9	33.6	0.0				0.0	21.8	23.1			
Incr Delay (d2), s/veh	0.3	4.0	0.0				0.0	8.6	66.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	11.5	15.7	0.0				0.0	12.7	19.9			
LnGrp Delay(d),s/veh	31.2	37.6	0.0				0.0	30.5	89.1			
LnGrp LOS	C	D						C	F			
Approach Vol, veh/h		2421						2186				
Approach Delay, s/veh		34.8						44.9				
Approach LOS		C						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		41.0		39.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 37		* 34				
Max Q Clear Time (g_c+I1), s		38.0		35.8				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary	
HCM 2010 Ctrl Delay	39.6
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	300	40	80	300	50	70	235	180	90	130	30
Future Volume (veh/h)	20	300	40	80	300	50	70	235	180	90	130	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		0.96	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2039	2039	2000	1961	1961	2000	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	21	312	36	83	312	45	73	245	155	94	135	21
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	57	402	46	161	469	68	258	310	196	207	416	65
Arrive On Green	0.03	0.22	0.22	0.09	0.28	0.28	0.15	0.30	0.30	0.12	0.27	0.27
Sat Flow, veh/h	1942	1786	206	1867	1667	240	1774	1048	663	1774	1556	242
Grp Volume(v), veh/h	21	0	348	83	0	357	73	0	400	94	0	156
Grp Sat Flow(s),veh/h/ln	1942	0	1992	1867	0	1907	1774	0	1711	1774	0	1798
Q Serve(g_s), s	0.7	0.0	10.1	2.6	0.0	10.2	2.3	0.0	13.3	3.1	0.0	4.3
Cycle Q Clear(g_c), s	0.7	0.0	10.1	2.6	0.0	10.2	2.3	0.0	13.3	3.1	0.0	4.3
Prop In Lane	1.00		0.10	1.00		0.13	1.00		0.39	1.00		0.13
Lane Grp Cap(c), veh/h	57	0	448	161	0	537	258	0	507	207	0	480
V/C Ratio(X)	0.37	0.00	0.78	0.52	0.00	0.66	0.28	0.00	0.79	0.45	0.00	0.32
Avail Cap(c_a), veh/h	251	0	744	302	0	774	287	0	686	287	0	721
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.5	0.0	22.5	27.0	0.0	19.6	23.6	0.0	20.0	25.5	0.0	18.2
Incr Delay (d2), s/veh	1.5	0.0	2.9	1.0	0.0	1.4	0.2	0.0	4.4	0.6	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	5.9	1.4	0.0	5.6	1.1	0.0	6.8	1.5	0.0	2.2
LnGrp Delay(d),s/veh	30.9	0.0	25.4	28.0	0.0	21.1	23.8	0.0	24.4	26.1	0.0	18.6
LnGrp LOS	C		C	C		C	C		C	C		B
Approach Vol, veh/h		369			440			473			250	
Approach Delay, s/veh		25.8			22.4			24.3			21.4	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.3	18.8	13.0	20.7	5.8	22.3	11.2	22.5
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	23.1	10.0	* 25	8.0	25.1	10.0	* 25
Max Q Clear Time (g_c+I1), s	4.6	12.1	4.3	6.3	2.7	12.2	5.1	15.3
Green Ext Time (p_c), s	0.1	1.1	0.0	0.5	0.0	1.2	0.1	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	23.6
HCM 2010 LOS	C

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	520	60	0	685	0	0
Future Volume (vph)	520	60	0	685	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			3.0		
Lane Util. Factor	1.00			1.00		
Frpb, ped/bikes	0.99			1.00		
Flpb, ped/bikes	1.00			1.00		
Frt	0.99			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	1557			1588		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	1557			1588		
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	542	62	0	714	0	0
RTOR Reduction (vph)	5	0	0	0	0	0
Lane Group Flow (vph)	600	0	0	714	0	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA		
Protected Phases	2			3 4 6		
Permitted Phases						
Actuated Green, G (s)	36.4			56.5		
Effective Green, g (s)	36.4			50.5		
Actuated g/C Ratio	0.45			0.63		
Clearance Time (s)	6.0					
Vehicle Extension (s)	3.0					
Lane Grp Cap (vph)	708			1002		
v/s Ratio Prot	c0.38			c0.45		
v/s Ratio Perm						
v/c Ratio	0.85			0.71		
Uniform Delay, d1	19.3			9.9		
Progression Factor	0.62			0.37		
Incremental Delay, d2	10.2			0.6		
Delay (s)	22.2			4.3		
Level of Service	C			A		
Approach Delay (s)	22.2			4.3	0.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	500	60	0	330	0	0	0	0	30	20	20
Future Volume (vph)	0	500	60	0	330	0	0	0	0	30	20	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0						6.0	
Lane Util. Factor		1.00			1.00						1.00	
Frpb, ped/bikes		0.99			1.00						0.99	
Flpb, ped/bikes		1.00			1.00						1.00	
Frt		0.99			1.00						0.96	
Flt Protected		1.00			1.00						0.98	
Satd. Flow (prot)		1557			1588						1476	
Flt Permitted		1.00			1.00						0.98	
Satd. Flow (perm)		1557			1588						1476	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	521	62	0	344	0	0	0	0	31	21	21
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	19	0
Lane Group Flow (vph)	0	580	0	0	344	0	0	0	0	0	54	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA					Perm	NA	
Protected Phases		2			4 6						8	
Permitted Phases										8		
Actuated Green, G (s)		42.7			58.9						9.1	
Effective Green, g (s)		42.7			58.9						9.1	
Actuated g/C Ratio		0.53			0.74						0.11	
Clearance Time (s)		6.0									6.0	
Vehicle Extension (s)		3.0									1.5	
Lane Grp Cap (vph)		831			1169						167	
v/s Ratio Prot		c0.37			c0.22							
v/s Ratio Perm											0.04	
v/c Ratio		0.70			0.29						0.33	
Uniform Delay, d1		13.9			3.6						32.6	
Progression Factor		0.65			0.06						0.64	
Incremental Delay, d2		3.7			0.0						0.3	
Delay (s)		12.6			0.3						21.2	
Level of Service		B			A						C	
Approach Delay (s)		12.6			0.3			0.0			21.2	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	520	0	0	675	10	20
Future Volume (vph)	520	0	0	675	10	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			6.0	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1588			1588	1420	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1588			1588	1420	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	542	0	0	703	10	21
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	542	0	0	703	14	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	54.3			36.4	14.1	
Effective Green, g (s)	48.7			36.4	14.1	
Actuated g/C Ratio	0.61			0.45	0.18	
Clearance Time (s)				6.0		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	966			722	250	
v/s Ratio Prot	c0.34			c0.44	c0.01	
v/s Ratio Perm						
v/c Ratio	0.56			0.97	0.05	
Uniform Delay, d1	9.3			21.3	27.4	
Progression Factor	0.22			1.07	1.93	
Incremental Delay, d2	0.4			22.2	0.0	
Delay (s)	2.4			45.0	52.9	
Level of Service	A			D	D	
Approach Delay (s)	2.4			45.0	52.9	
Approach LOS	A			D	D	

Intersection Summary			
HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	530	0	0	310	10	20	20	20	0	0	0
Future Volume (vph)	0	530	0	0	310	10	20	20	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			1.00			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1580			1470				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1580			1470				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	552	0	0	323	10	21	21	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	332	0	0	45	0	0	0	0
Confl. Peds. (#/hr)	10		10			10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		57.8			42.7			10.2				
Effective Green, g (s)		57.8			42.7			10.2				
Actuated g/C Ratio		0.72			0.53			0.13				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1147			843			187				
v/s Ratio Prot		c0.35			0.21			c0.03				
v/s Ratio Perm												
v/c Ratio		0.48			0.39			0.24				
Uniform Delay, d1		4.7			11.0			31.4				
Progression Factor		0.15			0.61			1.16				
Incremental Delay, d2		0.1			1.3			0.2				
Delay (s)		0.8			8.0			36.7				
Level of Service		A			A			D				
Approach Delay (s)		0.8			8.0			36.7			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	5.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	465	0	0	420	40	20	15	20	0	0	0
Future Volume (vph)	0	465	0	0	420	40	20	15	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1546			1469				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1546			1469				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	484	0	0	438	42	21	16	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	17	0	0	0	0
Lane Group Flow (vph)	0	484	0	0	476	0	0	41	0	0	0	0
Confl. Peds. (#/hr)	59		21			59			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		54.9			35.6			13.5				
Effective Green, g (s)		54.9			35.6			13.5				
Actuated g/C Ratio		0.69			0.45			0.17				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1089			687			247				
v/s Ratio Prot		c0.30			c0.31			c0.03				
v/s Ratio Perm												
v/c Ratio		0.44			0.69			0.16				
Uniform Delay, d1		5.7			17.8			28.4				
Progression Factor		0.18			0.63			1.02				
Incremental Delay, d2		0.3			5.1			0.2				
Delay (s)		1.3			16.3			29.3				
Level of Service		A			B			C				
Approach Delay (s)		1.3			16.3			29.3			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	34.8	52.9	0.07	4.6	F
C	IV	25	18.9	8.7	27.6	0.07	9.3	D
B	IV	25	17.9	29.1	47.0	0.07	5.2	F
A	IV	25	18.5	9.4	27.9	0.07	9.0	E
Lindaro	IV	25	25.3	10.9	36.2	0.14	14.0	C
Lincoln	IV	25	21.4	46.3	67.7	0.10	5.2	F
Francisco W.	IV	25	12.2	66.4	78.6	0.05	2.1	F
101 SBOn 2nd	IV	25	14.2	12.1	26.3	0.05	7.3	E
Total	IV		146.5	217.7	364.2	0.61	6.1	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	59.7	78.7	0.07	3.3	F
Tamalpais	IV	25	14.4	68.7	83.1	0.05	2.3	F
Lincoln	IV	25	13.2	68.5	81.7	0.05	2.2	F
Lindaro	IV	25	21.4	1.0	22.4	0.10	15.6	C
A	IV	25	25.3	9.1	34.4	0.14	14.7	C
B	IV	25	17.9	9.1	27.0	0.07	9.0	E
C	IV	25	19.0	3.6	22.6	0.07	11.4	D
D	IV	25	18.7	1.7	20.4	0.07	12.4	D
Total	IV		148.9	221.4	370.3	0.62	6.1	F

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	29	24.0	19.1	43.1	0.16	13.4	C
5th	IV	25	16.3	13.4	29.7	0.06	7.5	E
4th	IV	25	14.6	7.5	22.1	0.05	8.9	E
3rd	IV	25	17.7	7.9	25.6	0.07	9.4	D
2nd	IV	25	15.6	261.1	276.7	0.06	0.8	F
Total	IV		88.2	309.0	397.2	0.40	3.6	F

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	30	25.2	35.9	61.1	0.17	9.9	D
3rd St	IV	25	14.8	24.1	38.9	0.06	5.2	F
4th	IV	25	18.3	29.4	47.7	0.07	5.2	F
5th	IV	25	14.6	8.3	22.9	0.06	8.7	E
Mission	IV	25	15.7	6.8	22.5	0.06	9.5	D
Total	IV		88.6	104.5	193.1	0.41	7.6	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	15.7	44.2	0.16	12.9	D
Tamalpais	IV	25	16.0	52.8	68.8	0.06	3.2	F
Tamalpais	IV	25	3.1	2.9	6.0	0.01	7.0	E
Hetherton	IV	25	8.7	21.6	30.3	0.03	3.9	F
Irwin	IV	25	18.9	11.9	30.8	0.07	8.3	E
Total	IV		75.2	104.9	180.1	0.33	6.7	F

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	26.8	48.4	0.10	7.3	E
Hetherton	IV	25	18.9	36.1	55.0	0.07	4.7	F
Tamalpais	IV	25	8.7	82.6	91.3	0.03	1.3	F
Tamalpais	IV	25	3.1	3.7	6.8	0.01	6.2	F
Lincoln	IV	25	16.0	88.7	104.7	0.06	2.1	F
Total	IV		68.3	237.9	306.2	0.27	3.2	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	24.8	42.9	0.07	5.7	F
C	IV	25	18.9	8.4	27.3	0.07	9.4	D
B	IV	25	17.9	18.9	36.8	0.07	6.6	F
A	IV	25	18.5	9.7	28.2	0.07	8.9	E
Lindaro	IV	25	25.3	11.1	36.4	0.14	13.9	C
Lincoln	IV	25	21.4	14.6	36.0	0.10	9.7	D
Francisco W.	IV	25	12.2	61.4	73.6	0.05	2.3	F
101 SBOn Hetherton	IV	25	14.2	72.4	86.6	0.05	2.2	F
Total	IV		146.5	221.3	367.8	0.61	6.0	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	91.2	110.2	0.07	2.3	F
Tamalpais	IV	25	14.4	92.0	106.4	0.05	1.8	F
Lincoln	IV	25	13.2	18.2	31.4	0.05	5.7	F
Lindaro	IV	25	21.4	3.5	24.9	0.10	14.1	C
A	IV	25	25.3	10.8	36.1	0.14	14.0	C
B	IV	25	17.9	9.9	27.8	0.07	8.7	E
C	IV	25	19.0	4.3	23.3	0.07	11.1	D
D	IV	25	18.7	3.8	22.5	0.07	11.3	D
Total	IV		148.9	233.7	382.6	0.62	5.9	F

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	35	22.2	20.3	42.5	0.16	13.5	C
5th	IV	25	16.3	15.7	32.0	0.06	6.9	F
4th	IV	25	14.6	5.6	20.2	0.05	9.8	D
3rd	IV	25	17.7	21.9	39.6	0.07	6.1	F
2nd	IV	25	15.6	45.1	60.7	0.06	3.5	F
Total	IV		86.4	108.6	195.0	0.40	7.4	E

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	38	19.3	82.4	101.7	0.17	5.9	F
3rd St	IV	25	14.8	12.8	27.6	0.06	7.3	E
4th	IV	25	18.9	12.7	31.6	0.07	8.1	E
5th	IV	25	14.0	13.3	27.3	0.05	7.0	F
Mission	IV	25	15.7	3.8	19.5	0.06	10.9	D
Total	IV		82.7	125.0	207.7	0.41	7.1	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	12.8	41.3	0.16	13.8	C
Tamalpais	IV	25	16.1	24.0	40.1	0.06	5.5	F
Tamalpais	IV	25	4.3	2.3	6.6	0.02	8.9	E
Hetherton	IV	25	7.5	15.1	22.6	0.03	4.5	F
Irwin	IV	25	18.9	14.1	33.0	0.07	7.8	E
Total	IV		75.3	68.3	143.6	0.33	8.4	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	28.4	50.0	0.10	7.1	E
Hetherton	IV	25	18.9	13.9	32.8	0.07	7.8	E
Tamalpais	IV	25	7.5	47.5	55.0	0.03	1.8	F
Tamalpais	IV	25	4.3	2.7	7.0	0.02	8.4	E
Lincoln	IV	25	16.1	88.2	104.3	0.06	2.1	F
Total	IV		68.4	180.7	249.1	0.27	4.0	F

Leisch Method for Weaving Analysis

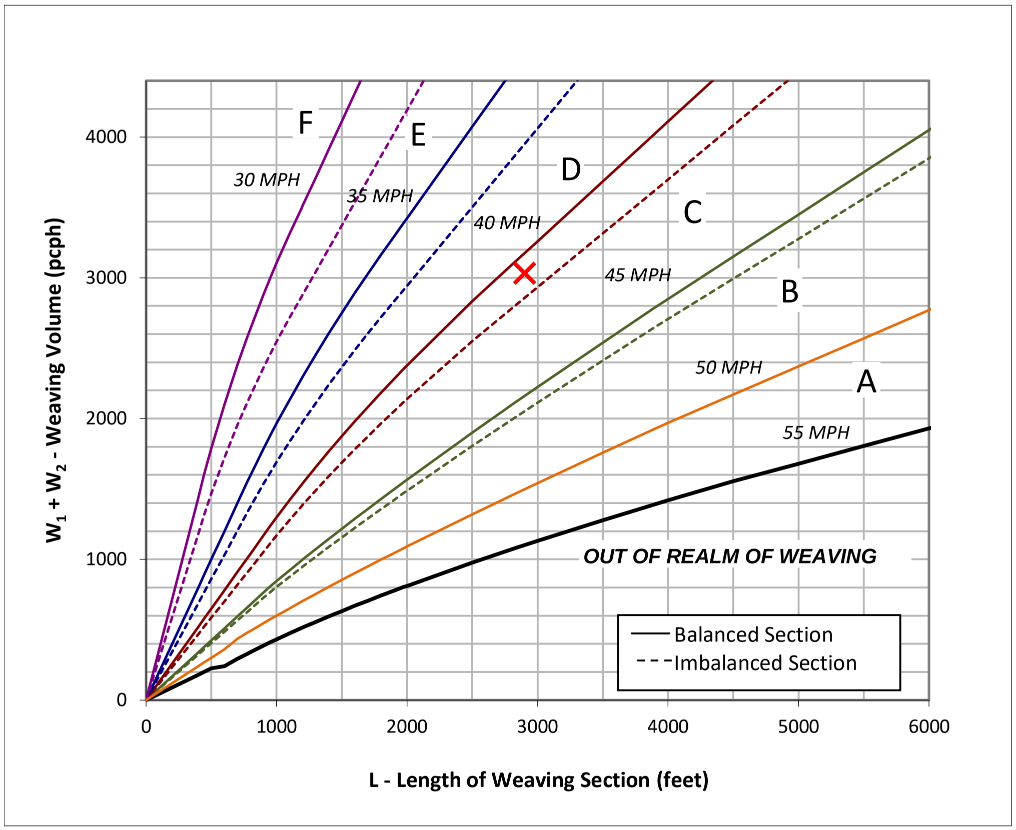
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

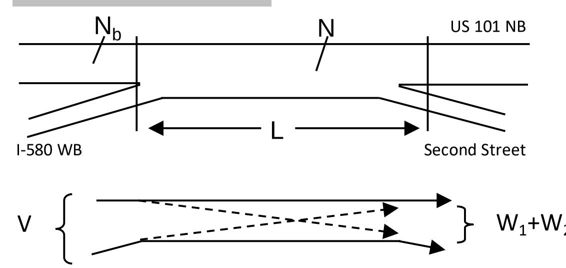
Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,956	Volume (vph)*	1,951	Volume (vph)*	957
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	4%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	6,218	Volume (pcph)	2,037	Volume (pcph)	996

Project Information

Project	BioMarin
Scenario	Cumulative No Project AM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   40 MPH and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 38.9
4. Weaving Intensity Factor (k): 2.59
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$: 1,561
6. Level of Service (LOS): D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4150	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1520
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	25.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	718	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	820
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	13.7
Speed 2 (S_3), mi/h	1.4	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6016	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1709
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	28.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6221	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	2248
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.98
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	52.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	42.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	3/17/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	6221	1987
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	4.40	3.72
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.958
Flow Rate (v_i), pc/h	6744	2254
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.98	1.07

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	103523.5	Density in Ramp Influence Area (D_R), pc/mi/ln	-
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	-
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2299
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	-
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.488	Outer Lanes Freeway Speed (S_O), mi/h	60.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	4445	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4234	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1583
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	26.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	998	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1104
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.0
Speed 2 (S_2), mi/h	1.0	Density (D_{ML}), pc/mi/ln	18.7
Speed 2 (S_3), mi/h	5.0	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

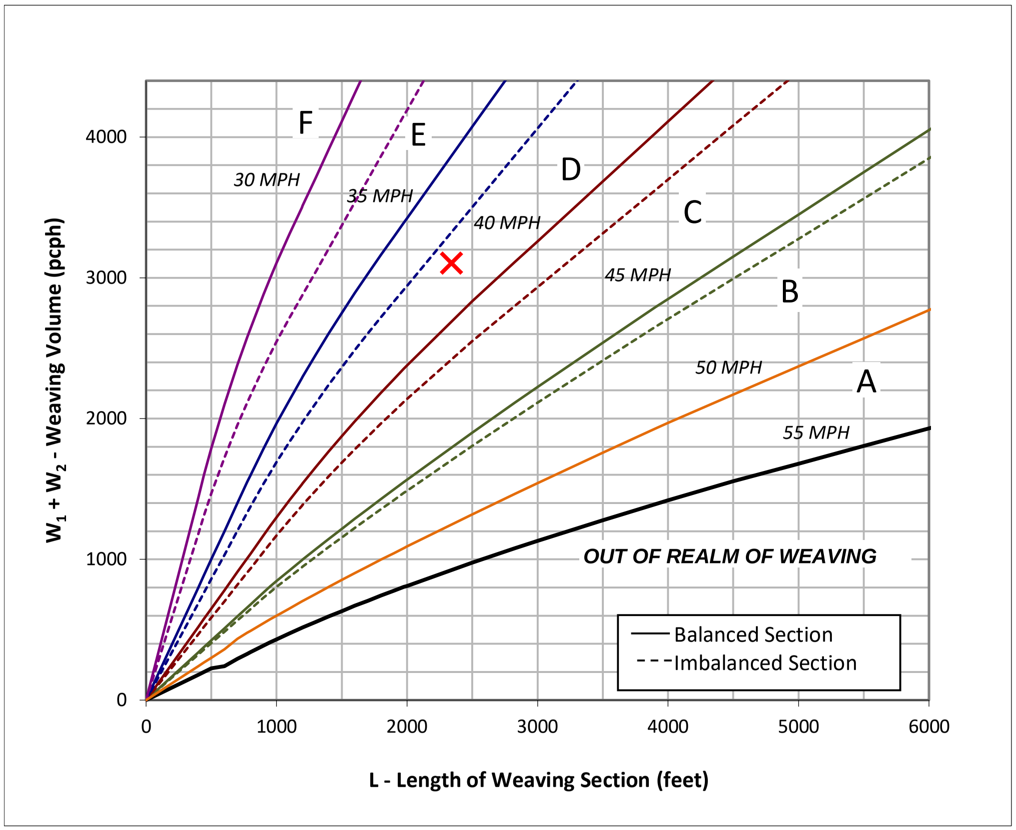
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

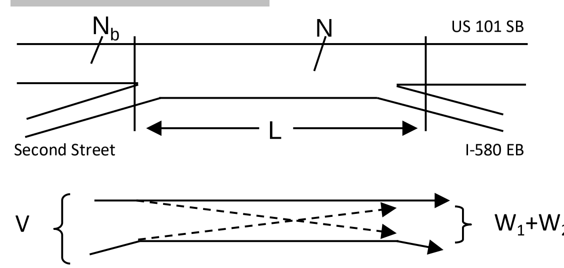
Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,712	Volume (vph)*	1,762	Volume (vph)*	1,224
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	2%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	7,007	Volume (pcph)	1,809	Volume (pcph)	1,297

Project Information

Project	BioMarin
Scenario	Cumulative No Project AM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 38.2
4. Weaving Intensity Factor (k) 2.63
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,281

6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

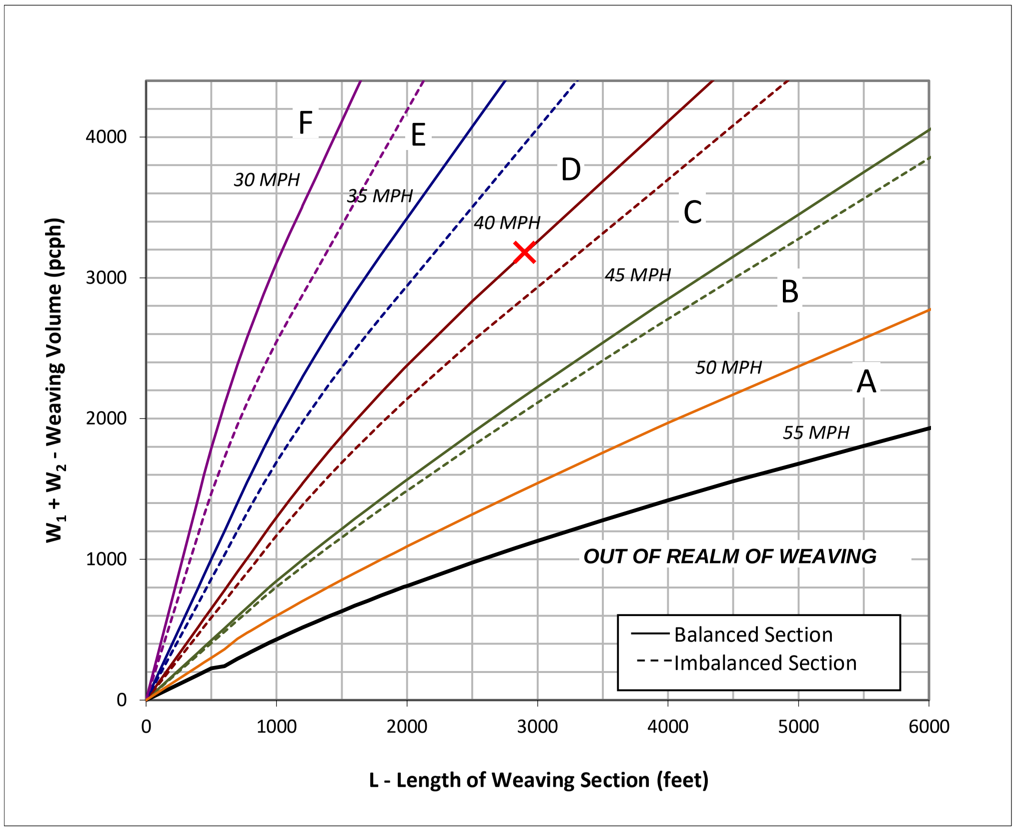
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

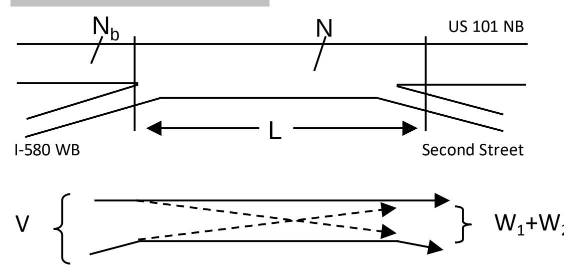
Project Information

Project	BioMarin
Scenario	Cumulative No Project PM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	7,250	Volume (vph)*	1,660	Volume (vph)*	1,412
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	7,569	Volume (pcph)	1,733	Volume (pcph)	1,449



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 38.5
4. Weaving Intensity Factor (k): 2.62
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$: 1,982
6. Level of Service (LOS): F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Baseline Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5170	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1913
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	58.2
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	32.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	848	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	890
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.7
Speed 2 (S_2), mi/h	0.3	Density (D_{ML}), pc/mi/ln	14.9
Speed 2 (S_3), mi/h	2.1	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	7460	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	2141
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	54.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	39.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1217	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	1342
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	5.597		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	47.9
Speed 2 (S_2), mi/h	2.3	Density (D_{ML}), pc/mi/ln	28.0
Speed 2 (S_3), mi/h	9.8	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5437	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1965
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	34.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1377	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1555
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	56.0
Speed 2 (S_2), mi/h	4.0	Density (D_{ML}), pc/mi/ln	27.8
Speed 2 (S_3), mi/h	15.4	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5437	2068
Peak Hour Factor (PHF)	0.97	0.96
Total Trucks, %	4.40	2.00
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.973
Flow Rate (v_i), pc/h	5894	2214
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.85	1.05

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	148151.7	Density in Ramp Influence Area (D_R), pc/mi/ln	-
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	-
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1800
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	-
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.511	Outer Lanes Freeway Speed (S_O), mi/h	62.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	4094	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1380	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1559
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	40.4
Speed 2 (S_2), mi/h	4.1	Density (D_{ML}), pc/mi/ln	38.6
Speed 2 (S_3), mi/h	15.5	Level of Service (LOS)	E

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative No Project Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3369	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1260
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	21.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	918	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1049
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.2
Speed 2 (S_2), mi/h	0.8	Density (D_{ML}), pc/mi/ln	17.7
Speed 2 (S_3), mi/h	4.2	Level of Service (LOS)	B

Leisch Method for Weaving Analysis

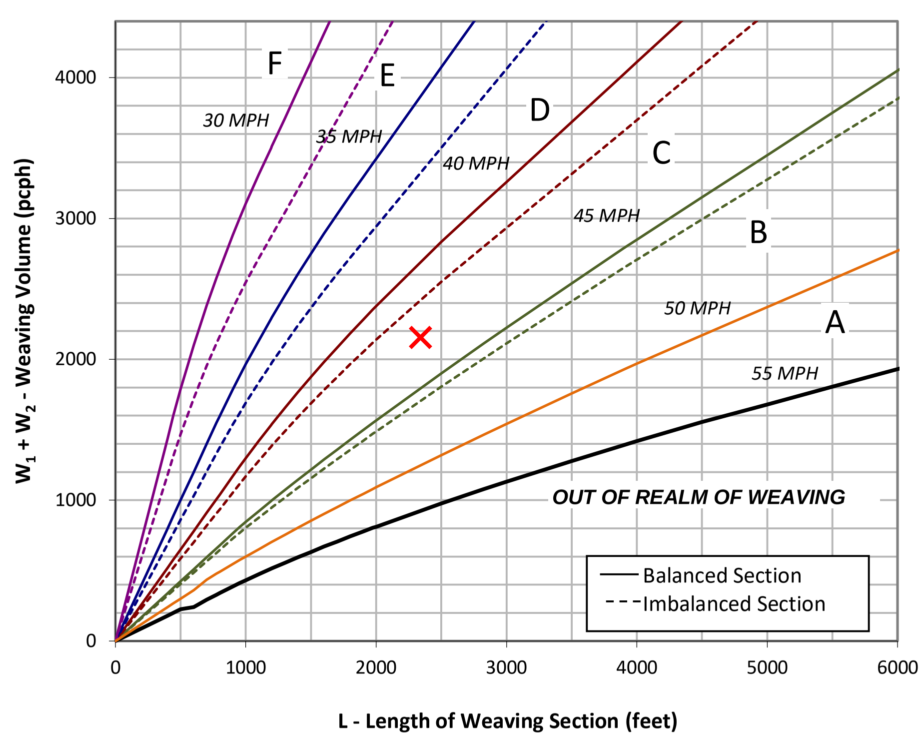
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

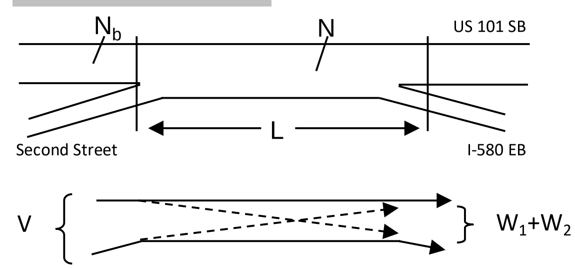
Project Information

Project	BioMarin
Scenario	Cumulative No Project PM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,358	Volume (vph)*	1,139	Volume (vph)*	901
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	5,594	Volume (pcph)	1,168	Volume (pcph)	989



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   40 MPH and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 43.0
4. Weaving Intensity Factor (k) 2.22
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,701
6. Level of Service (LOS) E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Appendix F:
Cumulative Plus Project Conditions (R&D Only) –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

April 5, 2019

FEHR PEERS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	500	20	80	585	50	20	230	90	60	420	380
Future Volume (veh/h)	120	500	20	80	585	50	20	230	90	60	420	380
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	0.99		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1710	1660	1660	1710	1800	1678	1728	1800	1748	1728
Adj Flow Rate, veh/h	130	543	20	87	636	50	22	250	80	65	457	206
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	148	868	32	341	626	49	68	439	134	136	833	363
Arrive On Green	0.09	0.55	0.55	0.55	0.55	0.55	0.85	0.85	0.85	0.43	0.43	0.43
Sat Flow, veh/h	1581	1588	59	787	1515	119	39	1028	314	188	1952	850
Grp Volume(v), veh/h	130	0	563	87	0	686	352	0	0	395	0	333
Grp Sat Flow(s),veh/h/ln	1581	0	1647	787	0	1634	1381	0	0	1613	0	1376
Q Serve(g_s), s	6.1	0.0	17.7	5.7	0.0	31.0	0.0	0.0	0.0	4.5	0.0	13.8
Cycle Q Clear(g_c), s	6.1	0.0	17.7	13.4	0.0	31.0	5.3	0.0	0.0	13.1	0.0	13.8
Prop In Lane	1.00		0.04	1.00		0.07	0.06		0.23	0.16		0.62
Lane Grp Cap(c), veh/h	148	0	900	341	0	676	640	0	0	744	0	587
V/C Ratio(X)	0.88	0.00	0.63	0.26	0.00	1.02	0.55	0.00	0.00	0.53	0.00	0.57
Avail Cap(c_a), veh/h	148	0	900	341	0	676	640	0	0	744	0	587
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.64	0.00	0.64	0.84	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.6	0.0	11.7	15.5	0.0	16.9	3.5	0.0	0.0	16.0	0.0	16.3
Incr Delay (d2), s/veh	47.7	0.0	3.3	1.1	0.0	31.5	2.8	0.0	0.0	2.7	0.0	4.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	8.8	1.3	0.0	19.5	2.3	0.0	0.0	6.6	0.0	5.8
LnGrp Delay(d),s/veh	81.3	0.0	15.0	16.7	0.0	48.4	6.4	0.0	0.0	18.7	0.0	20.2
LnGrp LOS	F		B	B		F	A			B		C
Approach Vol, veh/h		693			773			352			728	
Approach Delay, s/veh		27.4			44.8			6.4			19.4	
Approach LOS		C			D			A			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		45.2		36.8	10.0	35.2		36.8				
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6				
Max Green Setting (Gmax), s		* 41		25.4	7.0	* 31		25.4				
Max Q Clear Time (g_c+I1), s		19.7		7.3	8.1	33.0		15.8				
Green Ext Time (p_c), s		5.5		3.1	0.0	0.0		4.4				
Intersection Summary												
HCM 2010 Ctrl Delay			27.5									
HCM 2010 LOS			C									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	515	90	40	230	0	0	0	0	245	1091	500
Future Volume (vph)	0	515	90	40	230	0	0	0	0	245	1091	500
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.97
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2711			1767						2961	1303
Flt Permitted		1.00			0.80						0.99	1.00
Satd. Flow (perm)		2711			1421						2961	1303
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	560	98	43	250	0	0	0	0	266	1186	543
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	639	0	0	293	0	0	0	0	0	1452	543
Confl. Peds. (#/hr)	15		22	22		15			16			1
Confl. Bikes (#/hr)			3			2			1			3
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		23.8			23.8						42.4	35.4
Effective Green, g (s)		23.8			23.8						42.4	35.4
Actuated g/C Ratio		0.32			0.32						0.57	0.47
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		860			450						1673	615
v/s Ratio Prot		c0.24									c0.49	
v/s Ratio Perm					0.21							0.42
v/c Ratio		0.74			0.65						0.87	0.88
Uniform Delay, d1		22.9			22.0						13.9	17.9
Progression Factor		0.74			1.33						1.00	1.00
Incremental Delay, d2		4.8			5.6						6.4	16.7
Delay (s)		21.8			34.9						20.3	34.7
Level of Service		C			C						C	C
Approach Delay (s)		21.8			34.9			0.0			24.2	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	24.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	400	30	330	170	340	10	110	1146	140	40
Future Volume (vph)	400	30	330	170	340	10	110	1146	140	40
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1494	1794	1615	1471			3430	1294	
Flt Permitted		0.58	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		919	1794	1615	1471			3430	1294	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	435	33	359	185	370	11	120	1246	152	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	46	0
Lane Group Flow (vph)	0	468	359	185	381	0	0	1366	149	0
Confl. Peds. (#/hr)							13			6
Confl. Bikes (#/hr)					2	2				2
Parking (#/hr)				0				2		
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		34.8	34.8	19.8	19.8			31.8	31.8	
Effective Green, g (s)		34.8	34.8	19.8	19.8			31.8	31.8	
Actuated g/C Ratio		0.46	0.46	0.26	0.26			0.42	0.42	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0	
Lane Grp Cap (vph)		509	832	426	388			1454	548	
v/s Ratio Prot		c0.13	0.20	0.11	0.26					
v/s Ratio Perm		c0.29						0.40	0.12	
v/c Ratio		0.92	0.43	0.43	0.98			0.94	0.27	
Uniform Delay, d1		19.1	13.5	22.9	27.4			20.7	14.1	
Progression Factor		0.91	0.80	1.00	1.00			0.75	0.71	
Incremental Delay, d2		14.6	0.2	0.7	40.7			6.0	0.5	
Delay (s)		32.0	11.0	23.7	68.1			21.5	10.5	
Level of Service		C	B	C	E			C	B	
Approach Delay (s)			22.9	53.6				20.1		
Approach LOS			C	D				C		

Intersection Summary			
HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	320	40	70	290	70	20	240	70	50	420	50
Future Volume (veh/h)	40	320	40	70	290	70	20	240	70	50	420	50
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	0.99		0.95	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1398	1545	1530	1398	1485	1530	1440	1485	1469	1440	1485	1469
Adj Flow Rate, veh/h	43	348	36	76	315	63	22	261	62	54	457	49
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	126	409	42	143	356	71	72	563	128	97	612	63
Arrive On Green	0.30	0.30	0.30	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00
Sat Flow, veh/h	792	1370	142	785	1193	239	37	973	221	76	1057	109
Grp Volume(v), veh/h	43	0	384	76	0	378	345	0	0	560	0	0
Grp Sat Flow(s),veh/h/ln	792	0	1512	785	0	1432	1231	0	0	1242	0	0
Q Serve(g_s), s	2.9	0.0	17.9	4.5	0.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	22.4	0.0	17.9	22.4	0.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.09	1.00		0.17	0.06		0.18	0.10		0.09
Lane Grp Cap(c), veh/h	126	0	452	143	0	428	763	0	0	771	0	0
V/C Ratio(X)	0.34	0.00	0.85	0.53	0.00	0.88	0.45	0.00	0.00	0.73	0.00	0.00
Avail Cap(c_a), veh/h	126	0	452	143	0	428	763	0	0	771	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.94	0.00	0.94	0.86	0.00	0.00	0.38	0.00	0.00
Uniform Delay (d), s/veh	36.5	0.0	24.7	43.6	0.0	32.5	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	7.2	0.0	17.9	12.7	0.0	21.4	1.7	0.0	0.0	2.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	9.7	2.1	0.0	10.3	0.4	0.0	0.0	0.5	0.0	0.0
LnGrp Delay(d),s/veh	43.7	0.0	42.6	56.3	0.0	54.0	1.7	0.0	0.0	2.3	0.0	0.0
LnGrp LOS	D		D	E		D	A			A		
Approach Vol, veh/h		427			454			345			560	
Approach Delay, s/veh		42.7			54.3			1.7			2.3	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.0		48.0		27.0		48.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		22.4		43.4		22.4		43.4
Max Q Clear Time (g_c+I1), s		24.4		2.0		24.4		2.0
Green Ext Time (p_c), s		0.0		1.7		0.0		3.0

Intersection Summary			
HCM 2010 Ctrl Delay			25.1
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	260	180	40	245	0	0	0	0	50	1046	125
Future Volume (vph)	0	260	180	40	245	0	0	0	0	50	1046	125
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.94			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1665			1769						4119	1127
Flt Permitted		1.00			0.90						1.00	1.00
Satd. Flow (perm)		1665			1604						4119	1127
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	283	196	43	266	0	0	0	0	54	1137	136
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	468	0	0	309	0	0	0	0	0	1191	136
Confl. Peds. (#/hr)			15	15		14			22	22		10
Confl. Bikes (#/hr)			4			2			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		35.8			35.8						30.4	23.4
Effective Green, g (s)		35.8			35.8						30.4	23.4
Actuated g/C Ratio		0.48			0.48						0.41	0.31
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		794			765						1669	351
v/s Ratio Prot		c0.28										
v/s Ratio Perm					0.19						0.29	0.12
v/c Ratio		0.59			0.40						0.71	0.39
Uniform Delay, d1		14.2			12.7						18.7	20.2
Progression Factor		0.45			1.32						0.61	0.69
Incremental Delay, d2		3.0			0.9						1.3	1.6
Delay (s)		9.5			17.6						12.6	15.4
Level of Service		A			B						B	B
Approach Delay (s)		9.5			17.6			0.0			12.9	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	12.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	110	0	0	160	130	150	1186	20	0	0	0
Future Volume (veh/h)	150	110	0	0	160	130	150	1186	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	0.89	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1620	1573	1620			
Adj Flow Rate, veh/h	163	120	0	0	174	103	163	1289	21			
Adj No. of Lanes	1	1	0	0	1	0	0	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	0	3	0			
Cap, veh/h	218	491	0	0	254	151	166	1381	24			
Arrive On Green	0.10	0.10	0.00	0.00	0.31	0.31	0.19	0.19	0.19			
Sat Flow, veh/h	976	1573	0	0	816	483	293	2442	42			
Grp Volume(v), veh/h	163	120	0	0	0	277	770	0	703			
Grp Sat Flow(s),veh/h/ln	976	1573	0	0	0	1299	1385	0	1392			
Q Serve(g_s), s	9.4	5.3	0.0	0.0	0.0	14.0	41.5	0.0	37.0			
Cycle Q Clear(g_c), s	23.4	5.3	0.0	0.0	0.0	14.0	41.5	0.0	37.0			
Prop In Lane	1.00		0.00	0.00		0.37	0.21		0.03			
Lane Grp Cap(c), veh/h	218	491	0	0	0	405	783	0	787			
V/C Ratio(X)	0.75	0.24	0.00	0.00	0.00	0.68	0.98	0.00	0.89			
Avail Cap(c_a), veh/h	218	491	0	0	0	405	783	0	787			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	0.77	0.77	0.00	0.00	0.00	1.00	0.09	0.00	0.09			
Uniform Delay (d), s/veh	41.8	25.5	0.0	0.0	0.0	22.6	30.1	0.0	28.3			
Incr Delay (d2), s/veh	10.4	0.2	0.0	0.0	0.0	4.7	6.5	0.0	1.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	2.3	0.0	0.0	0.0	5.5	17.3	0.0	14.6			
LnGrp Delay(d),s/veh	52.2	25.7	0.0	0.0	0.0	27.3	36.6	0.0	30.0			
LnGrp LOS	D	C				C	D		C			
Approach Vol, veh/h		283			277			1473				
Approach Delay, s/veh		41.0			27.3			33.5				
Approach LOS		D			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		28.0		47.0		28.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		23.4		42.4		23.4		
Max Q Clear Time (g_c+I1), s		25.4		43.5		16.0		
Green Ext Time (p_c), s		0.0		0.0		0.7		

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	265	20	80	340	60	20	240	70	85	370	80
Future Volume (veh/h)	40	265	20	80	340	60	20	240	70	85	370	80
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.90	0.97		0.91	0.97		0.92	0.99		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1573	1510	1620	1573	1573	1620	1620	1573	1555	1620	1573	1555
Adj Flow Rate, veh/h	43	288	19	87	370	56	22	261	62	92	402	78
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	117	423	28	209	400	60	74	598	136	144	541	99
Arrive On Green	0.30	0.30	0.30	0.10	0.10	0.10	0.19	0.19	0.19	1.00	1.00	1.00
Sat Flow, veh/h	853	1390	92	925	1314	199	39	1024	233	151	926	170
Grp Volume(v), veh/h	43	0	307	87	0	426	345	0	0	572	0	0
Grp Sat Flow(s),veh/h/ln	853	0	1482	925	0	1513	1296	0	0	1248	0	0
Q Serve(g_s), s	1.9	0.0	13.6	7.0	0.0	20.9	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	22.8	0.0	13.6	20.6	0.0	20.9	17.1	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.06	1.00		0.13	0.06		0.18	0.16		0.14
Lane Grp Cap(c), veh/h	117	0	450	209	0	460	808	0	0	784	0	0
V/C Ratio(X)	0.37	0.00	0.68	0.42	0.00	0.93	0.43	0.00	0.00	0.73	0.00	0.00
Avail Cap(c_a), veh/h	117	0	450	209	0	460	808	0	0	784	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.76	0.00	0.00	0.48	0.00	0.00
Uniform Delay (d), s/veh	37.0	0.0	22.9	39.5	0.0	32.9	19.5	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	8.7	0.0	8.1	5.5	0.0	25.5	1.3	0.0	0.0	2.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	6.6	2.1	0.0	12.1	6.6	0.0	0.0	0.6	0.0	0.0
LnGrp Delay(d),s/veh	45.7	0.0	31.0	45.1	0.0	58.4	20.8	0.0	0.0	2.9	0.0	0.0
LnGrp LOS	D		C	D		E	C			A		
Approach Vol, veh/h		350			513			345			572	
Approach Delay, s/veh		32.8			56.1			20.8			2.9	
Approach LOS		C			E			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.0		48.0		27.0		48.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 23		* 44		* 23		* 44
Max Q Clear Time (g_c+I1), s		24.8		19.1		22.9		2.0
Green Ext Time (p_c), s		0.0		3.3		0.0		7.3

Intersection Summary	
HCM 2010 Ctrl Delay	27.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑			↱
Traffic Volume (vph)	0	500	430	0	0	55
Future Volume (vph)	0	500	430	0	0	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6	5.6			5.2
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00			0.87
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1573	1573			1188
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1573	1573			1188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	543	467	0	0	60
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	0	543	467	0	0	11
Confl. Peds. (#/hr)				39		46
Confl. Bikes (#/hr)				4		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		50.3	50.4			13.8
Effective Green, g (s)		50.3	50.4			13.8
Actuated g/C Ratio		0.67	0.67			0.18
Clearance Time (s)						5.2
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1054	1057			218
v/s Ratio Prot		c0.35	c0.30			
v/s Ratio Perm						0.01
v/c Ratio		0.52	0.44			0.05
Uniform Delay, d1		6.2	5.7			25.2
Progression Factor		1.32	0.48			1.00
Incremental Delay, d2		0.3	0.2			0.1
Delay (s)		8.6	2.9			25.3
Level of Service		A	A			C
Approach Delay (s)		8.6	2.9		25.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	7.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	305	200	200	305	0	0	0	0	110	966	190
Future Volume (vph)	0	305	200	200	305	0	0	0	0	110	966	190
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00						1.00	0.89
Flpb, ped/bikes		1.00	1.00	0.98	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1625	1181	1607	1520						4264	1184
Flt Permitted		1.00	1.00	0.49	1.00						0.99	1.00
Satd. Flow (perm)		1625	1181	824	1520						4264	1184
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	332	217	217	332	0	0	0	0	120	1050	207
RTOR Reduction (vph)	0	0	27	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	332	190	217	332	0	0	0	0	0	1170	207
Confl. Peds. (#/hr)			40	40		22			9	9		30
Confl. Bikes (#/hr)			8			4						2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		35.8	35.8	35.8	35.8						30.4	23.4
Effective Green, g (s)		35.8	35.8	35.8	35.8						30.4	23.4
Actuated g/C Ratio		0.48	0.48	0.48	0.48						0.41	0.31
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		775	563	393	725						1728	369
v/s Ratio Prot		0.20			0.22							
v/s Ratio Perm			0.16	c0.26							0.27	0.17
v/c Ratio		0.43	0.34	0.55	0.46						0.68	0.56
Uniform Delay, d1		12.9	12.2	13.9	13.1						18.3	21.5
Progression Factor		0.49	0.42	1.03	1.07						0.32	0.42
Incremental Delay, d2		1.5	1.4	3.8	1.4						1.5	4.4
Delay (s)		7.8	6.6	18.2	15.4						7.4	13.4
Level of Service		A	A	B	B						A	B
Approach Delay (s)		7.3			16.5			0.0			8.3	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	170	240	0	0	380	70	130	1146	50	0	0	0
Future Volume (veh/h)	170	240	0	0	380	70	130	1146	50	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1510	1573	1620			
Adj Flow Rate, veh/h	185	261	0	0	413	66	141	1246	50			
Adj No. of Lanes	1	1	0	0	1	0	1	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	137	625	0	0	465	74	706	1356	54			
Arrive On Green	0.79	0.79	0.00	0.00	0.13	0.13	0.16	0.16	0.16			
Sat Flow, veh/h	813	1573	0	0	1170	187	1438	2763	111			
Grp Volume(v), veh/h	185	261	0	0	0	479	141	673	623			
Grp Sat Flow(s),veh/h/ln	813	1573	0	0	0	1357	1438	1494	1379			
Q Serve(g_s), s	3.8	3.8	0.0	0.0	0.0	26.0	6.4	33.3	33.3			
Cycle Q Clear(g_c), s	29.8	3.8	0.0	0.0	0.0	26.0	6.4	33.3	33.3			
Prop In Lane	1.00		0.00	0.00		0.14	1.00		0.08			
Lane Grp Cap(c), veh/h	137	625	0	0	0	539	706	733	677			
V/C Ratio(X)	1.35	0.42	0.00	0.00	0.00	0.89	0.20	0.92	0.92			
Avail Cap(c_a), veh/h	137	625	0	0	0	539	706	733	677			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.91	0.91	0.00	0.00	0.00	1.00	0.17	0.17	0.17			
Uniform Delay (d), s/veh	22.0	5.0	0.0	0.0	0.0	31.0	18.7	30.0	30.0			
Incr Delay (d2), s/veh	196.0	1.9	0.0	0.0	0.0	19.3	0.1	4.3	4.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	10.2	1.8	0.0	0.0	0.0	12.7	2.6	14.7	13.6			
LnGrp Delay(d),s/veh	218.1	6.9	0.0	0.0	0.0	50.2	18.8	34.2	34.7			
LnGrp LOS	F	A				D	B	C	C			
Approach Vol, veh/h		446			479			1437				
Approach Delay, s/veh		94.5			50.2			32.9				
Approach LOS		F			D			C				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6						
Phs Duration (G+Y+Rc), s		34.0		41.0		34.0						
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2						
Max Green Setting (Gmax), s		* 30		* 37		* 30						
Max Q Clear Time (g_c+I1), s		31.8		35.3		28.0						
Green Ext Time (p_c), s		0.0		1.0		0.4						
Intersection Summary												
HCM 2010 Ctrl Delay			48.0									
HCM 2010 LOS			D									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	320	1221	0	0	0	0	0	240	30
Future Volume (veh/h)	0	0	0	320	1221	0	0	0	0	0	240	30
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.98
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1530	1485	0				0	1485	1530
Adj Flow Rate, veh/h				348	1327	0				0	261	17
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				586	2028	0				0	525	34
Arrive On Green				0.22	0.22	0.00				0.00	0.21	0.21
Sat Flow, veh/h				755	3124	0				0	2611	164
Grp Volume(v), veh/h				598	1077	0				0	144	134
Grp Sat Flow(s),veh/h/ln				1297	1230	0				0	1411	1290
Q Serve(g_s), s				31.7	29.8	0.0				0.0	6.8	6.9
Cycle Q Clear(g_c), s				31.7	29.8	0.0				0.0	6.8	6.9
Prop In Lane				0.58		0.00				0.00		0.13
Lane Grp Cap(c), veh/h				952	1662	0				0	292	267
V/C Ratio(X)				0.63	0.65	0.00				0.00	0.49	0.50
Avail Cap(c_a), veh/h				952	1662	0				0	440	402
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.68	0.68	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				21.8	21.0	0.0				0.0	26.3	26.3
Incr Delay (d2), s/veh				2.1	1.3	0.0				0.0	1.3	1.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.0	10.5	0.0				0.0	2.8	2.6
LnGrp Delay(d),s/veh				23.9	22.4	0.0				0.0	27.6	27.8
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1675						278	
Approach Delay, s/veh					22.9						27.6	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.9		20.1				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 43		23.4				
Max Q Clear Time (g_c+I1), s		33.7		8.9				
Green Ext Time (p_c), s		5.6		0.9				

Intersection Summary		
HCM 2010 Ctrl Delay		23.6
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1416	120	110	250	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1416	120	110	250	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1398	1398	1440	1398	0			
Adj Flow Rate, veh/h				0	1539	97	120	272	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	2536	774	218	404	0			
Arrive On Green				0.00	0.22	0.22	0.07	0.07	0.00			
Sat Flow, veh/h				0	3943	1164	640	1870	0			
Grp Volume(v), veh/h				0	1539	97	216	176	0			
Grp Sat Flow(s),veh/h/ln				0	1272	1164	1238	1209	0			
Q Serve(g_s), s				0.0	27.2	5.0	11.7	10.7	0.0			
Cycle Q Clear(g_c), s				0.0	27.2	5.0	12.8	10.7	0.0			
Prop In Lane				0.00		1.00	0.56		0.00			
Lane Grp Cap(c), veh/h				0	2536	774	351	270	0			
V/C Ratio(X)				0.00	0.61	0.13	0.61	0.65	0.00			
Avail Cap(c_a), veh/h				0	2536	774	421	338	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	0.57	0.57	0.79	0.79	0.00			
Uniform Delay (d), s/veh				0.0	20.5	11.8	32.8	31.9	0.0			
Incr Delay (d2), s/veh				0.0	0.6	0.2	1.5	2.5	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	9.8	1.7	4.6	3.7	0.0			
LnGrp Delay(d),s/veh				0.0	21.1	12.0	34.3	34.4	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1636			392				
Approach Delay, s/veh					20.5			34.3				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.0		21.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 46		* 21				
Max Q Clear Time (g_c+I1), s		29.2		14.8				
Green Ext Time (p_c), s		8.4		0.9				

Intersection Summary			
HCM 2010 Ctrl Delay			23.2
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	90	1471	0	0	0	0	0	200	60
Future Volume (veh/h)	0	0	0	90	1471	0	0	0	0	0	200	60
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1398	0				0	1398	1440
Adj Flow Rate, veh/h				98	1599	0				0	217	45
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				165	2266	0				0	486	97
Arrive On Green				0.21	0.21	0.00				0.00	0.24	0.24
Sat Flow, veh/h				170	3616	0				0	2091	401
Grp Volume(v), veh/h				631	1066	0				0	139	123
Grp Sat Flow(s),veh/h/ln				1356	1158	0				0	1328	1094
Q Serve(g_s), s				23.1	32.0	0.0				0.0	6.7	7.2
Cycle Q Clear(g_c), s				32.3	32.0	0.0				0.0	6.7	7.2
Prop In Lane				0.16		0.00				0.00		0.37
Lane Grp Cap(c), veh/h				933	1499	0				0	320	263
V/C Ratio(X)				0.68	0.71	0.00				0.00	0.44	0.47
Avail Cap(c_a), veh/h				933	1499	0				0	411	338
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.69	0.69	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.0	23.0	0.0				0.0	24.2	24.3
Incr Delay (d2), s/veh				2.7	2.0	0.0				0.0	0.9	1.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.9	10.7	0.0				0.0	2.5	2.3
LnGrp Delay(d),s/veh				25.7	25.0	0.0				0.0	25.1	25.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1697						262	
Approach Delay, s/veh					25.3						25.3	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		52.7		22.3				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 43		* 23				
Max Q Clear Time (g_c+I1), s		34.3		9.2				
Green Ext Time (p_c), s		5.6		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	25.3
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	1311	80	210	135	0	0	140	30
Future Volume (veh/h)	0	0	0	40	1311	80	210	135	0	0	140	30
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				43	1425	78	228	147	0	0	152	21
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				73	2568	145	303	606	0	0	302	42
Arrive On Green				0.56	0.56	0.56	0.02	0.11	0.00	0.00	0.22	0.22
Sat Flow, veh/h				131	4617	261	1748	1835	0	0	1389	192
Grp Volume(v), veh/h				571	474	501	228	147	0	0	0	173
Grp Sat Flow(s),veh/h/ln				1741	1590	1679	1748	1835	0	0	0	1581
Q Serve(g_s), s				16.2	14.2	14.2	0.6	5.5	0.0	0.0	0.0	7.2
Cycle Q Clear(g_c), s				16.2	14.2	14.2	0.6	5.5	0.0	0.0	0.0	7.2
Prop In Lane				0.08		0.16	1.00		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				968	885	934	303	606	0	0	0	344
V/C Ratio(X)				0.59	0.54	0.54	0.75	0.24	0.00	0.00	0.00	0.50
Avail Cap(c_a), veh/h				968	885	934	443	807	0	0	0	390
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.84	0.84	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				11.0	10.5	10.5	33.1	24.8	0.0	0.0	0.0	25.8
Incr Delay (d2), s/veh				2.6	2.3	2.2	6.8	0.4	0.0	0.0	0.0	2.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				8.5	6.8	7.1	5.2	2.9	0.0	0.0	0.0	3.4
LnGrp Delay(d),s/veh				13.6	12.9	12.7	40.0	25.2	0.0	0.0	0.0	28.2
LnGrp LOS				B	B	B	D	C				C
Approach Vol, veh/h					1546			375			173	
Approach Delay, s/veh					13.1			34.2			28.2	
Approach LOS					B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.0	20.8		46.2		28.8
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			10.0	18.5		33.5		33.0
Max Q Clear Time (g_c+I1), s			2.6	9.2		18.2		7.5
Green Ext Time (p_c), s			1.0	0.8		11.2		1.1

Intersection Summary	
HCM 2010 Ctrl Delay	18.1
HCM 2010 LOS	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative + BioMarin Only Conditions**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	20	22	108.6%	6.4	2.1	A
	Through	5	4	81.0%	13.4	11.6	B
	Right Turn						
	Subtotal	25	26	103.0%	8.3	3.3	A
SB	Left Turn						
	Through	5	5	103.0%	27.0	18.0	D
	Right Turn	10	12	117.8%	14.0	9.6	B
	Subtotal	15	17	112.9%	20.4	7.4	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	30	24	78.5%	2.4	0.3	A
	Through	1,401	1,328	94.8%	1.8	0.3	A
	Right Turn	10	11	114.1%	1.3	0.4	A
	Subtotal	1,441	1,363	94.6%	1.8	0.3	A
Total		1,481	1,406	94.9%	2.1	0.3	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	83	79	95.3%	25.7	7.2	C
	Through	10	9	88.3%	19.8	18.6	B
	Right Turn						
	Subtotal	93	88	94.6%	24.9	6.2	C
SB	Left Turn						
	Through	40	39	98.4%	45.4	12.1	D
	Right Turn	10	8	84.6%	15.9	10.2	B
	Subtotal	50	48	95.7%	40.9	10.4	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	432	90.6%	22.0	6.2	C
	Through	1,378	1,305	94.7%	7.1	1.4	A
	Right Turn	30	26	87.1%	5.8	2.0	A
	Subtotal	1,885	1,763	93.6%	10.8	2.6	B
Total		2,028	1,899	93.7%	12.2	2.7	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	175	1759	75	41	195	0	0	290	165
Future Volume (veh/h)	0	0	0	175	1759	75	41	195	0	0	290	165
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	1.00		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1620	1573	1620	1620	1573	0	0	1510	1555
Adj Flow Rate, veh/h				190	1912	77	45	212	0	0	315	177
Adj No. of Lanes				0	3	0	0	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				175	1882	78	57	189	0	0	316	178
Arrive On Green				0.16	0.16	0.16	0.13	0.13	0.00	0.00	0.13	0.13
Sat Flow, veh/h				370	3976	164	1	466	0	0	778	437
Grp Volume(v), veh/h				797	666	715	257	0	0	0	0	492
Grp Sat Flow(s),veh/h/ln				1554	1431	1525	467	0	0	0	0	1215
Q Serve(g_s), s				35.5	34.8	35.1	0.2	0.0	0.0	0.0	0.0	30.3
Cycle Q Clear(g_c), s				35.5	34.8	35.1	30.5	0.0	0.0	0.0	0.0	30.3
Prop In Lane				0.24		0.11	0.18		0.00	0.00		0.36
Lane Grp Cap(c), veh/h				736	677	722	246	0	0	0	0	494
V/C Ratio(X)				1.08	0.98	0.99	1.04	0.00	0.00	0.00	0.00	1.00
Avail Cap(c_a), veh/h				736	677	722	246	0	0	0	0	494
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	0.33	0.33
Upstream Filter(I)				0.26	0.26	0.26	1.00	0.00	0.00	0.00	0.00	0.44
Uniform Delay (d), s/veh				31.6	31.4	31.5	27.9	0.0	0.0	0.0	0.0	32.4
Incr Delay (d2), s/veh				44.7	13.9	14.9	69.3	0.0	0.0	0.0	0.0	25.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				24.4	16.4	17.8	9.8	0.0	0.0	0.0	0.0	13.7
LnGrp Delay(d),s/veh				76.3	45.2	46.4	97.2	0.0	0.0	0.0	0.0	58.2
LnGrp LOS				F	D	D	F					E
Approach Vol, veh/h					2179			257			492	
Approach Delay, s/veh					57.0			97.2			58.2	
Approach LOS					E			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				35.0		40.0		35.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				30.5		35.5		30.5
Max Q Clear Time (g_c+I1), s				32.5		37.5		32.3
Green Ext Time (p_c), s				0.0		0.0		0.0

Intersection Summary			
HCM 2010 Ctrl Delay			60.7
HCM 2010 LOS			E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	295	1944	30	50	50	0	0	0	0
Future Volume (vph)	0	0	0	295	1944	30	50	50	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6				
Lane Util. Factor					0.91		1.00	1.00				
Frpb, ped/bikes					1.00		1.00	1.00				
Flpb, ped/bikes					0.98		0.93	1.00				
Frt					1.00		1.00	1.00				
Flt Protected					0.99		0.95	1.00				
Satd. Flow (prot)					3698		1057	1237				
Flt Permitted					0.99		0.95	1.00				
Satd. Flow (perm)					3698		1057	1237				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	321	2113	33	54	54	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2465	0	54	54	0	0	0	0
Confl. Peds. (#/hr)			73	73		38	49		63			49
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA				
Protected Phases					6			4				
Permitted Phases				6			4					
Actuated Green, G (s)					51.8		19.0	19.0				
Effective Green, g (s)					51.8		19.0	19.0				
Actuated g/C Ratio					0.58		0.21	0.21				
Clearance Time (s)					11.6		7.6	7.6				
Vehicle Extension (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					2128		223	261				
v/s Ratio Prot								0.04				
v/s Ratio Perm					0.67		c0.05					
v/c Ratio					1.16		0.24	0.21				
Uniform Delay, d1					19.1		29.5	29.3				
Progression Factor					1.00		1.00	1.00				
Incremental Delay, d2					77.1		1.2	0.8				
Delay (s)					96.2		30.7	30.1				
Level of Service					F		C	C				
Approach Delay (s)		0.0			96.2			30.4			0.0	
Approach LOS		A			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	93.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	149.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	455	1678	0	0	0	0	0	825	541
Future Volume (veh/h)	0	0	0	455	1678	0	0	0	0	0	825	541
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.84
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1545	1573	0				0	1573	1485
Adj Flow Rate, veh/h				495	1824	0				0	897	579
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				721	2004	0				0	1955	481
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1471	4718	0				0	4435	1057
Grp Volume(v), veh/h				495	1824	0				0	897	579
Grp Sat Flow(s),veh/h/ln				1471	1573	0				0	1431	1057
Q Serve(g_s), s				24.4	28.6	0.0				0.0	14.3	34.1
Cycle Q Clear(g_c), s				24.4	28.6	0.0				0.0	14.3	34.1
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				721	2004	0				0	1955	481
V/C Ratio(X)				0.69	0.91	0.00				0.00	0.46	1.20
Avail Cap(c_a), veh/h				724	2013	0				0	1955	481
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				0.18	0.18	0.00				0.00	0.75	0.75
Uniform Delay (d), s/veh				29.0	30.8	0.0				0.0	23.4	31.9
Incr Delay (d2), s/veh				0.5	1.3	0.0				0.0	0.6	105.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				10.1	12.7	0.0				0.0	5.8	24.1
LnGrp Delay(d),s/veh				29.5	32.2	0.0				0.0	24.0	137.5
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2319						1476	
Approach Delay, s/veh					31.6						68.5	
Approach LOS					C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						35.9		39.1
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						32.0		34.0
Max Q Clear Time (g_c+I1), s						30.6		36.1
Green Ext Time (p_c), s						1.3		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	46.0
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1100	120	1043	1211	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1100	120	1043	1211	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1485	1485	1398	1398	0			
Adj Flow Rate, veh/h				0	1196	104	1134	1316	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	1332	389	1468	1542	0			
Arrive On Green				0.00	0.33	0.33	0.18	0.18	0.00			
Sat Flow, veh/h				0	4189	1184	2663	2796	0			
Grp Volume(v), veh/h				0	1196	104	1134	1316	0			
Grp Sat Flow(s),veh/h/ln				0	1352	1184	1331	1398	0			
Q Serve(g_s), s				0.0	21.1	4.8	30.4	34.2	0.0			
Cycle Q Clear(g_c), s				0.0	21.1	4.8	30.4	34.2	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1332	389	1468	1542	0			
V/C Ratio(X)				0.00	0.90	0.27	0.77	0.85	0.00			
Avail Cap(c_a), veh/h				0	1379	403	1468	1542	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	0.09	0.09	0.00			
Uniform Delay (d), s/veh				0.0	24.0	18.5	26.2	27.7	0.0			
Incr Delay (d2), s/veh				0.0	8.0	0.4	0.4	0.6	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	8.8	1.6	11.3	13.4	0.0			
LnGrp Delay(d),s/veh				0.0	32.0	18.9	26.6	28.3	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1300			2450				
Approach Delay, s/veh					30.9			27.5				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				45.9		29.1		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				40.5		25.5		
Max Q Clear Time (g_c+I1), s				36.2		23.1		
Green Ext Time (p_c), s				3.8		1.6		

Intersection Summary	
HCM 2010 Ctrl Delay	28.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2061	90	0	0	0	0	0	270	80	475	0
Future Volume (veh/h)	0	2061	90	0	0	0	0	0	270	80	475	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1660	1710				0	1573	1620	1748	1748	0
Adj Flow Rate, veh/h	0	2240	91				0	0	277	87	516	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	420	246	565	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.32	0.11	0.11	0.00
Sat Flow, veh/h		0					0	0	1300	1072	1748	0
Grp Volume(v), veh/h		0.0					0	0	277	87	516	0
Grp Sat Flow(s),veh/h/ln							0	0	1300	1072	1748	0
Q Serve(g_s), s							0.0	0.0	13.7	6.0	21.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	13.7	19.7	21.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	420	246	565	0
V/C Ratio(X)							0.00	0.00	0.66	0.35	0.91	0.00
Avail Cap(c_a), veh/h							0	0	440	263	592	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.86	0.86	0.00
Uniform Delay (d), s/veh							0.0	0.0	21.8	38.2	32.5	0.0
Incr Delay (d2), s/veh							0.0	0.0	2.6	0.3	15.7	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	5.2	1.8	13.1	0.0
LnGrp Delay(d),s/veh							0.0	0.0	24.4	38.5	48.2	0.0
LnGrp LOS									C	D	D	
Approach Vol, veh/h								277			603	
Approach Delay, s/veh								24.4			46.8	
Approach LOS								C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				28.8				28.8
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				25.4				25.4
Max Q Clear Time (g_c+I1), s				23.9				15.7
Green Ext Time (p_c), s				0.3				0.6

Intersection Summary	
HCM 2010 Ctrl Delay	39.8
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2301	0	0	0	0	0	225	100	0	0	0
Future Volume (veh/h)	110	2301	0	0	0	0	0	225	100	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1485	0				0	1485	1440			
Adj Flow Rate, veh/h	120	2501	0				0	245	107			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	166	2789	0				0	361	152			
Arrive On Green	0.23	0.23	0.00				0.00	0.18	0.18			
Sat Flow, veh/h	159	3990	0				0	1966	827			
Grp Volume(v), veh/h	927	1694	0				0	183	169			
Grp Sat Flow(s),veh/h/ln	1446	1352	0				0	1485	1308			
Q Serve(g_s), s	39.4	45.6	0.0				0.0	8.6	9.1			
Cycle Q Clear(g_c), s	46.9	45.6	0.0				0.0	8.6	9.1			
Prop In Lane	0.13		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	1065	1890	0				0	273	240			
V/C Ratio(X)	0.87	0.90	0.00				0.00	0.67	0.70			
Avail Cap(c_a), veh/h	1065	1890	0				0	412	363			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.16	0.16	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	26.6	26.2	0.0				0.0	28.5	28.7			
Incr Delay (d2), s/veh	1.7	1.2	0.0				0.0	6.0	7.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	19.3	17.4	0.0				0.0	4.0	3.8			
LnGrp Delay(d),s/veh	28.3	27.4	0.0				0.0	34.5	36.5			
LnGrp LOS	C	C						C	D			
Approach Vol, veh/h		2621						352				
Approach Delay, s/veh		27.8						35.5				
Approach LOS		C						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				18.0		57.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		45.4		
Max Q Clear Time (g_c+I1), s				11.1		48.9		
Green Ext Time (p_c), s				2.0		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	28.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2326	70	0	0	0	0	0	170	70	230	0
Future Volume (veh/h)	0	2326	70	0	0	0	0	0	170	70	230	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.93	0.97		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1382				0	1573	1591	1545	1485	0
Adj Flow Rate, veh/h	0	2528	72				0	0	165	76	250	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	291	216	346	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.23	0.08	0.08	0.00
Sat Flow, veh/h		0					0	0	1247	1036	1485	0
Grp Volume(v), veh/h		0.0					0	0	165	76	250	0
Grp Sat Flow(s),veh/h/ln							0	0	1247	1036	1485	0
Q Serve(g_s), s							0.0	0.0	8.8	5.4	12.3	0.0
Cycle Q Clear(g_c), s							0.0	0.0	8.8	14.2	12.3	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	291	216	346	0
V/C Ratio(X)							0.00	0.00	0.57	0.35	0.72	0.00
Avail Cap(c_a), veh/h							0	0	357	272	426	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.90	0.90	0.00
Uniform Delay (d), s/veh							0.0	0.0	25.4	37.4	32.2	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.7	0.3	2.8	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	3.1	1.6	5.3	0.0
LnGrp Delay(d),s/veh							0.0	0.0	26.1	37.7	35.1	0.0
LnGrp LOS									C	D	D	
Approach Vol, veh/h								165			326	
Approach Delay, s/veh								26.1			35.7	
Approach LOS								C			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs				4				8				
Phs Duration (G+Y+Rc), s				22.0				22.0				
Change Period (Y+Rc), s				4.5				4.5				
Max Green Setting (Gmax), s				21.5				21.5				
Max Q Clear Time (g_c+I1), s				16.2				10.8				
Green Ext Time (p_c), s				0.4				0.3				
Intersection Summary												
HCM 2010 Ctrl Delay			32.5									
HCM 2010 LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	2251	205	0	0	0	0	260	20	50	125	0
Future Volume (veh/h)	100	2251	205	0	0	0	0	260	20	50	125	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	109	2447	210				0	283	13	54	136	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	124	2930	253				0	448	20	156	366	0
Arrive On Green	0.22	0.22	0.22				0.00	0.15	0.15	0.01	0.07	0.00
Sat Flow, veh/h	187	4423	383				0	3147	140	1581	1660	0
Grp Volume(v), veh/h	1013	840	914				0	145	151	54	136	0
Grp Sat Flow(s),veh/h/ln	1738	1590	1664				0	1577	1627	1581	1660	0
Q Serve(g_s), s	42.3	37.5	39.3				0.0	6.5	6.6	0.0	5.9	0.0
Cycle Q Clear(g_c), s	42.3	37.5	39.3				0.0	6.5	6.6	0.0	5.9	0.0
Prop In Lane	0.11		0.23				0.00		0.09	1.00		0.00
Lane Grp Cap(c), veh/h	1152	1054	1103				0	231	238	156	366	0
V/C Ratio(X)	0.88	0.80	0.83				0.00	0.63	0.64	0.35	0.37	0.00
Avail Cap(c_a), veh/h	1152	1054	1103				0	336	347	170	487	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.81	0.81	0.00
Uniform Delay (d), s/veh	26.4	24.5	25.2				0.0	30.1	30.1	35.9	29.8	0.0
Incr Delay (d2), s/veh	1.0	0.6	0.7				0.0	5.9	5.9	2.3	1.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.7	16.7	18.4				0.0	3.2	3.3	1.2	2.8	0.0
LnGrp Delay(d),s/veh	27.4	25.1	25.9				0.0	36.0	36.0	38.2	30.9	0.0
LnGrp LOS	C	C	C					D	D	D	C	
Approach Vol, veh/h		2766						296			190	
Approach Delay, s/veh		26.2						36.0			33.0	
Approach LOS		C						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		54.3		20.7			5.6	15.2
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		44.2		* 22			* 2	* 16
Max Q Clear Time (g_c+I1), s		44.3		7.9			2.0	8.6
Green Ext Time (p_c), s		0.0		0.8			0.0	1.3

Intersection Summary			
HCM 2010 Ctrl Delay			27.5
HCM 2010 LOS			C

Notes

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative + BioMarin Only Conditions**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	37	33	90.5%	19.9	7.3	C
	Through						
	Right Turn						
	Subtotal	37	33	90.5%	19.9	7.3	C
EB	Left Turn	25	27	107.5%	3.3	0.9	A
	Through	2,306	2,305	99.9%	2.7	0.3	A
	Right Turn						
	Subtotal	2,331	2,332	100.0%	2.7	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,368	2,365	99.9%	2.9	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn						
	Through	52	58	111.1%	15.8	4.7	B
	Right Turn	281	278	99.0%	20.1	5.0	C
	Subtotal	333	336	100.9%	19.4	4.6	B
SB	Left Turn	72	70	97.6%	40.2	6.1	D
	Through	442	394	89.2%	35.4	3.0	D
	Right Turn						
	Subtotal	514	464	90.4%	36.0	3.1	D
EB	Left Turn	41	30	73.6%	15.5	5.6	B
	Through	2,277	2,260	99.2%	15.0	2.2	B
	Right Turn	60	57	94.5%	10.9	2.9	B
	Subtotal	2,378	2,347	98.7%	14.9	2.2	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,225	3,147	97.6%	18.5	1.8	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	2450	40	0	0	0	0	111	50	140	270	0
Future Volume (veh/h)	140	2450	40	0	0	0	0	111	50	140	270	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1398	1382	1342	0
Adj Flow Rate, veh/h	152	2663	26				0	121	41	152	293	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	146	2754	656				0	429	353	245	459	0
Arrive On Green	0.19	0.19	0.19				0.00	0.31	0.31	0.10	0.10	0.00
Sat Flow, veh/h	252	4741	1130				0	1398	1149	538	1555	0
Grp Volume(v), veh/h	837	1978	26				0	121	41	229	216	0
Grp Sat Flow(s),veh/h/ln	1385	1202	1130				0	1398	1149	872	1160	0
Q Serve(g_s), s	43.6	40.6	1.4				0.0	4.9	1.9	15.1	13.3	0.0
Cycle Q Clear(g_c), s	43.6	40.6	1.4				0.0	4.9	1.9	20.0	13.3	0.0
Prop In Lane	0.18		1.00				0.00		1.00	0.66		0.00
Lane Grp Cap(c), veh/h	805	2095	656				0	429	353	348	356	0
V/C Ratio(X)	1.04	0.94	0.04				0.00	0.28	0.12	0.66	0.60	0.00
Avail Cap(c_a), veh/h	805	2095	656				0	500	411	399	415	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	29.1	13.3				0.0	19.7	18.7	33.8	29.3	0.0
Incr Delay (d2), s/veh	22.1	1.2	0.0				0.0	0.4	0.1	3.3	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.7	13.8	0.4				0.0	1.9	0.6	5.0	4.5	0.0
LnGrp Delay(d),s/veh	52.4	30.4	13.3				0.0	20.1	18.8	37.1	31.2	0.0
LnGrp LOS	F	C	B					C	B	D	C	
Approach Vol, veh/h		2841						162			445	
Approach Delay, s/veh		36.7						19.7			34.3	
Approach LOS		D						B			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		47.8		27.2				27.2				
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2				
Max Green Setting (Gmax), s		* 40		* 27				* 27				
Max Q Clear Time (g_c+I1), s		45.6		6.9				22.0				
Green Ext Time (p_c), s		0.0		0.6				0.9				
Intersection Summary												
HCM 2010 Ctrl Delay			35.6									
HCM 2010 LOS			D									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	2505	70	0	0	0	0	50	270	100	200	0
Future Volume (veh/h)	50	2505	70	0	0	0	0	50	270	100	200	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1454	1398	1398	0
Adj Flow Rate, veh/h	54	2723	48				0	54	254	109	217	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	52	2794	615				0	360	310	288	360	0
Arrive On Green	0.19	0.19	0.19				0.00	0.26	0.26	0.26	0.26	0.00
Sat Flow, veh/h	91	4910	1081				0	1398	1204	845	1398	0
Grp Volume(v), veh/h	828	1949	48				0	54	254	109	217	0
Grp Sat Flow(s),veh/h/ln	1394	1202	1081				0	1398	1204	845	1398	0
Q Serve(g_s), s	42.7	40.1	2.7				0.0	2.2	14.9	8.6	10.2	0.0
Cycle Q Clear(g_c), s	42.7	40.1	2.7				0.0	2.2	14.9	10.8	10.2	0.0
Prop In Lane	0.07		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	793	2053	615				0	360	310	288	360	0
V/C Ratio(X)	1.04	0.95	0.08				0.00	0.15	0.82	0.38	0.60	0.00
Avail Cap(c_a), veh/h	793	2053	615				0	513	441	381	513	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.5	29.4	14.2				0.0	21.5	26.2	25.7	24.5	0.0
Incr Delay (d2), s/veh	23.8	1.4	0.0				0.0	0.2	8.0	0.8	1.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.7	13.6	0.8				0.0	0.9	5.6	2.1	4.1	0.0
LnGrp Delay(d),s/veh	54.2	30.8	14.3				0.0	21.7	34.2	26.5	26.1	0.0
LnGrp LOS	F	C	B					C	C	C	C	
Approach Vol, veh/h		2825						308			326	
Approach Delay, s/veh		37.4						32.0			26.2	
Approach LOS		D						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		49.2		25.8				25.8
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		34.5		27.5				27.5
Max Q Clear Time (g_c+I1), s		44.7		16.9				12.8
Green Ext Time (p_c), s		0.0		2.4				2.8

Intersection Summary	
HCM 2010 Ctrl Delay	35.8
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1266	1449	0	0	0	0	0	0	220	1060	0
Future Volume (veh/h)	0	1266	1449	0	0	0	0	0	0	220	1060	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1485							1485	1485	0
Adj Flow Rate, veh/h	0	1376	1562							239	1152	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.92	0.92	0.92							0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3							3	3	0
Cap, veh/h	0	2406	1364							406	852	0
Arrive On Green	0.00	0.18	0.18							0.09	0.09	0.00
Sat Flow, veh/h	0	4456	2525							1415	2971	0
Grp Volume(v), veh/h	0	1376	1562							239	1152	0
Grp Sat Flow(s),veh/h/ln	0	1485	1263							1415	1485	0
Q Serve(g_s), s	0.0	21.2	40.5							12.1	21.5	0.0
Cycle Q Clear(g_c), s	0.0	21.2	40.5							12.1	21.5	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2406	1364							406	852	0
V/C Ratio(X)	0.00	0.57	1.15							0.59	1.35	0.00
Avail Cap(c_a), veh/h	0	2406	1364							406	852	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.86	0.86	0.00
Uniform Delay (d), s/veh	0.0	22.9	30.8							29.7	34.0	0.0
Incr Delay (d2), s/veh	0.0	0.1	66.4							1.9	165.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.7	26.7							5.0	28.4	0.0
LnGrp Delay(d),s/veh	0.0	23.0	97.2							31.7	199.4	0.0
LnGrp LOS		C	F							C	F	
Approach Vol, veh/h		2938									1391	
Approach Delay, s/veh		62.4									170.6	
Approach LOS		E									F	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4								
Phs Duration (G+Y+Rc), s		49.0		26.0								
Change Period (Y+Rc), s		8.5		4.5								
Max Green Setting (Gmax), s		40.5		21.5								
Max Q Clear Time (g_c+I1), s		42.5		23.5								
Green Ext Time (p_c), s		0.0		0.0								
Intersection Summary												
HCM 2010 Ctrl Delay			97.2									
HCM 2010 LOS			F									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	776	880	0	0	0	0	0	1488	500	0	0	0
Future Volume (veh/h)	776	880	0	0	0	0	0	1488	500	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1454	1485	0				0	1398	1398			
Adj Flow Rate, veh/h	843	957	0				0	1617	516			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	1292	1180	0				0	2003	567			
Arrive On Green	0.13	0.13	0.00				0.00	0.48	0.48			
Sat Flow, veh/h	2769	2971	0				0	4194	1188			
Grp Volume(v), veh/h	843	957	0				0	1617	516			
Grp Sat Flow(s),veh/h/ln	1385	1485	0				0	1398	1188			
Q Serve(g_s), s	22.1	23.5	0.0				0.0	24.6	30.1			
Cycle Q Clear(g_c), s	22.1	23.5	0.0				0.0	24.6	30.1			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1292	1180	0				0	2003	567			
V/C Ratio(X)	0.65	0.81	0.00				0.00	0.81	0.91			
Avail Cap(c_a), veh/h	1292	1180	0				0	2013	570			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.35	0.35	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	29.2	29.8	0.0				0.0	16.7	18.1			
Incr Delay (d2), s/veh	0.9	2.2	0.0				0.0	2.9	19.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.6	10.0	0.0				0.0	10.0	12.8			
LnGrp Delay(d),s/veh	30.1	32.1	0.0				0.0	19.5	37.5			
LnGrp LOS	C	C						B	D			
Approach Vol, veh/h		1800						2133				
Approach Delay, s/veh		31.2						23.9				
Approach LOS		C						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		34.0		41.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 30		* 36				
Max Q Clear Time (g_c+I1), s		25.5		32.1				
Green Ext Time (p_c), s		3.7		3.7				

Intersection Summary	
HCM 2010 Ctrl Delay	27.2
HCM 2010 LOS	C

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	20	330	50	10	80	220	63	60	299	160	71	221
Future Volume (veh/h)	20	330	50	10	80	220	63	60	299	160	71	221
Number	5	2	12		1	6	16	3	8	18	7	4
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94		1.00		0.97	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2019	2019	2000		1942	1942	2000	1845	1845	1900	1845	1845
Adj Flow Rate, veh/h	22	359	46		87	239	56	65	325	150	77	240
Adj No. of Lanes	1	1	0		1	1	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3		3	3	3	3	3	3	3	3
Cap, veh/h	58	433	56		153	456	107	164	375	173	178	547
Arrive On Green	0.03	0.25	0.25		0.08	0.30	0.30	0.09	0.32	0.32	0.10	0.33
Sat Flow, veh/h	1923	1741	223		1849	1513	354	1757	1182	546	1757	1682
Grp Volume(v), veh/h	22	0	405		87	0	295	65	0	475	77	0
Grp Sat Flow(s),veh/h/ln	1923	0	1965		1849	0	1867	1757	0	1728	1757	0
Q Serve(g_s), s	0.8	0.0	13.3		3.1	0.0	9.0	2.4	0.0	17.7	2.8	0.0
Cycle Q Clear(g_c), s	0.8	0.0	13.3		3.1	0.0	9.0	2.4	0.0	17.7	2.8	0.0
Prop In Lane	1.00		0.11		1.00		0.19	1.00		0.32	1.00	
Lane Grp Cap(c), veh/h	58	0	489		153	0	563	164	0	548	178	0
V/C Ratio(X)	0.38	0.00	0.83		0.57	0.00	0.52	0.40	0.00	0.87	0.43	0.00
Avail Cap(c_a), veh/h	225	0	635		270	0	658	231	0	677	231	0
HCM Platoon Ratio	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00		1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.6	0.0	24.3		30.2	0.0	19.8	29.2	0.0	22.0	28.9	0.0
Incr Delay (d2), s/veh	1.5	0.0	7.0		1.2	0.0	0.8	0.6	0.0	9.8	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	8.2		1.6	0.0	4.7	1.2	0.0	9.9	1.4	0.0
LnGrp Delay(d),s/veh	34.1	0.0	31.3		31.4	0.0	20.6	29.8	0.0	31.7	29.5	0.0
LnGrp LOS	C		C		C		C	C		C	C	
Approach Vol, veh/h		427				382			540			335
Approach Delay, s/veh		31.5				23.0			31.5			21.2
Approach LOS		C				C			C			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.7	21.9	10.4	26.4	6.1	25.5	10.9	25.9
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	22.1	9.0	* 27	8.0	24.1	9.0	* 27
Max Q Clear Time (g_c+I1), s	5.1	15.3	4.4	9.7	2.8	11.0	4.8	19.7
Green Ext Time (p_c), s	0.1	1.0	0.0	0.9	0.0	0.9	0.0	1.3

Intersection Summary			
HCM 2010 Ctrl Delay			27.5
HCM 2010 LOS			C

Notes

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	20
Future Volume (veh/h)	20
Number	14
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.92
Parking Bus, Adj	1.00
Adj Sat Flow, veh/h/ln	1900
Adj Flow Rate, veh/h	18
Adj No. of Lanes	0
Peak Hour Factor	0.92
Percent Heavy Veh, %	3
Cap, veh/h	41
Arrive On Green	0.33
Sat Flow, veh/h	126
Grp Volume(v), veh/h	258
Grp Sat Flow(s),veh/h/ln	1809
Q Serve(g_s), s	7.7
Cycle Q Clear(g_c), s	7.7
Prop In Lane	0.07
Lane Grp Cap(c), veh/h	588
V/C Ratio(X)	0.44
Avail Cap(c_a), veh/h	709
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	18.2
Incr Delay (d2), s/veh	0.5
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	3.9
LnGrp Delay(d),s/veh	18.7
LnGrp LOS	B
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	

Timer

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	585	75	0	740	0	0
Future Volume (vph)	585	75	0	740	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			3.0		
Lane Util. Factor	1.00			1.00		
Frpb, ped/bikes	0.99			1.00		
Flpb, ped/bikes	1.00			1.00		
Frt	0.98			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	1540			1573		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	1540			1573		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	636	82	0	804	0	0
RTOR Reduction (vph)	6	0	0	0	0	0
Lane Group Flow (vph)	712	0	0	804	0	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA		
Protected Phases	2			3 4 6		
Permitted Phases						
Actuated Green, G (s)	34.4			51.8		
Effective Green, g (s)	34.4			46.2		
Actuated g/C Ratio	0.46			0.62		
Clearance Time (s)	5.6					
Vehicle Extension (s)	3.0					
Lane Grp Cap (vph)	706			968		
v/s Ratio Prot	c0.46			c0.51		
v/s Ratio Perm						
v/c Ratio	1.01			0.83		
Uniform Delay, d1	20.3			11.3		
Progression Factor	0.97			0.51		
Incremental Delay, d2	30.6			0.6		
Delay (s)	50.4			6.3		
Level of Service	D			A		
Approach Delay (s)	50.4			6.3	0.0	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	390	50	0	380	0	0	0	0	20	20	30
Future Volume (vph)	0	390	50	0	380	0	0	0	0	20	20	30
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6						5.6	
Lane Util. Factor		1.00			1.00						1.00	
Frpb, ped/bikes		0.99			1.00						0.98	
Flpb, ped/bikes		1.00			1.00						1.00	
Frt		0.98			1.00						0.94	
Flt Protected		1.00			1.00						0.99	
Satd. Flow (prot)		1541			1573						1432	
Flt Permitted		1.00			1.00						0.99	
Satd. Flow (perm)		1541			1573						1432	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	424	54	0	413	0	0	0	0	22	22	33
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	29	0
Lane Group Flow (vph)	0	473	0	0	413	0	0	0	0	0	48	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA					Perm	NA	
Protected Phases		2			4 6						8	
Permitted Phases										8		
Actuated Green, G (s)		39.3			55.7						8.1	
Effective Green, g (s)		39.3			55.7						8.1	
Actuated g/C Ratio		0.52			0.74						0.11	
Clearance Time (s)		5.6									5.6	
Vehicle Extension (s)		3.0									1.5	
Lane Grp Cap (vph)		807			1168						154	
v/s Ratio Prot		c0.31			c0.26							
v/s Ratio Perm											0.03	
v/c Ratio		0.59			0.35						0.31	
Uniform Delay, d1		12.3			3.4						30.9	
Progression Factor		0.57			0.09						0.85	
Incremental Delay, d2		1.8			0.1						0.0	
Delay (s)		8.8			0.4						26.2	
Level of Service		A			A						C	
Approach Delay (s)		8.8			0.4			0.0			26.2	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	6.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	585	0	0	730	10	20
Future Volume (vph)	585	0	0	730	10	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			5.6	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1573			1573	1408	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1573			1573	1408	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	636	0	0	793	11	22
RTOR Reduction (vph)	0	0	0	0	19	0
Lane Group Flow (vph)	636	0	0	793	14	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	52.4			34.4	11.8	
Effective Green, g (s)	47.2			34.4	11.8	
Actuated g/C Ratio	0.63			0.46	0.16	
Clearance Time (s)				5.6		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	989			721	221	
v/s Ratio Prot	c0.40			c0.50	c0.01	
v/s Ratio Perm						
v/c Ratio	0.64			1.10	0.07	
Uniform Delay, d1	8.7			20.3	26.9	
Progression Factor	0.45			1.16	1.05	
Incremental Delay, d2	0.1			57.1	0.0	
Delay (s)	4.0			80.6	28.4	
Level of Service	A			F	C	
Approach Delay (s)	4.0			80.6	28.4	
Approach LOS	A			F	C	

Intersection Summary			
HCM 2000 Control Delay	46.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	410	0	0	350	20	30	10	30	0	0	0
Future Volume (vph)	0	410	0	0	350	20	30	10	30	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.98				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1557			1422				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1557			1422				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	0	0	380	22	33	11	33	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	28	0	0	0	0
Lane Group Flow (vph)	0	446	0	0	400	0	0	49	0	0	0	0
Confl. Peds. (#/hr)	10					10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		53.0			39.3			10.8				
Effective Green, g (s)		53.0			39.3			10.8				
Actuated g/C Ratio		0.71			0.52			0.14				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1111			815			204				
v/s Ratio Prot		c0.28			c0.26			c0.03				
v/s Ratio Perm												
v/c Ratio		0.40			0.49			0.24				
Uniform Delay, d1		4.5			11.4			28.5				
Progression Factor		0.02			0.65			1.26				
Incremental Delay, d2		0.1			2.0			0.1				
Delay (s)		0.1			9.4			36.1				
Level of Service		A			A			D				
Approach Delay (s)		0.1			9.4			36.1			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	500	0	0	420	70	10	10	10	0	0	0
Future Volume (vph)	0	500	0	0	420	70	10	10	10	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1517			1464				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1517			1464				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	543	0	0	457	76	11	11	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	543	0	0	525	0	0	24	0	0	0	0
Confl. Peds. (#/hr)	39		22			39			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		50.3			30.9			13.9				
Effective Green, g (s)		50.3			30.9			13.9				
Actuated g/C Ratio		0.67			0.41			0.19				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1054			625			271				
v/s Ratio Prot		c0.35			c0.35			c0.02				
v/s Ratio Perm												
v/c Ratio		0.52			0.84			0.09				
Uniform Delay, d1		6.2			19.8			25.3				
Progression Factor		0.07			0.98			1.01				
Incremental Delay, d2		0.4			11.5			0.1				
Delay (s)		0.8			30.9			25.7				
Level of Service		A			C			C				
Approach Delay (s)		0.8			30.9			25.7			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	495	20	70	550	70	40	525	60	0	400	320
Future Volume (veh/h)	280	495	20	70	550	70	40	525	60	0	400	320
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.97	0.99		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1676	1676	1710	1676	1676	1710	1800	1694	1728	0	1765	1728
Adj Flow Rate, veh/h	292	516	19	73	573	67	42	547	52	0	417	144
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	2	2
Cap, veh/h	279	943	35	397	551	64	97	1035	96	0	937	319
Arrive On Green	0.17	0.59	0.59	0.75	0.75	0.75	0.77	0.77	0.77	0.00	0.39	0.39
Sat Flow, veh/h	1597	1606	59	819	1469	172	119	2672	248	0	2506	823
Grp Volume(v), veh/h	292	0	535	73	0	640	332	0	309	0	287	274
Grp Sat Flow(s),veh/h/ln	1597	0	1665	819	0	1641	1563	0	1477	0	1676	1565
Q Serve(g_s), s	14.0	0.0	15.6	2.2	0.0	30.0	0.0	0.0	6.5	0.0	10.1	10.4
Cycle Q Clear(g_c), s	14.0	0.0	15.6	2.2	0.0	30.0	5.8	0.0	6.5	0.0	10.1	10.4
Prop In Lane	1.00		0.04	1.00		0.10	0.13		0.17	0.00		0.53
Lane Grp Cap(c), veh/h	279	0	978	397	0	615	656	0	572	0	650	606
V/C Ratio(X)	1.05	0.00	0.55	0.18	0.00	1.04	0.51	0.00	0.54	0.00	0.44	0.45
Avail Cap(c_a), veh/h	279	0	978	397	0	615	656	0	572	0	650	606
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.76	0.00	0.76	0.75	0.00	0.75	0.00	1.00	1.00
Uniform Delay (d), s/veh	33.0	0.0	10.0	6.5	0.0	10.0	6.2	0.0	6.2	0.0	18.1	18.2
Incr Delay (d2), s/veh	66.1	0.0	2.2	0.8	0.0	42.5	2.1	0.0	2.7	0.0	2.2	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.3	0.0	7.7	0.6	0.0	19.9	2.9	0.0	2.8	0.0	5.1	4.9
LnGrp Delay(d),s/veh	99.1	0.0	12.2	7.3	0.0	52.5	8.3	0.0	9.0	0.0	20.3	20.6
LnGrp LOS	F		B	A		F	A		A		C	C
Approach Vol, veh/h		827			713			641			561	
Approach Delay, s/veh		42.9			47.9			8.6			20.4	
Approach LOS		D			D			A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		51.2		35.8	17.0	34.2		35.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 47		24.4	14.0	* 30		24.4
Max Q Clear Time (g_c+I1), s		17.6		8.5	16.0	32.0		12.4
Green Ext Time (p_c), s		5.8		5.2	0.0	0.0		3.8

Intersection Summary		
HCM 2010 Ctrl Delay		31.6
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	50	40	180	0	0	0	0	250	1226	495
Future Volume (vph)	0	490	50	40	180	0	0	0	0	250	1226	495
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.98
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.99			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2769			1781						2992	1321
Flt Permitted		1.00			0.82						0.99	1.00
Satd. Flow (perm)		2769			1474						2992	1321
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	510	52	42	188	0	0	0	0	260	1277	516
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	230	0	0	0	0	0	1537	516
Confl. Peds. (#/hr)			15	15		4			11			
Confl. Bikes (#/hr)			3			3			3			2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		23.8			23.8						47.4	40.4
Effective Green, g (s)		23.8			23.8						47.4	40.4
Actuated g/C Ratio		0.30			0.30						0.59	0.50
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		823			438						1772	667
v/s Ratio Prot		c0.20									c0.51	
v/s Ratio Perm					0.16							0.39
v/c Ratio		0.67			0.53						0.87	0.77
Uniform Delay, d1		24.7			23.4						13.7	16.1
Progression Factor		0.46			0.42						1.00	1.00
Incremental Delay, d2		3.8			3.8						6.0	8.5
Delay (s)		15.2			13.5						19.7	24.6
Level of Service		B			B						B	C
Approach Delay (s)		15.2			13.5			0.0			20.9	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	400	20	320	145	320	20	70	1623	200	60
Future Volume (vph)	400	20	320	145	320	20	70	1623	200	60
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1509	1812	1812	1485			3678	1316	
Flt Permitted		0.62	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		986	1812	1812	1485			3678	1316	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	417	21	333	151	333	21	73	1691	208	62
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	39	0
Lane Group Flow (vph)	0	438	333	151	354	0	0	1764	232	0
Confl. Peds. (#/hr)							8			3
Confl. Bikes (#/hr)					4	4				
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		33.8	33.8	18.8	18.8			37.8	37.8	
Effective Green, g (s)		33.8	33.8	18.8	18.8			37.8	37.8	
Actuated g/C Ratio		0.42	0.42	0.24	0.24			0.47	0.47	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0	
Lane Grp Cap (vph)		487	765	425	348			1737	621	
v/s Ratio Prot		c0.12	0.18	0.08	c0.24					
v/s Ratio Perm		0.26						0.48	0.18	
v/c Ratio		0.90	0.44	0.36	1.02			1.02	0.37	
Uniform Delay, d1		21.5	16.3	25.5	30.6			21.1	13.5	
Progression Factor		0.68	0.77	1.00	1.00			0.48	0.24	
Incremental Delay, d2		13.7	0.3	0.5	52.7			19.2	0.9	
Delay (s)		28.4	12.8	26.1	83.3			29.4	4.2	
Level of Service		C	B	C	F			C	A	
Approach Delay (s)			21.7	66.2				26.1		
Approach LOS			C	E				C		

Intersection Summary			
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	103.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	400	40	30	245	65	60	470	90	90	360	40
Future Volume (veh/h)	90	400	40	30	245	65	60	470	90	90	360	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	1.00		0.97	0.98		0.93	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1412	1560	1530	1412	1500	1530	1440	1500	1469	1440	1500	1469
Adj Flow Rate, veh/h	94	417	38	31	255	56	62	490	76	94	375	34
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	427	622	57	244	525	115	137	933	142	223	812	75
Arrive On Green	0.44	0.44	0.44	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Sat Flow, veh/h	846	1405	128	745	1185	260	189	2110	321	361	1836	170
Grp Volume(v), veh/h	94	0	455	31	0	311	325	0	303	238	0	265
Grp Sat Flow(s),veh/h/ln	846	0	1533	745	0	1446	1339	0	1280	1046	0	1320
Q Serve(g_s), s	6.0	0.0	18.8	2.1	0.0	3.5	0.0	0.0	4.1	0.9	0.0	3.1
Cycle Q Clear(g_c), s	9.5	0.0	18.8	20.9	0.0	3.5	3.5	0.0	4.1	5.1	0.0	3.1
Prop In Lane	1.00		0.08	1.00		0.18	0.19		0.25	0.39		0.13
Lane Grp Cap(c), veh/h	427	0	679	244	0	640	646	0	566	526	0	584
V/C Ratio(X)	0.22	0.00	0.67	0.13	0.00	0.49	0.50	0.00	0.54	0.45	0.00	0.45
Avail Cap(c_a), veh/h	427	0	679	244	0	640	646	0	566	526	0	584
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.97	0.00	0.97	0.82	0.00	0.82	0.68	0.00	0.68
Uniform Delay (d), s/veh	16.3	0.0	17.7	9.8	0.0	2.8	2.8	0.0	2.8	2.7	0.0	2.7
Incr Delay (d2), s/veh	1.2	0.0	5.2	1.0	0.0	2.5	2.3	0.0	3.0	1.9	0.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	8.8	0.5	0.0	1.7	1.7	0.0	1.6	1.1	0.0	1.3
LnGrp Delay(d),s/veh	17.4	0.0	22.9	10.8	0.0	5.3	5.1	0.0	5.8	4.6	0.0	4.5
LnGrp LOS	B		C	B		A	A		A	A		A
Approach Vol, veh/h		549			342			628			503	
Approach Delay, s/veh		22.0			5.8			5.4			4.5	
Approach LOS		C			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.0		40.0		40.0		40.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		35.4		35.4		35.4		35.4
Max Q Clear Time (g_c+I1), s		20.8		6.1		22.9		7.1
Green Ext Time (p_c), s		2.4		3.0		1.2		2.5

Intersection Summary		
HCM 2010 Ctrl Delay		9.8
HCM 2010 LOS		A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	360	190	70	180	0	0	0	0	50	1126	140
Future Volume (vph)	0	360	190	70	180	0	0	0	0	50	1126	140
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1700			1773						4164	1147
Flt Permitted		1.00			0.67						1.00	1.00
Satd. Flow (perm)		1700			1209						4164	1147
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	375	198	73	188	0	0	0	0	52	1173	146
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	566	0	0	261	0	0	0	0	0	1225	146
Confl. Peds. (#/hr)	12		12	12		12			12	12		7
Confl. Bikes (#/hr)			6			4			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		40.8			40.8						30.4	23.4
Effective Green, g (s)		40.8			40.8						30.4	23.4
Actuated g/C Ratio		0.51			0.51						0.38	0.29
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		867			616						1582	335
v/s Ratio Prot		c0.33										
v/s Ratio Perm					0.22						0.29	0.13
v/c Ratio		0.65			0.42						0.77	0.44
Uniform Delay, d1		14.4			12.3						21.8	22.9
Progression Factor		0.33			0.97						0.70	0.77
Incremental Delay, d2		3.5			1.7						1.9	2.1
Delay (s)		8.3			13.6						17.1	19.6
Level of Service		A			B						B	B
Approach Delay (s)		8.3			13.6			0.0			17.3	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	160	0	0	140	120	100	1548	20	0	0	0
Future Volume (veh/h)	270	160	0	0	140	120	100	1548	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.96			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1620	1588	1620			
Adj Flow Rate, veh/h	281	167	0	0	146	120	104	1612	19			
Adj No. of Lanes	1	1	0	0	1	0	0	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	0	2	0			
Cap, veh/h	366	683	0	0	297	244	118	1950	24			
Arrive On Green	0.72	0.72	0.00	0.00	0.43	0.43	0.15	0.15	0.15			
Sat Flow, veh/h	994	1588	0	0	691	568	259	4286	52			
Grp Volume(v), veh/h	281	167	0	0	0	266	632	527	576			
Grp Sat Flow(s),veh/h/ln	994	1588	0	0	0	1259	1575	1445	1577			
Q Serve(g_s), s	22.2	2.9	0.0	0.0	0.0	12.2	31.4	28.2	28.2			
Cycle Q Clear(g_c), s	34.4	2.9	0.0	0.0	0.0	12.2	31.4	28.2	28.2			
Prop In Lane	1.00		0.00	0.00		0.45	0.16		0.03			
Lane Grp Cap(c), veh/h	366	683	0	0	0	541	717	658	717			
V/C Ratio(X)	0.77	0.24	0.00	0.00	0.00	0.49	0.88	0.80	0.80			
Avail Cap(c_a), veh/h	366	683	0	0	0	541	717	658	717			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	0.71	0.71	0.00	0.00	0.00	1.00	0.49	0.49	0.49			
Uniform Delay (d), s/veh	17.6	6.8	0.0	0.0	0.0	16.5	31.9	30.5	30.5			
Incr Delay (d2), s/veh	6.9	0.1	0.0	0.0	0.0	0.7	8.0	5.1	4.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.8	1.3	0.0	0.0	0.0	4.3	15.3	12.2	13.3			
LnGrp Delay(d),s/veh	24.5	7.0	0.0	0.0	0.0	17.2	39.8	35.6	35.2			
LnGrp LOS	C	A				B	D	D	D			
Approach Vol, veh/h		448			266			1735				
Approach Delay, s/veh		18.0			17.2			37.0				
Approach LOS		B			B			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		39.0		41.0		39.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		34.4		36.4		34.4		
Max Q Clear Time (g_c+I1), s		36.4		33.4		14.2		
Green Ext Time (p_c), s		0.0		2.2		1.1		

Intersection Summary	
HCM 2010 Ctrl Delay	31.4
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	245	40	115	280	155	30	430	90	50	310	70
Future Volume (veh/h)	50	245	40	115	280	155	30	430	90	50	310	70
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91	0.97		0.90	0.93		0.83	0.97		0.83
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1588	1525	1620	1588	1588	1620	1620	1588	1555	1620	1588	1555
Adj Flow Rate, veh/h	52	255	34	120	292	135	31	448	73	52	323	52
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	284	647	86	446	493	228	83	934	147	123	719	125
Arrive On Green	0.50	0.50	0.50	0.16	0.16	0.16	0.13	0.13	0.13	0.80	0.80	0.80
Sat Flow, veh/h	861	1300	173	949	991	458	84	2350	370	167	1809	315
Grp Volume(v), veh/h	52	0	289	120	0	427	297	0	255	210	0	217
Grp Sat Flow(s),veh/h/ln	861	0	1473	949	0	1450	1513	0	1291	975	0	1316
Q Serve(g_s), s	4.0	0.0	9.8	9.3	0.0	21.8	0.0	0.0	14.7	4.4	0.0	4.0
Cycle Q Clear(g_c), s	25.8	0.0	9.8	19.1	0.0	21.8	13.9	0.0	14.7	19.0	0.0	4.0
Prop In Lane	1.00		0.12	1.00		0.32	0.10		0.29	0.25		0.24
Lane Grp Cap(c), veh/h	284	0	733	446	0	721	651	0	513	444	0	523
V/C Ratio(X)	0.18	0.00	0.39	0.27	0.00	0.59	0.46	0.00	0.50	0.47	0.00	0.42
Avail Cap(c_a), veh/h	284	0	733	446	0	721	651	0	513	444	0	523
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.93	0.00	0.93	0.80	0.00	0.80	0.80	0.00	0.80
Uniform Delay (d), s/veh	25.6	0.0	12.6	29.3	0.0	25.9	27.0	0.0	27.3	6.7	0.0	5.4
Incr Delay (d2), s/veh	1.4	0.0	1.6	1.4	0.0	3.3	1.9	0.0	2.7	2.9	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	4.3	2.6	0.0	9.4	6.5	0.0	5.6	1.6	0.0	1.6
LnGrp Delay(d),s/veh	27.0	0.0	14.2	30.6	0.0	29.2	28.8	0.0	30.0	9.5	0.0	7.3
LnGrp LOS	C		B	C		C	C		C	A		A
Approach Vol, veh/h		341			547			552			427	
Approach Delay, s/veh		16.1			29.5			29.4			8.4	
Approach LOS		B			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		44.0		36.0		44.0		36.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 40		* 32		* 40		* 32
Max Q Clear Time (g_c+I1), s		27.8		16.7		23.8		21.0
Green Ext Time (p_c), s		2.3		4.3		4.8		2.7

Intersection Summary		
HCM 2010 Ctrl Delay		22.2
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	465	440	0	0	120
Future Volume (vph)	0	465	440	0	0	120
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0	6.0			5.6
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00			0.78
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1588	1588			1074
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1588	1588			1074
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	484	458	0	0	125
RTOR Reduction (vph)	0	0	0	0	0	104
Lane Group Flow (vph)	0	484	458	0	0	21
Confl. Peds. (#/hr)				59		78
Confl. Bikes (#/hr)				14		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		54.9	55.1			13.3
Effective Green, g (s)		54.9	55.1			13.3
Actuated g/C Ratio		0.69	0.69			0.17
Clearance Time (s)						5.6
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1089	1093			178
v/s Ratio Prot		c0.30	c0.29			
v/s Ratio Perm						0.02
v/c Ratio		0.44	0.42			0.12
Uniform Delay, d1		5.7	5.4			28.4
Progression Factor		0.95	0.15			1.00
Incremental Delay, d2		0.3	0.2			0.3
Delay (s)		5.7	1.0			28.6
Level of Service		A	A			C
Approach Delay (s)		5.7	1.0		28.6	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	6.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	285	190	80	260	0	0	0	0	135	1046	205
Future Volume (vph)	0	285	190	80	260	0	0	0	0	135	1046	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.93	1.00	1.00						1.00	0.92
Flpb, ped/bikes		1.00	1.00	0.97	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1172	1609	1535						4143	1102
Flt Permitted		1.00	1.00	0.47	1.00						0.99	1.00
Satd. Flow (perm)		1641	1172	792	1535						4143	1102
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	297	198	83	271	0	0	0	0	141	1090	214
RTOR Reduction (vph)	0	0	37	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	297	161	83	271	0	0	0	0	0	1231	214
Confl. Peds. (#/hr)			51	51		28			11	11		19
Confl. Bikes (#/hr)			10			16			1			1
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		29.8	29.8	29.8	29.8						41.4	34.4
Effective Green, g (s)		29.8	29.8	29.8	29.8						41.4	34.4
Actuated g/C Ratio		0.37	0.37	0.37	0.37						0.52	0.43
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		611	436	295	571						2144	473
v/s Ratio Prot		c0.18			0.18							
v/s Ratio Perm			0.14	0.10							0.30	0.19
v/c Ratio		0.49	0.37	0.28	0.47						0.57	0.45
Uniform Delay, d1		19.2	18.3	17.6	19.1						13.2	16.1
Progression Factor		0.56	0.40	0.93	0.95						0.33	0.47
Incremental Delay, d2		2.5	2.2	2.2	2.6						0.7	2.0
Delay (s)		13.2	9.5	18.5	20.7						5.1	9.7
Level of Service		B	A	B	C						A	A
Approach Delay (s)		11.7			20.2			0.0			5.8	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	230	0	0	210	90	120	1403	170	0	0	0
Future Volume (veh/h)	180	230	0	0	210	90	120	1403	170	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1525	1588	1620			
Adj Flow Rate, veh/h	188	240	0	0	219	83	125	1461	157			
Adj No. of Lanes	1	1	0	0	1	0	1	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	262	631	0	0	374	142	722	1976	212			
Arrive On Green	0.13	0.13	0.00	0.00	0.13	0.13	0.16	0.16	0.16			
Sat Flow, veh/h	963	1588	0	0	941	356	1452	3971	427			
Grp Volume(v), veh/h	188	240	0	0	0	302	125	1063	555			
Grp Sat Flow(s),veh/h/ln	963	1588	0	0	0	1297	1452	1445	1507			
Q Serve(g_s), s	14.3	11.1	0.0	0.0	0.0	17.5	5.9	28.0	28.0			
Cycle Q Clear(g_c), s	31.8	11.1	0.0	0.0	0.0	17.5	5.9	28.0	28.0			
Prop In Lane	1.00		0.00	0.00		0.27	1.00		0.28			
Lane Grp Cap(c), veh/h	262	631	0	0	0	516	722	1438	750			
V/C Ratio(X)	0.72	0.38	0.00	0.00	0.00	0.59	0.17	0.74	0.74			
Avail Cap(c_a), veh/h	262	631	0	0	0	516	722	1438	750			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.87	0.87	0.00	0.00	0.00	1.00	0.35	0.35	0.35			
Uniform Delay (d), s/veh	44.1	25.7	0.0	0.0	0.0	28.6	19.3	28.5	28.5			
Incr Delay (d2), s/veh	13.7	1.5	0.0	0.0	0.0	4.8	0.2	1.2	2.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.2	5.1	0.0	0.0	0.0	7.0	2.4	11.5	12.2			
LnGrp Delay(d),s/veh	57.9	27.3	0.0	0.0	0.0	33.4	19.5	29.7	30.9			
LnGrp LOS	E	C				C	B	C	C			
Approach Vol, veh/h		428			302			1743				
Approach Delay, s/veh		40.7			33.4			29.4				
Approach LOS		D			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		36.0		44.0		36.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 32		* 40		* 32		
Max Q Clear Time (g_c+I1), s		33.8		30.0		19.5		
Green Ext Time (p_c), s		0.0		6.0		1.0		

Intersection Summary	
HCM 2010 Ctrl Delay	31.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	335	1590	0	0	0	0	0	300	60
Future Volume (veh/h)	0	0	0	335	1590	0	0	0	0	0	300	60
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.94
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.82
Adj Sat Flow, veh/h/ln				1530	1500	0				0	1500	1530
Adj Flow Rate, veh/h				349	1656	0				0	312	43
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				510	2183	0				0	462	63
Arrive On Green				0.23	0.23	0.00				0.00	0.20	0.20
Sat Flow, veh/h				645	3301	0				0	2352	309
Grp Volume(v), veh/h				725	1280	0				0	193	162
Grp Sat Flow(s),veh/h/ln				1339	1242	0				0	1425	1161
Q Serve(g_s), s				40.8	38.4	0.0				0.0	10.0	10.3
Cycle Q Clear(g_c), s				40.8	38.4	0.0				0.0	10.0	10.3
Prop In Lane				0.48		0.00				0.00		0.27
Lane Grp Cap(c), veh/h				986	1707	0				0	289	236
V/C Ratio(X)				0.73	0.75	0.00				0.00	0.67	0.69
Avail Cap(c_a), veh/h				986	1707	0				0	417	339
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.45	0.45	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				25.4	24.5	0.0				0.0	29.4	29.5
Incr Delay (d2), s/veh				2.2	1.4	0.0				0.0	2.7	3.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.7	13.6	0.0				0.0	4.1	3.5
LnGrp Delay(d),s/veh				27.7	25.9	0.0				0.0	32.1	33.0
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					2005						355	
Approach Delay, s/veh					26.6						32.5	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		59.2		20.8				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 48		23.4				
Max Q Clear Time (g_c+I1), s		42.8		12.3				
Green Ext Time (p_c), s		3.9		1.1				

Intersection Summary	
HCM 2010 Ctrl Delay	27.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1785	160	150	330	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1785	160	150	330	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1412	1412	1440	1412	0			
Adj Flow Rate, veh/h				0	1859	133	156	344	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	2	2	0			
Cap, veh/h				0	2481	757	247	442	0			
Arrive On Green				0.00	0.21	0.21	0.08	0.08	0.00			
Sat Flow, veh/h				0	3981	1175	700	1822	0			
Grp Volume(v), veh/h				0	1859	133	270	230	0			
Grp Sat Flow(s),veh/h/ln				0	1285	1175	1237	1220	0			
Q Serve(g_s), s				0.0	36.1	7.4	16.9	14.7	0.0			
Cycle Q Clear(g_c), s				0.0	36.1	7.4	17.3	14.7	0.0			
Prop In Lane				0.00		1.00	0.58		0.00			
Lane Grp Cap(c), veh/h				0	2481	757	382	307	0			
V/C Ratio(X)				0.00	0.75	0.18	0.71	0.75	0.00			
Avail Cap(c_a), veh/h				0	2481	757	408	333	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	0.27	0.27	0.74	0.74	0.00			
Uniform Delay (d), s/veh				0.0	25.5	14.1	35.4	34.2	0.0			
Incr Delay (d2), s/veh				0.0	0.6	0.1	3.9	6.3	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	13.0	2.4	6.3	5.5	0.0			
LnGrp Delay(d),s/veh				0.0	26.0	14.3	39.3	40.6	0.0			
LnGrp LOS					C	B	D	D				
Approach Vol, veh/h					1992			500				
Approach Delay, s/veh					25.3			39.9				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		55.7		24.3				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 50		* 22				
Max Q Clear Time (g_c+I1), s		38.1		19.3				
Green Ext Time (p_c), s		8.0		0.6				

Intersection Summary	
HCM 2010 Ctrl Delay	28.2
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	195	1850	0	0	0	0	0	290	100
Future Volume (veh/h)	0	0	0	195	1850	0	0	0	0	0	290	100
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.85
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1412	0				0	1412	1440
Adj Flow Rate, veh/h				203	1927	0				0	302	95
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				272	2176	0				0	446	134
Arrive On Green				0.22	0.22	0.00				0.00	0.24	0.24
Sat Flow, veh/h				330	3453	0				0	1904	552
Grp Volume(v), veh/h				786	1344	0				0	217	180
Grp Sat Flow(s),veh/h/ln				1329	1169	0				0	1341	1044
Q Serve(g_s), s				44.3	44.5	0.0				0.0	11.7	12.6
Cycle Q Clear(g_c), s				46.1	44.5	0.0				0.0	11.7	12.6
Prop In Lane				0.26		0.00				0.00		0.53
Lane Grp Cap(c), veh/h				923	1524	0				0	326	254
V/C Ratio(X)				0.85	0.88	0.00				0.00	0.67	0.71
Avail Cap(c_a), veh/h				923	1524	0				0	389	303
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.46	0.46	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				29.0	28.4	0.0				0.0	27.3	27.7
Incr Delay (d2), s/veh				4.8	3.8	0.0				0.0	3.3	6.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				18.2	15.3	0.0				0.0	4.6	4.0
LnGrp Delay(d),s/veh				33.8	32.2	0.0				0.0	30.7	33.7
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					2130						397	
Approach Delay, s/veh					32.8						32.0	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		56.4		23.6				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 48		* 23				
Max Q Clear Time (g_c+I1), s		48.1		14.6				
Green Ext Time (p_c), s		0.2		1.1				

Intersection Summary	
HCM 2010 Ctrl Delay	32.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	80	1695	100	260	175	0	0	180	50
Future Volume (veh/h)	0	0	0	80	1695	100	260	175	0	0	180	50
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				83	1766	96	271	182	0	0	188	38
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				108	2452	137	315	666	0	0	275	56
Arrive On Green				0.53	0.53	0.53	0.03	0.12	0.00	0.00	0.21	0.21
Sat Flow, veh/h				203	4590	257	1765	1853	0	0	1308	264
Grp Volume(v), veh/h				717	597	631	271	182	0	0	0	226
Grp Sat Flow(s),veh/h/ln				1755	1606	1690	1765	1853	0	0	0	1572
Q Serve(g_s), s				25.8	22.0	22.2	5.3	7.2	0.0	0.0	0.0	10.6
Cycle Q Clear(g_c), s				25.8	22.0	22.2	5.3	7.2	0.0	0.0	0.0	10.6
Prop In Lane				0.12		0.15	1.00		0.00	0.00		0.17
Lane Grp Cap(c), veh/h				937	858	903	315	666	0	0	0	330
V/C Ratio(X)				0.77	0.70	0.70	0.86	0.27	0.00	0.00	0.00	0.68
Avail Cap(c_a), veh/h				937	858	903	327	718	0	0	0	364
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.73	0.73	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				14.7	13.8	13.9	35.8	25.7	0.0	0.0	0.0	29.2
Incr Delay (d2), s/veh				5.9	4.6	4.5	16.4	0.3	0.0	0.0	0.0	6.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				13.9	10.7	11.3	7.4	3.7	0.0	0.0	0.0	5.2
LnGrp Delay(d),s/veh				20.6	18.5	18.3	52.2	26.1	0.0	0.0	0.0	35.9
LnGrp LOS				C	B	B	D	C				D
Approach Vol, veh/h					1945			453			226	
Approach Delay, s/veh					19.2			41.7			35.9	
Approach LOS					B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			11.5	21.3		47.2		32.8
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			8.0	18.5		40.5		31.0
Max Q Clear Time (g_c+I1), s			7.3	12.6		27.8		9.2
Green Ext Time (p_c), s			0.1	0.8		11.1		1.4

Intersection Summary			
HCM 2010 Ctrl Delay			24.5
HCM 2010 LOS			C

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **Cumulative Plus BioMarin Only Conditions**
Volume and Delay by Movement **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	41	37	90.8%	15.9	7.3	C
	Through	5	3	69.1%	12.7	16.4	B
	Right Turn						
	Subtotal	46	41	88.5%	16.1	6.6	C
SB	Left Turn						
	Through	15	18	122.9%	34.6	12.8	D
	Right Turn	10	9	92.2%	14.7	9.9	B
	Subtotal	25	28	110.6%	29.0	11.6	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	65	72	110.5%	3.4	0.4	A
	Through	1,829	1,817	99.4%	3.1	0.6	A
	Right Turn	10	6	61.4%	2.1	0.4	A
	Subtotal	1,904	1,895	99.5%	3.1	0.6	A
Total		1,975	1,964	99.4%	3.7	0.6	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	129	129	100.3%	32.3	3.4	C
	Through	20	27	134.4%	34.5	9.3	C
	Right Turn						
	Subtotal	149	156	104.9%	32.7	3.8	C
SB	Left Turn						
	Through	50	50	99.8%	30.4	9.7	C
	Right Turn	10	8	80.6%	18.9	14.5	B
	Subtotal	60	58	96.6%	29.7	8.3	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	253	104.7%	9.3	1.4	A
	Through	1,852	1,822	98.4%	8.2	1.5	A
	Right Turn	40	41	102.7%	8.1	3.6	A
	Subtotal	2,134	2,117	99.2%	8.3	1.4	A
Total		2,343	2,331	99.5%	10.6	1.6	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	110	1814	150	50	345	0	0	285	160
Future Volume (veh/h)	0	0	0	110	1814	150	50	345	0	0	285	160
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.98		1.00	1.00		0.82
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1620	1588	1620	1620	1588	0	0	1525	1555
Adj Flow Rate, veh/h				115	1890	145	52	359	0	0	297	161
Adj No. of Lanes				0	3	0	0	2	0	0	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				132	2293	180	102	668	0	0	536	274
Arrive On Green				0.19	0.19	0.19	0.62	0.62	0.00	0.00	0.10	0.10
Sat Flow, veh/h				229	3984	313	145	2215	0	0	1796	878
Grp Volume(v), veh/h				793	661	696	201	210	0	0	247	211
Grp Sat Flow(s),veh/h/ln				1577	1445	1503	915	1373	0	0	1448	1150
Q Serve(g_s), s				39.1	34.9	35.4	3.9	6.7	0.0	0.0	13.0	14.0
Cycle Q Clear(g_c), s				39.1	34.9	35.4	17.9	6.7	0.0	0.0	13.0	14.0
Prop In Lane				0.14		0.21	0.26		0.00	0.00		0.76
Lane Grp Cap(c), veh/h				908	832	866	342	428	0	0	452	359
V/C Ratio(X)				0.87	0.79	0.80	0.59	0.49	0.00	0.00	0.55	0.59
Avail Cap(c_a), veh/h				936	858	893	342	428	0	0	452	359
HCM Platoon Ratio				0.33	0.33	0.33	2.00	2.00	1.00	1.00	0.33	0.33
Upstream Filter(I)				0.29	0.29	0.29	1.00	1.00	0.00	0.00	0.88	0.88
Uniform Delay (d), s/veh				29.6	27.9	28.1	12.6	11.6	0.0	0.0	30.5	31.0
Incr Delay (d2), s/veh				2.9	1.5	1.6	7.2	4.0	0.0	0.0	4.2	6.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.8	14.3	15.2	2.8	2.9	0.0	0.0	5.7	5.1
LnGrp Delay(d),s/veh				32.5	29.4	29.7	19.8	15.6	0.0	0.0	34.7	37.1
LnGrp LOS				C	C	C	B	B			C	D
Approach Vol, veh/h					2150			411			458	
Approach Delay, s/veh					30.6			17.7			35.8	
Approach LOS					C			B			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				29.4		50.6		29.4
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				23.5		47.5		23.5
Max Q Clear Time (g_c+I1), s				19.9		41.1		16.0
Green Ext Time (p_c), s				0.6		4.9		1.3

Intersection Summary			
HCM 2010 Ctrl Delay			29.6
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	350	1934	50	125	55	0	0	0	0
Future Volume (vph)	0	0	0	350	1934	50	125	55	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6				
Lane Util. Factor					0.91		1.00	1.00				
Frpb, ped/bikes					1.00		1.00	1.00				
Flpb, ped/bikes					0.96		0.96	1.00				
Frt					1.00		1.00	1.00				
Flt Protected					0.99		0.95	1.00				
Satd. Flow (prot)					3667		1098	1249				
Flt Permitted					0.99		0.95	1.00				
Satd. Flow (perm)					3667		1098	1249				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	365	2015	52	130	57	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2429	0	130	57	0	0	0	0
Confl. Peds. (#/hr)			106	106		44	30		69			30
Confl. Bikes (#/hr)						2			3			8
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA				
Protected Phases					6			4				
Permitted Phases				6			4					
Actuated Green, G (s)					51.8		19.0	19.0				
Effective Green, g (s)					51.8		19.0	19.0				
Actuated g/C Ratio					0.58		0.21	0.21				
Clearance Time (s)					11.6		7.6	7.6				
Vehicle Extension (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					2110		231	263				
v/s Ratio Prot								0.05				
v/s Ratio Perm					0.66		c0.12					
v/c Ratio					1.15		0.56	0.22				
Uniform Delay, d1					19.1		31.8	29.3				
Progression Factor					1.00		1.00	1.00				
Incremental Delay, d2					74.1		5.1	0.9				
Delay (s)					93.2		36.9	30.2				
Level of Service					F		D	C				
Approach Delay (s)		0.0			93.2			34.8			0.0	
Approach LOS		A			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	89.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	163.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	510	1728	0	0	0	0	0	725	591
Future Volume (veh/h)	0	0	0	510	1728	0	0	0	0	0	725	591
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1560	1588	0				0	1588	1500
Adj Flow Rate, veh/h				531	1800	0				0	755	608
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				716	2009	0				0	2020	509
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1486	4765	0				0	4479	1093
Grp Volume(v), veh/h				531	1800	0				0	755	608
Grp Sat Flow(s),veh/h/ln				1486	1588	0				0	1445	1093
Q Serve(g_s), s				27.9	29.7	0.0				0.0	12.5	37.3
Cycle Q Clear(g_c), s				27.9	29.7	0.0				0.0	12.5	37.3
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				716	2009	0				0	2020	509
V/C Ratio(X)				0.74	0.90	0.00				0.00	0.37	1.19
Avail Cap(c_a), veh/h				721	2025	0				0	2020	509
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				0.09	0.09	0.00				0.00	0.83	0.83
Uniform Delay (d), s/veh				31.9	32.7	0.0				0.0	23.4	33.9
Incr Delay (d2), s/veh				0.4	0.6	0.0				0.0	0.4	102.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.6	13.2	0.0				0.0	5.1	25.8
LnGrp Delay(d),s/veh				32.3	33.3	0.0				0.0	23.8	136.5
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2331						1363	
Approach Delay, s/veh					33.1						74.1	
Approach LOS					C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						37.7		42.3
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						34.0		37.0
Max Q Clear Time (g_c+I1), s						31.7		39.3
Green Ext Time (p_c), s						2.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	48.2
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1235	210	998	1483	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1235	210	998	1483	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.93	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1500	1500	1398	1398	0			
Adj Flow Rate, veh/h				0	1286	200	1127	1424	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	3	3	0			
Cap, veh/h				0	1254	363	1548	1625	0			
Arrive On Green				0.00	0.31	0.31	0.19	0.19	0.00			
Sat Flow, veh/h				0	4230	1184	2663	2796	0			
Grp Volume(v), veh/h				0	1286	200	1127	1424	0			
Grp Sat Flow(s),veh/h/ln				0	1365	1184	1331	1398	0			
Q Serve(g_s), s				0.0	24.5	11.3	31.8	39.6	0.0			
Cycle Q Clear(g_c), s				0.0	24.5	11.3	31.8	39.6	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1254	363	1548	1625	0			
V/C Ratio(X)				0.00	1.03	0.55	0.73	0.88	0.00			
Avail Cap(c_a), veh/h				0	1254	363	1548	1625	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	0.09	0.09	0.00			
Uniform Delay (d), s/veh				0.0	27.8	23.2	26.4	29.5	0.0			
Incr Delay (d2), s/veh				0.0	32.1	1.8	0.3	0.7	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	12.9	3.8	11.8	15.5	0.0			
LnGrp Delay(d),s/veh				0.0	59.8	25.0	26.7	30.2	0.0			
LnGrp LOS					F	C	C	C				
Approach Vol, veh/h					1486			2551				
Approach Delay, s/veh					55.1			28.7				
Approach LOS					E			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				51.0		29.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				46.5		24.5		
Max Q Clear Time (g_c+I1), s				41.6		26.5		
Green Ext Time (p_c), s				4.3		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	38.4
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1626	110	0	0	0	0	0	435	185	470	0
Future Volume (veh/h)	0	1626	110	0	0	0	0	0	435	185	470	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.96	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1676	1710				0	1588	1620	1765	1765	0
Adj Flow Rate, veh/h	0	1694	106				0	0	439	193	490	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	575	238	781	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.44	0.15	0.15	0.00
Sat Flow, veh/h		0					0	0	1300	933	1765	0
Grp Volume(v), veh/h		0.0					0	0	439	193	490	0
Grp Sat Flow(s),veh/h/ln							0	0	1300	933	1765	0
Q Serve(g_s), s							0.0	0.0	22.7	12.7	20.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	22.7	35.4	20.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	575	238	781	0
V/C Ratio(X)							0.00	0.00	0.76	0.81	0.63	0.00
Avail Cap(c_a), veh/h							0	0	575	238	781	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.74	0.74	0.00
Uniform Delay (d), s/veh							0.0	0.0	18.8	47.0	28.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	5.4	13.7	0.9	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	8.9	5.2	10.4	0.0
LnGrp Delay(d),s/veh							0.0	0.0	24.2	60.7	28.9	0.0
LnGrp LOS									C	E	C	
Approach Vol, veh/h								439			683	
Approach Delay, s/veh								24.2			37.9	
Approach LOS								C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				40.0				40.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				35.4				35.4
Max Q Clear Time (g_c+I1), s				37.4				24.7
Green Ext Time (p_c), s				0.0				1.1

Intersection Summary	
HCM 2010 Ctrl Delay	32.5
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	200	2051	0	0	0	0	0	260	120	0	0	0
Future Volume (veh/h)	200	2051	0	0	0	0	0	260	120	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1500	0				0	1500	1440			
Adj Flow Rate, veh/h	208	2136	0				0	271	117			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	299	2663	0				0	376	157			
Arrive On Green	0.23	0.23	0.00				0.00	0.19	0.19			
Sat Flow, veh/h	346	3798	0				0	1992	833			
Grp Volume(v), veh/h	818	1526	0				0	202	186			
Grp Sat Flow(s),veh/h/ln	1414	1365	0				0	1500	1325			
Q Serve(g_s), s	42.0	42.1	0.0				0.0	10.1	10.6			
Cycle Q Clear(g_c), s	44.0	42.1	0.0				0.0	10.1	10.6			
Prop In Lane	0.25		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	1048	1914	0				0	283	250			
V/C Ratio(X)	0.78	0.80	0.00				0.00	0.71	0.74			
Avail Cap(c_a), veh/h	1048	1914	0				0	390	344			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.37	0.37	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	26.0	25.4	0.0				0.0	30.4	30.6			
Incr Delay (d2), s/veh	2.2	1.3	0.0				0.0	7.2	9.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	17.9	16.3	0.0				0.0	4.7	4.6			
LnGrp Delay(d),s/veh	28.2	26.7	0.0				0.0	37.6	40.4			
LnGrp LOS	C	C						D	D			
Approach Vol, veh/h		2344						388				
Approach Delay, s/veh		27.2						39.0				
Approach LOS		C						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				19.3		60.7		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		50.4		
Max Q Clear Time (g_c+I1), s				12.6		46.0		
Green Ext Time (p_c), s				2.0		4.3		

Intersection Summary		
HCM 2010 Ctrl Delay		28.9
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2086	90	0	0	0	0	0	250	210	290	0
Future Volume (veh/h)	0	2086	90	0	0	0	0	0	250	210	290	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.90	0.97		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1382				0	1588	1591	1560	1500	0
Adj Flow Rate, veh/h	0	2173	88				0	0	243	219	302	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	359	205	441	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.29	0.10	0.10	0.00
Sat Flow, veh/h		0					0	0	1221	974	1500	0
Grp Volume(v), veh/h		0.0					0	0	243	219	302	0
Grp Sat Flow(s),veh/h/ln							0	0	1221	974	1500	0
Q Serve(g_s), s							0.0	0.0	14.0	9.5	15.6	0.0
Cycle Q Clear(g_c), s							0.0	0.0	14.0	23.5	15.6	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	359	205	441	0
V/C Ratio(X)							0.00	0.00	0.68	1.07	0.69	0.00
Avail Cap(c_a), veh/h							0	0	359	205	441	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.68	0.68	0.00
Uniform Delay (d), s/veh							0.0	0.0	24.9	45.2	32.5	0.0
Incr Delay (d2), s/veh							0.0	0.0	4.2	70.9	2.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	5.1	8.6	6.8	0.0
LnGrp Delay(d),s/veh							0.0	0.0	29.1	116.1	35.1	0.0
LnGrp LOS									C	F	D	
Approach Vol, veh/h								243			521	
Approach Delay, s/veh								29.1			69.1	
Approach LOS								C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				28.0				28.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				23.5				23.5
Max Q Clear Time (g_c+I1), s				25.5				16.0
Green Ext Time (p_c), s				0.0				0.4

Intersection Summary	
HCM 2010 Ctrl Delay	56.4
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2251	185	0	0	0	0	335	30	120	140	0
Future Volume (veh/h)	110	2251	185	0	0	0	0	335	30	120	140	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.90	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	115	2345	182				0	349	23	125	146	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	134	2881	227				0	516	34	161	431	0
Arrive On Green	0.21	0.21	0.21				0.00	0.17	0.17	0.01	0.08	0.00
Sat Flow, veh/h	208	4483	353				0	3096	197	1597	1744	0
Grp Volume(v), veh/h	969	804	869				0	183	189	125	146	0
Grp Sat Flow(s),veh/h/ln	1754	1606	1684				0	1593	1616	1597	1744	0
Q Serve(g_s), s	42.6	37.8	39.2				0.0	8.6	8.8	0.0	6.3	0.0
Cycle Q Clear(g_c), s	42.6	37.8	39.2				0.0	8.6	8.8	0.0	6.3	0.0
Prop In Lane	0.12		0.21				0.00		0.12	1.00		0.00
Lane Grp Cap(c), veh/h	1127	1032	1082				0	273	277	161	431	0
V/C Ratio(X)	0.86	0.78	0.80				0.00	0.67	0.68	0.77	0.34	0.00
Avail Cap(c_a), veh/h	1127	1032	1082				0	321	325	164	482	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.16	0.16	0.16				0.00	1.00	1.00	0.63	0.63	0.00
Uniform Delay (d), s/veh	28.0	26.2	26.7				0.0	31.0	31.1	38.4	30.6	0.0
Incr Delay (d2), s/veh	1.5	1.0	1.1				0.0	7.0	7.3	15.6	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.1	17.1	18.6				0.0	4.3	4.4	3.5	3.1	0.0
LnGrp Delay(d),s/veh	29.5	27.1	27.8				0.0	38.0	38.4	54.0	31.2	0.0
LnGrp LOS	C	C	C					D	D	D	C	
Approach Vol, veh/h		2642						372			271	
Approach Delay, s/veh		28.2						38.2			41.7	
Approach LOS		C						D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		56.0		24.0			6.1	17.9
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		49.1		* 22			* 2	* 16
Max Q Clear Time (g_c+I1), s		44.6		8.3			2.0	10.8
Green Ext Time (p_c), s		4.5		0.8			0.0	1.3

Intersection Summary			
HCM 2010 Ctrl Delay			30.5
HCM 2010 LOS			C

Notes

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative Plus BioMarin Only Conditions**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	94	96	102.5%	29.9	7.1	D
	Through						
	Right Turn						
	Subtotal	94	96	102.5%	29.9	7.1	D
EB	Left Turn	45	40	89.6%	3.1	0.4	A
	Through	2,391	2,383	99.7%	2.7	0.2	A
	Right Turn						
	Subtotal	2,436	2,423	99.5%	2.7	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,530	2,519	99.6%	3.8	0.6	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	89	87	97.5%	18.4	3.4	B
	Right Turn	433	435	100.6%	31.4	8.8	C
	Subtotal	522	522	100.0%	29.3	7.9	C
SB	Left Turn	117	115	98.1%	31.4	11.3	C
	Through	180	195	108.2%	19.3	4.9	B
	Right Turn						
	Subtotal	297	310	104.2%	23.7	6.6	C
EB	Left Turn	60	65	108.2%	20.4	3.5	C
	Through	2,353	2,307	98.1%	19.9	2.4	B
	Right Turn	42	38	91.4%	16.4	3.5	B
	Subtotal	2,455	2,411	98.2%	19.8	2.4	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,274	3,242	99.0%	21.7	2.2	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	2547	61	0	0	0	0	210	140	150	190	0
Future Volume (veh/h)	235	2547	61	0	0	0	0	210	140	150	190	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1412	1382	1355	0
Adj Flow Rate, veh/h	245	2653	43				0	219	134	156	198	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	222	2597	657				0	473	389	246	409	0
Arrive On Green	0.18	0.18	0.18				0.00	0.34	0.34	0.67	0.67	0.00
Sat Flow, veh/h	397	4637	1172				0	1412	1161	477	1281	0
Grp Volume(v), veh/h	859	2039	43				0	219	134	169	185	0
Grp Sat Flow(s),veh/h/ln	1392	1214	1172				0	1412	1161	525	1172	0
Q Serve(g_s), s	44.8	44.8	2.4				0.0	9.8	6.9	15.9	6.1	0.0
Cycle Q Clear(g_c), s	44.8	44.8	2.4				0.0	9.8	6.9	25.6	6.1	0.0
Prop In Lane	0.29		1.00				0.00		1.00	0.92		0.00
Lane Grp Cap(c), veh/h	779	2040	657				0	473	389	262	393	0
V/C Ratio(X)	1.10	1.00	0.07				0.00	0.46	0.34	0.64	0.47	0.00
Avail Cap(c_a), veh/h	779	2040	657				0	473	389	262	393	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.6	32.6	15.3				0.0	20.9	20.0	17.5	9.8	0.0
Incr Delay (d2), s/veh	48.2	5.9	0.0				0.0	0.7	0.5	5.3	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.7	16.1	0.8				0.0	3.9	2.3	4.0	1.9	0.0
LnGrp Delay(d),s/veh	80.8	38.5	15.4				0.0	21.6	20.5	22.8	10.7	0.0
LnGrp LOS	F	D	B					C	C	C	B	
Approach Vol, veh/h		2941						353			354	
Approach Delay, s/veh		50.5						21.2			16.4	
Approach LOS		D						C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		49.0		31.0				31.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2				
Max Green Setting (Gmax), s		* 45		* 27				* 27				
Max Q Clear Time (g_c+I1), s		46.8		11.8				27.6				
Green Ext Time (p_c), s		0.0		1.3				0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			44.4									
HCM 2010 LOS			D									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	2677	120	0	0	0	0	150	370	85	255	0
Future Volume (veh/h)	40	2677	120	0	0	0	0	150	370	85	255	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1468	1412	1412	0
Adj Flow Rate, veh/h	42	2789	80				0	156	351	89	266	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	37	2599	582				0	446	384	254	446	0
Arrive On Green	0.17	0.17	0.17				0.00	0.32	0.32	0.32	0.32	0.00
Sat Flow, veh/h	70	4981	1116				0	1412	1217	710	1412	0
Grp Volume(v), veh/h	845	1986	80				0	156	351	89	266	0
Grp Sat Flow(s),veh/h/ln	1408	1214	1116				0	1412	1217	710	1412	0
Q Serve(g_s), s	41.7	41.7	4.9				0.0	6.8	22.2	8.8	12.7	0.0
Cycle Q Clear(g_c), s	41.7	41.7	4.9				0.0	6.8	22.2	15.6	12.7	0.0
Prop In Lane	0.05		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	735	1901	582				0	446	384	254	446	0
V/C Ratio(X)	1.15	1.05	0.14				0.00	0.35	0.91	0.35	0.60	0.00
Avail Cap(c_a), veh/h	735	1901	582				0	468	403	265	468	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.10	0.10	0.10				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	33.1	33.1	17.8				0.0	21.1	26.3	27.1	23.1	0.0
Incr Delay (d2), s/veh	68.9	22.3	0.0				0.0	0.5	24.3	0.8	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.3	17.9	1.5				0.0	2.7	10.0	1.8	5.2	0.0
LnGrp Delay(d),s/veh	102.1	55.4	17.9				0.0	21.5	50.7	27.9	25.0	0.0
LnGrp LOS	F	F	B					C	D	C	C	
Approach Vol, veh/h		2911						507			355	
Approach Delay, s/veh		67.9						41.7			25.7	
Approach LOS		E						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		48.2		31.8				31.8
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		40.5		26.5				26.5
Max Q Clear Time (g_c+I1), s		43.7		24.2				17.6
Green Ext Time (p_c), s		0.0		1.1				3.0

Intersection Summary	
HCM 2010 Ctrl Delay	60.4
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1968	1159	0	0	0	0	0	0	390	845	0
Future Volume (veh/h)	0	1968	1159	0	0	0	0	0	0	390	845	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1500							1500	1500	0
Adj Flow Rate, veh/h	0	2050	1176							406	880	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.96	0.96	0.96							0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2							2	2	0
Cap, veh/h	0	2303	1305							465	977	0
Arrive On Green	0.00	0.17	0.17							0.11	0.11	0.00
Sat Flow, veh/h	0	4500	2550							1429	3000	0
Grp Volume(v), veh/h	0	2050	1176							406	880	0
Grp Sat Flow(s),veh/h/ln	0	1500	1275							1429	1500	0
Q Serve(g_s), s	0.0	35.6	36.2							22.4	23.2	0.0
Cycle Q Clear(g_c), s	0.0	35.6	36.2							22.4	23.2	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2303	1305							465	977	0
V/C Ratio(X)	0.00	0.89	0.90							0.87	0.90	0.00
Avail Cap(c_a), veh/h	0	2303	1305							473	994	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.90	0.90	0.00
Uniform Delay (d), s/veh	0.0	31.0	31.3							34.1	34.4	0.0
Incr Delay (d2), s/veh	0.0	0.6	1.1							14.7	10.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	14.9	13.0							10.8	11.0	0.0
LnGrp Delay(d),s/veh	0.0	31.6	32.4							48.8	44.5	0.0
LnGrp LOS		C	C							D	D	
Approach Vol, veh/h		3226									1286	
Approach Delay, s/veh		31.9									45.8	
Approach LOS		C									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		49.4		30.6				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		40.5		26.5				
Max Q Clear Time (g_c+I1), s		38.2		25.2				
Green Ext Time (p_c), s		2.3		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	35.9
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1013	1395	0	0	0	0	0	1488	600	0	0	0
Future Volume (veh/h)	1013	1395	0	0	0	0	0	1488	600	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1468	1500	0				0	1412	1412			
Adj Flow Rate, veh/h	1095	1397	0				0	1653	540			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	1466	1380	0				0	1789	495			
Arrive On Green	0.15	0.15	0.00				0.00	0.42	0.42			
Sat Flow, veh/h	2797	3000	0				0	4235	1172			
Grp Volume(v), veh/h	1095	1397	0				0	1653	540			
Grp Sat Flow(s),veh/h/ln	1398	1500	0				0	1412	1172			
Q Serve(g_s), s	30.5	36.8	0.0				0.0	29.6	33.8			
Cycle Q Clear(g_c), s	30.5	36.8	0.0				0.0	29.6	33.8			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1466	1380	0				0	1789	495			
V/C Ratio(X)	0.75	1.01	0.00				0.00	0.92	1.09			
Avail Cap(c_a), veh/h	1466	1380	0				0	1789	495			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.09	0.09	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	31.3	33.9	0.0				0.0	21.9	23.1			
Incr Delay (d2), s/veh	0.3	10.6	0.0				0.0	8.9	67.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	11.9	17.3	0.0				0.0	13.0	20.1			
LnGrp Delay(d),s/veh	31.6	44.5	0.0				0.0	30.8	90.4			
LnGrp LOS	C	F						C	F			
Approach Vol, veh/h		2492						2193				
Approach Delay, s/veh		38.8						45.5				
Approach LOS		D						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		41.0		39.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 37		* 34				
Max Q Clear Time (g_c+I1), s		38.8		35.8				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary			
HCM 2010 Ctrl Delay			41.9
HCM 2010 LOS			D

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	300	40	80	300	51	70	236	180	102	139	30
Future Volume (veh/h)	20	300	40	80	300	51	70	236	180	102	139	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		0.96	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2039	2039	2000	1961	1961	2000	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	21	312	36	83	312	46	73	246	155	106	145	22
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	57	401	46	160	466	69	255	310	195	215	426	65
Arrive On Green	0.03	0.22	0.22	0.09	0.28	0.28	0.14	0.30	0.30	0.12	0.27	0.27
Sat Flow, veh/h	1942	1786	206	1867	1661	245	1774	1050	662	1774	1562	237
Grp Volume(v), veh/h	21	0	348	83	0	358	73	0	401	106	0	167
Grp Sat Flow(s),veh/h/ln	1942	0	1992	1867	0	1906	1774	0	1712	1774	0	1800
Q Serve(g_s), s	0.7	0.0	10.3	2.7	0.0	10.4	2.3	0.0	13.5	3.5	0.0	4.7
Cycle Q Clear(g_c), s	0.7	0.0	10.3	2.7	0.0	10.4	2.3	0.0	13.5	3.5	0.0	4.7
Prop In Lane	1.00		0.10	1.00		0.13	1.00		0.39	1.00		0.13
Lane Grp Cap(c), veh/h	57	0	447	160	0	535	255	0	506	215	0	490
V/C Ratio(X)	0.37	0.00	0.78	0.52	0.00	0.67	0.29	0.00	0.79	0.49	0.00	0.34
Avail Cap(c_a), veh/h	249	0	736	299	0	766	284	0	679	284	0	714
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.8	0.0	22.8	27.3	0.0	19.9	23.9	0.0	20.3	25.7	0.0	18.2
Incr Delay (d2), s/veh	1.5	0.0	3.0	1.0	0.0	1.5	0.2	0.0	4.7	0.7	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	6.0	1.4	0.0	5.7	1.1	0.0	7.0	1.7	0.0	2.4
LnGrp Delay(d),s/veh	31.2	0.0	25.7	28.3	0.0	21.4	24.1	0.0	24.9	26.3	0.0	18.6
LnGrp LOS	C		C	C		C	C		C	C		B
Approach Vol, veh/h		369			441			474			273	
Approach Delay, s/veh		26.1			22.7			24.8			21.6	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.3	18.9	13.0	21.2	5.8	22.4	11.6	22.7
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	23.1	10.0	* 25	8.0	25.1	10.0	* 25
Max Q Clear Time (g_c+I1), s	4.7	12.3	4.3	6.7	2.7	12.4	5.5	15.5
Green Ext Time (p_c), s	0.1	1.1	0.0	0.6	0.0	1.2	0.1	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	23.9
HCM 2010 LOS	C

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	520	60	0	685	0	0
Future Volume (vph)	520	60	0	685	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			3.0		
Lane Util. Factor	1.00			1.00		
Frpb, ped/bikes	0.99			1.00		
Flpb, ped/bikes	1.00			1.00		
Frt	0.99			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	1557			1588		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	1557			1588		
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	542	62	0	714	0	0
RTOR Reduction (vph)	5	0	0	0	0	0
Lane Group Flow (vph)	600	0	0	714	0	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA		
Protected Phases	2			3 4 6		
Permitted Phases						
Actuated Green, G (s)	36.4			56.5		
Effective Green, g (s)	36.4			50.5		
Actuated g/C Ratio	0.45			0.63		
Clearance Time (s)	6.0					
Vehicle Extension (s)	3.0					
Lane Grp Cap (vph)	708			1002		
v/s Ratio Prot	c0.38			c0.45		
v/s Ratio Perm						
v/c Ratio	0.85			0.71		
Uniform Delay, d1	19.3			9.9		
Progression Factor	0.62			0.37		
Incremental Delay, d2	10.2			0.6		
Delay (s)	22.1			4.3		
Level of Service	C			A		
Approach Delay (s)	22.1			4.3	0.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	500	60	0	330	0	0	0	0	30	20	20
Future Volume (vph)	0	500	60	0	330	0	0	0	0	30	20	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0						6.0	
Lane Util. Factor		1.00			1.00						1.00	
Frpb, ped/bikes		0.99			1.00						0.99	
Flpb, ped/bikes		1.00			1.00						1.00	
Frt		0.99			1.00						0.96	
Flt Protected		1.00			1.00						0.98	
Satd. Flow (prot)		1557			1588						1476	
Flt Permitted		1.00			1.00						0.98	
Satd. Flow (perm)		1557			1588						1476	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	521	62	0	344	0	0	0	0	31	21	21
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	19	0
Lane Group Flow (vph)	0	580	0	0	344	0	0	0	0	0	54	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA					Perm	NA	
Protected Phases		2			4 6						8	
Permitted Phases										8		
Actuated Green, G (s)		42.7			58.9						9.1	
Effective Green, g (s)		42.7			58.9						9.1	
Actuated g/C Ratio		0.53			0.74						0.11	
Clearance Time (s)		6.0									6.0	
Vehicle Extension (s)		3.0									1.5	
Lane Grp Cap (vph)		831			1169						167	
v/s Ratio Prot		c0.37			c0.22							
v/s Ratio Perm											0.04	
v/c Ratio		0.70			0.29						0.33	
Uniform Delay, d1		13.9			3.6						32.6	
Progression Factor		0.66			0.06						0.64	
Incremental Delay, d2		3.6			0.0						0.3	
Delay (s)		12.8			0.3						21.2	
Level of Service		B			A						C	
Approach Delay (s)		12.8			0.3			0.0			21.2	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	520	0	0	675	10	20
Future Volume (vph)	520	0	0	675	10	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			6.0	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1588			1588	1420	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1588			1588	1420	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	542	0	0	703	10	21
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	542	0	0	703	14	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	54.3			36.4	14.1	
Effective Green, g (s)	48.7			36.4	14.1	
Actuated g/C Ratio	0.61			0.45	0.18	
Clearance Time (s)				6.0		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	966			722	250	
v/s Ratio Prot	c0.34			c0.44	c0.01	
v/s Ratio Perm						
v/c Ratio	0.56			0.97	0.05	
Uniform Delay, d1	9.3			21.3	27.4	
Progression Factor	0.22			1.07	1.94	
Incremental Delay, d2	0.4			22.2	0.0	
Delay (s)	2.4			45.0	53.3	
Level of Service	A			D	D	
Approach Delay (s)	2.4			45.0	53.3	
Approach LOS	A			D	D	

Intersection Summary			
HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	530	0	0	310	10	20	20	20	0	0	0
Future Volume (vph)	0	530	0	0	310	10	20	20	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			1.00			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1580			1470				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1580			1470				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	552	0	0	323	10	21	21	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	332	0	0	45	0	0	0	0
Confl. Peds. (#/hr)	10		10			10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		57.8			42.7			10.2				
Effective Green, g (s)		57.8			42.7			10.2				
Actuated g/C Ratio		0.72			0.53			0.13				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1147			843			187				
v/s Ratio Prot		c0.35			0.21			c0.03				
v/s Ratio Perm												
v/c Ratio		0.48			0.39			0.24				
Uniform Delay, d1		4.7			11.0			31.4				
Progression Factor		0.15			0.63			1.16				
Incremental Delay, d2		0.1			1.3			0.2				
Delay (s)		0.8			8.2			36.7				
Level of Service		A			A			D				
Approach Delay (s)		0.8			8.2			36.7			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	5.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	465	0	0	420	40	20	15	20	0	0	0
Future Volume (vph)	0	465	0	0	420	40	20	15	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1546			1469				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1546			1469				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	484	0	0	438	42	21	16	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	17	0	0	0	0
Lane Group Flow (vph)	0	484	0	0	476	0	0	41	0	0	0	0
Confl. Peds. (#/hr)	59		21			59			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		54.9			35.6			13.5				
Effective Green, g (s)		54.9			35.6			13.5				
Actuated g/C Ratio		0.69			0.45			0.17				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1089			687			247				
v/s Ratio Prot		c0.30			c0.31			c0.03				
v/s Ratio Perm												
v/c Ratio		0.44			0.69			0.16				
Uniform Delay, d1		5.7			17.8			28.4				
Progression Factor		0.18			0.62			1.02				
Incremental Delay, d2		0.3			5.1			0.2				
Delay (s)		1.3			16.2			29.3				
Level of Service		A			B			C				
Approach Delay (s)		1.3			16.2			29.3			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	36.0	54.1	0.07	4.5	F
C	IV	25	18.9	8.9	27.8	0.07	9.2	D
B	IV	25	17.9	30.8	48.7	0.07	5.0	F
A	IV	25	18.5	9.6	28.1	0.07	8.9	E
Lindaro	IV	25	25.3	39.2	64.5	0.14	7.8	E
Lincoln	IV	25	21.4	44.8	66.2	0.10	5.3	F
Francisco W.	IV	25	12.2	69.3	81.5	0.05	2.0	F
101 SBOn 2nd	IV	25	14.2	11.6	25.8	0.05	7.5	E
Total	IV		146.5	250.2	396.7	0.61	5.6	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	99.7	118.7	0.07	2.2	F
Tamalpais	IV	25	14.4	98.0	112.4	0.05	1.7	F
Lincoln	IV	25	13.2	73.6	86.8	0.05	2.1	F
Lindaro	IV	25	21.4	1.1	22.5	0.10	15.6	C
A	IV	25	19.5	10.0	29.5	0.07	9.0	E
B	IV	25	17.9	9.3	27.2	0.07	8.9	E
C	IV	25	19.0	3.6	22.6	0.07	11.4	D
D	IV	25	18.7	1.7	20.4	0.07	12.4	D
Total	IV		143.1	297.0	440.1	0.56	4.6	F

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	29	24.0	21.3	45.3	0.16	12.7	D
5th	IV	25	16.3	12.8	29.1	0.06	7.6	E
4th	IV	25	14.6	7.5	22.1	0.05	8.9	E
3rd	IV	25	17.7	7.6	25.3	0.07	9.5	D
2nd	IV	25	15.6	261.4	277.0	0.06	0.8	F
Total	IV		88.2	310.6	398.8	0.40	3.6	F

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	30	25.2	36.9	62.1	0.17	9.7	D
3rd St	IV	25	14.8	30.0	44.8	0.06	4.5	F
4th	IV	25	18.3	29.9	48.2	0.07	5.1	F
5th	IV	25	14.6	8.4	23.0	0.06	8.6	E
Mission	IV	25	15.7	6.9	22.6	0.06	9.4	D
Total	IV		88.6	112.1	200.7	0.41	7.3	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	15.7	44.2	0.16	12.9	D
Tamalpais	IV	25	16.0	52.8	68.8	0.06	3.2	F
Tamalpais	IV	25	3.1	2.9	6.0	0.01	7.0	E
Hetherton	IV	25	8.7	21.6	30.3	0.03	3.9	F
Irwin	IV	25	18.9	12.1	31.0	0.07	8.3	E
Total	IV		75.2	105.1	180.3	0.33	6.7	F

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	26.8	48.4	0.10	7.3	E
Hetherton	IV	25	18.9	36.1	55.0	0.07	4.7	F
Tamalpais	IV	25	8.7	82.6	91.3	0.03	1.3	F
Tamalpais	IV	25	3.1	3.7	6.8	0.01	6.2	F
Lincoln	IV	25	16.0	88.7	104.7	0.06	2.1	F
Total	IV		68.3	237.9	306.2	0.27	3.2	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	24.8	42.9	0.07	5.7	F
C	IV	25	18.9	8.4	27.3	0.07	9.4	D
B	IV	25	17.9	18.9	36.8	0.07	6.6	F
A	IV	25	18.5	9.7	28.2	0.07	8.9	E
Lindaro	IV	25	25.3	51.0	76.3	0.14	6.6	F
Lincoln	IV	25	21.4	24.2	45.6	0.10	7.7	E
Francisco W.	IV	25	12.2	86.3	98.5	0.05	1.7	F
101 SBOn Hetherton	IV	25	14.2	80.5	94.7	0.05	2.0	F
Total	IV		146.5	303.8	450.3	0.61	4.9	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	93.3	112.3	0.07	2.3	F
Tamalpais	IV	25	14.4	95.0	109.4	0.05	1.8	F
Lincoln	IV	25	13.2	18.5	31.7	0.05	5.7	F
Lindaro	IV	25	21.4	3.7	25.1	0.10	14.0	C
A	IV	25	19.5	10.9	30.4	0.07	8.7	E
B	IV	25	17.9	10.2	28.1	0.07	8.6	E
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		143.1	239.9	383.0	0.56	5.2	F

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	35	22.2	20.6	42.8	0.16	13.4	C
5th	IV	25	16.3	17.3	33.6	0.06	6.6	F
4th	IV	25	14.6	5.2	19.8	0.05	10.0	D
3rd	IV	25	17.7	21.9	39.6	0.07	6.1	F
2nd	IV	25	15.6	54.2	69.8	0.06	3.0	F
Total	IV		86.4	119.2	205.6	0.40	7.0	E

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	38	19.3	82.6	101.9	0.17	5.9	F
3rd St	IV	25	14.8	13.7	28.5	0.06	7.0	E
4th	IV	25	18.9	11.8	30.7	0.07	8.4	E
5th	IV	25	14.0	14.1	28.1	0.05	6.8	F
Mission	IV	25	15.7	3.4	19.1	0.06	11.2	D
Total	IV		82.7	125.6	208.3	0.41	7.0	E

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	12.8	41.3	0.16	13.8	C
Tamalpais	IV	25	16.1	24.0	40.1	0.06	5.5	F
Tamalpais	IV	25	4.3	2.3	6.6	0.02	8.9	E
Hetherton	IV	25	7.5	15.1	22.6	0.03	4.5	F
Irwin	IV	25	18.9	14.1	33.0	0.07	7.8	E
Total	IV		75.3	68.3	143.6	0.33	8.4	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	28.4	50.0	0.10	7.1	E
Hetherton	IV	25	18.9	13.8	32.7	0.07	7.8	E
Tamalpais	IV	25	7.5	47.5	55.0	0.03	1.8	F
Tamalpais	IV	25	4.3	2.7	7.0	0.02	8.4	E
Lincoln	IV	25	16.1	88.2	104.3	0.06	2.1	F
Total	IV		68.4	180.6	249.0	0.27	4.0	F

Leisch Method for Weaving Analysis

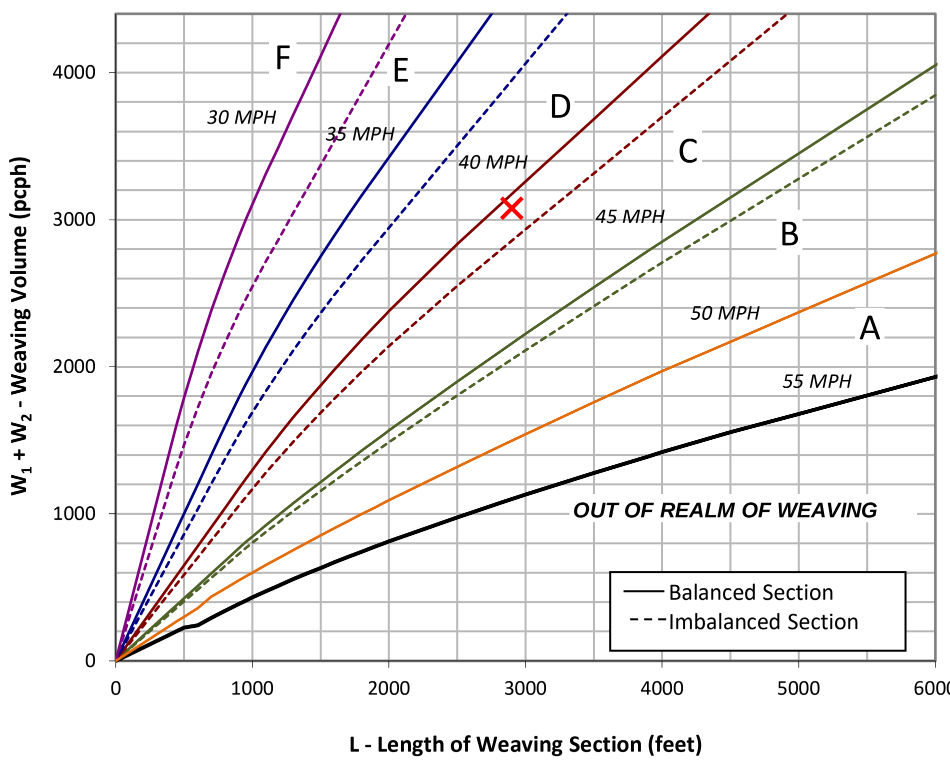
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

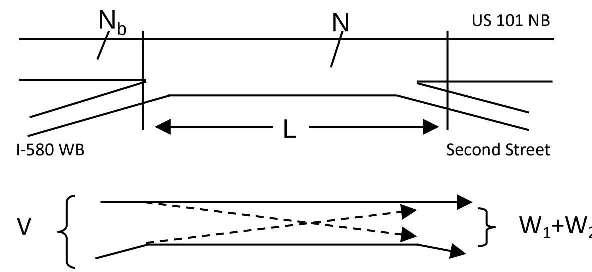
Project Information

Project	BioMarin
Scenario	Cumulative Plus Project No CS AM PH
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,036	Volume (vph)*	1,951	Volume (vph)*	1,000
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	4%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	6,302	Volume (pcph)	2,037	Volume (pcph)	1,041



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   40 MPH and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 38.6
4. Weaving Intensity Factor (k) 2.61
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,595

6. Level of Service (LOS) D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4150	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1520
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	25.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000

Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	718	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	820
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	13.7
Speed 2 (S_3), mi/h	1.4	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6021	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1710
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	28.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000

Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6275	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	2267
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.99
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	51.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	43.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000

Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	3/17/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	6275	2047
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	4.40	3.72
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.958
Flow Rate (v_i), pc/h	6802	2323
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.99	1.11

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	111476.2	Density in Ramp Influence Area (D_R), pc/mi/ln	-
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	-
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2316
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	-
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.483	Outer Lanes Freeway Speed (S_O), mi/h	60.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	4486	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F		

Managed Lane Geometric Data			
Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4234	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1583
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	26.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000

Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	998	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1104
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

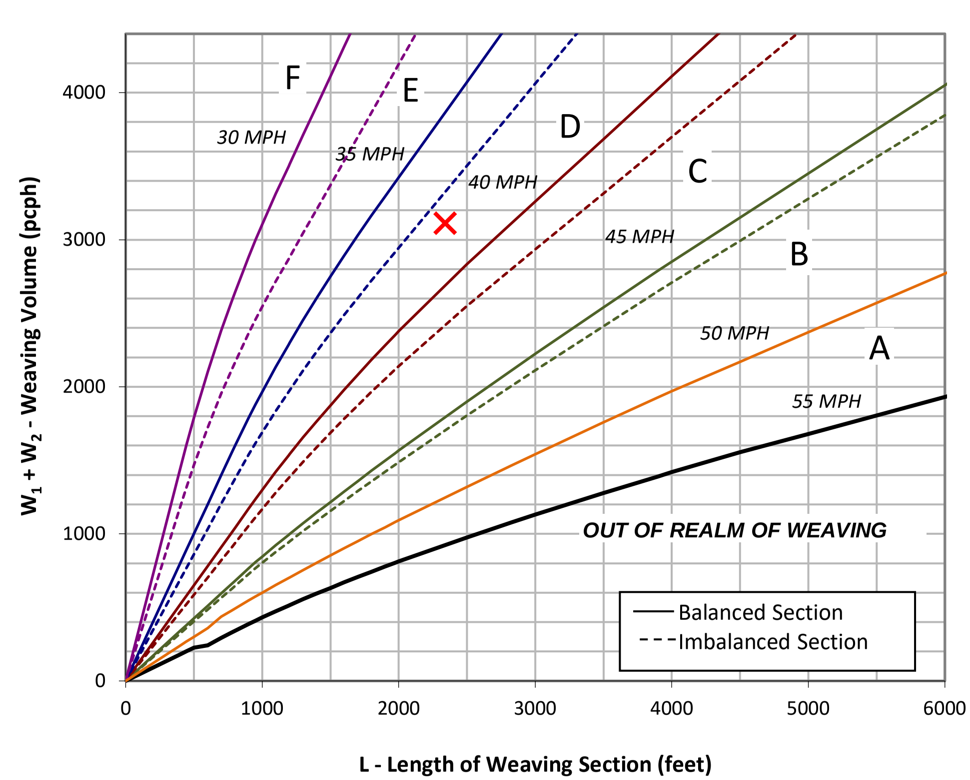
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.0
Speed 2 (S_2), mi/h	1.0	Density (D_{ML}), pc/mi/ln	18.7
Speed 2 (S_3), mi/h	5.0	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

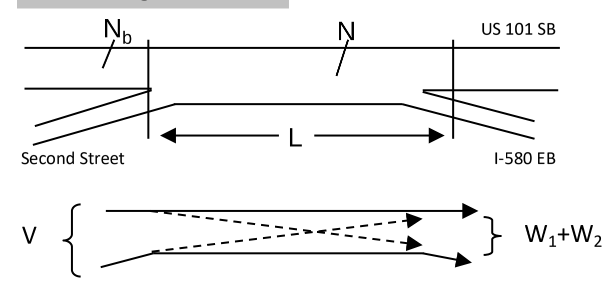
Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

Project Information	
Project	BioMarin
Scenario	Cumulative Plus Project No SenCent PM PH
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,720	Volume (vph)*	1,767	Volume (vph)*	1,225
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	2%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	7,016	Volume (pcph)	1,814	Volume (pcph)	1,298



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 38.2
4. Weaving Intensity Factor (k) 2.63
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 2,284
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

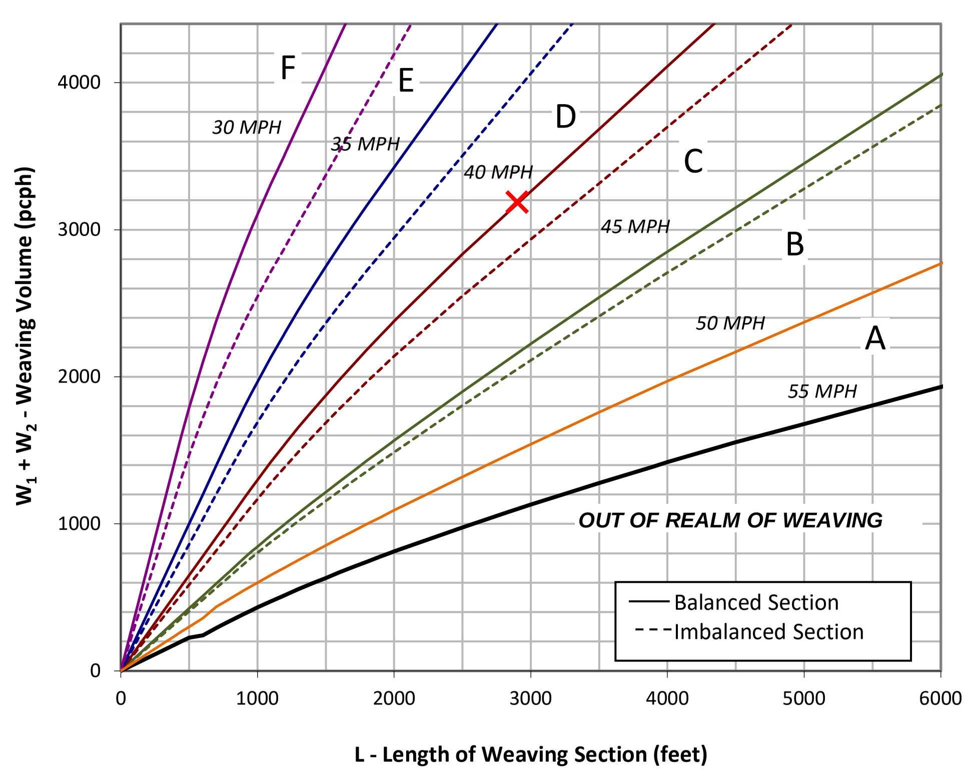
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

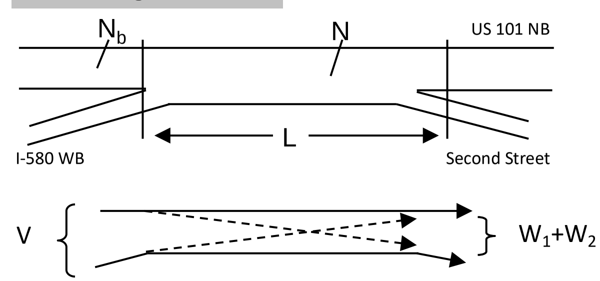
Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	7,257	Volume (vph)*	1,661	Volume (vph)*	1,417
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	7,576	Volume (pcph)	1,734	Volume (pcph)	1,454

Project Information

Project	BioMarin
Scenario	Cumulative Plus Project PM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 38.5
4. Weaving Intensity Factor (k): 2.62
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$: 1,985
6. Level of Service (LOS): F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative + Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5170	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1913
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	58.2
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	32.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	848	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	890
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.7
Speed 2 (S_2), mi/h	0.3	Density (D_{ML}), pc/mi/ln	14.9
Speed 2 (S_3), mi/h	2.1	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6021	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1710
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	28.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000

Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5442	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1966
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	34.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1377	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1555
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	56.0
Speed 2 (S_2), mi/h	4.0	Density (D_{ML}), pc/mi/ln	27.8
Speed 2 (S_3), mi/h	15.4	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5442	2080
Peak Hour Factor (PHF)	0.97	0.96
Total Trucks, %	4.40	2.00
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.973
Flow Rate (v_i), pc/h	5899	2227
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.85	1.06

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	151607.6	Density in Ramp Influence Area (D_R), pc/mi/ln	-
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	-
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1799
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	-
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.510	Outer Lanes Freeway Speed (S_O), mi/h	62.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	4100	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F		

Managed Lane Geometric Data			
Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1380	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1559
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	40.4
Speed 2 (S_2), mi/h	4.1	Density (D_{ML}), pc/mi/ln	38.6
Speed 2 (S_3), mi/h	15.5	Level of Service (LOS)	E

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative Plus Project No Senior Center Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3369	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1260
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	21.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	918	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1049
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.2
Speed 2 (S_2), mi/h	0.8	Density (D_{ML}), pc/mi/ln	17.7
Speed 2 (S_3), mi/h	4.2	Level of Service (LOS)	B

Leisch Method for Weaving Analysis

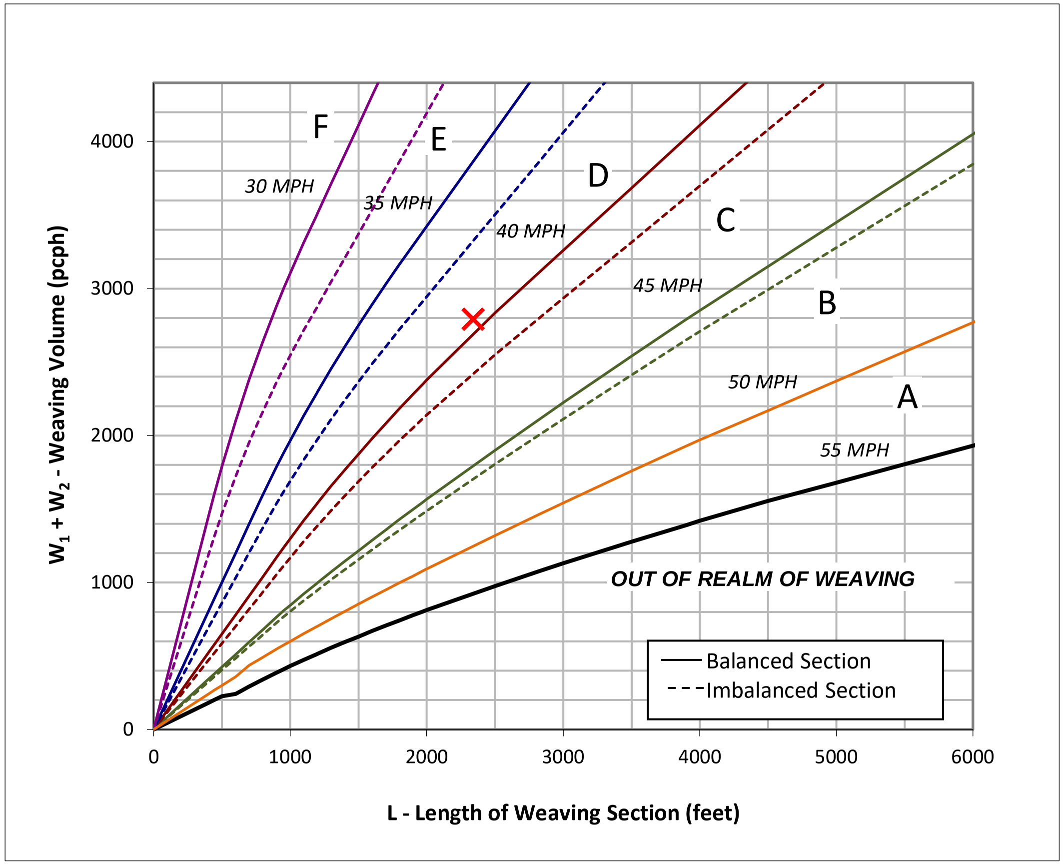
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

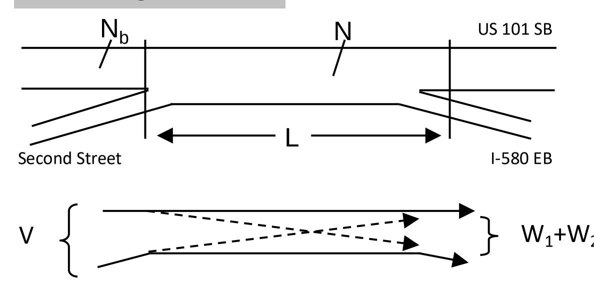
Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,432	Volume (vph)*	1,180	Volume (vph)*	1,442
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	5,671	Volume (pcph)	1,210	Volume (pcph)	1,582

Project Information

Project	BioMarin
Scenario	Cumulative Plus Project No SenCent PM PH
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 39.6
4. Weaving Intensity Factor (k) 2.55
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 1,886
6. Level of Service (LOS) E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Appendix G:

Cumulative Plus Project Conditions (R&D and Senior Services and Housing) – Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

April 5, 2019

FEHR PEERS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	500	20	80	585	50	20	230	90	60	421	380
Future Volume (veh/h)	120	500	20	80	585	50	20	230	90	60	421	380
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	0.99		0.97	0.99		0.94	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1660	1660	1710	1660	1660	1710	1800	1678	1728	1800	1748	1728
Adj Flow Rate, veh/h	130	543	20	87	636	50	22	250	80	65	458	206
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	148	868	32	341	626	49	68	439	134	136	833	362
Arrive On Green	0.09	0.55	0.55	0.55	0.55	0.55	0.85	0.85	0.85	0.43	0.43	0.43
Sat Flow, veh/h	1581	1588	59	787	1515	119	39	1028	314	187	1953	849
Grp Volume(v), veh/h	130	0	563	87	0	686	352	0	0	395	0	334
Grp Sat Flow(s),veh/h/ln	1581	0	1647	787	0	1634	1381	0	0	1614	0	1376
Q Serve(g_s), s	6.1	0.0	17.7	5.7	0.0	31.0	0.0	0.0	0.0	4.5	0.0	13.8
Cycle Q Clear(g_c), s	6.1	0.0	17.7	13.4	0.0	31.0	5.3	0.0	0.0	13.2	0.0	13.8
Prop In Lane	1.00		0.04	1.00		0.07	0.06		0.23	0.16		0.62
Lane Grp Cap(c), veh/h	148	0	900	341	0	676	640	0	0	744	0	587
V/C Ratio(X)	0.88	0.00	0.63	0.26	0.00	1.02	0.55	0.00	0.00	0.53	0.00	0.57
Avail Cap(c_a), veh/h	148	0	900	341	0	676	640	0	0	744	0	587
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.64	0.00	0.64	0.84	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.6	0.0	11.7	15.5	0.0	16.9	3.5	0.0	0.0	16.0	0.0	16.3
Incr Delay (d2), s/veh	47.7	0.0	3.3	1.1	0.0	31.5	2.8	0.0	0.0	2.7	0.0	4.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	8.8	1.3	0.0	19.5	2.3	0.0	0.0	6.6	0.0	5.8
LnGrp Delay(d),s/veh	81.3	0.0	15.0	16.7	0.0	48.4	6.4	0.0	0.0	18.7	0.0	20.2
LnGrp LOS	F		B	B		F	A			B		C
Approach Vol, veh/h		693			773			352			729	
Approach Delay, s/veh		27.4			44.8			6.4			19.4	
Approach LOS		C			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		45.2		36.8	10.0	35.2		36.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 41		25.4	7.0	* 31		25.4
Max Q Clear Time (g_c+I1), s		19.7		7.3	8.1	33.0		15.8
Green Ext Time (p_c), s		5.5		3.1	0.0	0.0		4.4

Intersection Summary	
HCM 2010 Ctrl Delay	27.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	515	90	40	230	0	0	0	0	245	1097	500
Future Volume (vph)	0	515	90	40	230	0	0	0	0	245	1097	500
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.97
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2711			1767						2961	1303
Flt Permitted		1.00			0.80						0.99	1.00
Satd. Flow (perm)		2711			1421						2961	1303
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	560	98	43	250	0	0	0	0	266	1192	543
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	639	0	0	293	0	0	0	0	0	1458	543
Confl. Peds. (#/hr)	15		22	22		15			16			1
Confl. Bikes (#/hr)			3			2			1			3
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		23.8			23.8						42.4	35.4
Effective Green, g (s)		23.8			23.8						42.4	35.4
Actuated g/C Ratio		0.32			0.32						0.57	0.47
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		860			450						1673	615
v/s Ratio Prot		c0.24									c0.49	
v/s Ratio Perm					0.21							0.42
v/c Ratio		0.74			0.65						0.87	0.88
Uniform Delay, d1		22.9			22.0						14.0	17.9
Progression Factor		0.74			1.33						1.00	1.00
Incremental Delay, d2		4.8			5.6						6.6	16.7
Delay (s)		21.8			34.9						20.5	34.7
Level of Service		C			C						C	C
Approach Delay (s)		21.8			34.9			0.0			24.4	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	400	30	330	170	340	10	110	1150	140	40
Future Volume (vph)	400	30	330	170	340	10	110	1150	140	40
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1494	1794	1615	1471			3430	1294	
Flt Permitted		0.58	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		919	1794	1615	1471			3430	1294	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	435	33	359	185	370	11	120	1250	152	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	46	0
Lane Group Flow (vph)	0	468	359	185	381	0	0	1370	149	0
Confl. Peds. (#/hr)							13			6
Confl. Bikes (#/hr)					2	2				2
Parking (#/hr)				0				2		
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		34.8	34.8	19.8	19.8			31.8	31.8	
Effective Green, g (s)		34.8	34.8	19.8	19.8			31.8	31.8	
Actuated g/C Ratio		0.46	0.46	0.26	0.26			0.42	0.42	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0	
Lane Grp Cap (vph)		509	832	426	388			1454	548	
v/s Ratio Prot		c0.13	0.20	0.11	0.26					
v/s Ratio Perm		c0.29						0.40	0.12	
v/c Ratio		0.92	0.43	0.43	0.98			0.94	0.27	
Uniform Delay, d1		19.1	13.5	22.9	27.4			20.7	14.1	
Progression Factor		0.91	0.80	1.00	1.00			0.75	0.71	
Incremental Delay, d2		14.6	0.2	0.7	40.7			6.1	0.5	
Delay (s)		32.0	11.0	23.7	68.1			21.7	10.5	
Level of Service		C	B	C	E			C	B	
Approach Delay (s)			22.9	53.6				20.3		
Approach LOS			C	D				C		

Intersection Summary			
HCM 2000 Control Delay	27.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	94.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	320	40	70	290	70	20	240	70	50	421	50
Future Volume (veh/h)	40	320	40	70	290	70	20	240	70	50	421	50
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	0.99		0.95	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1398	1545	1530	1398	1485	1530	1440	1485	1469	1440	1485	1469
Adj Flow Rate, veh/h	43	348	36	76	315	63	22	261	62	54	458	49
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	126	409	42	143	356	71	72	563	128	97	612	63
Arrive On Green	0.30	0.30	0.30	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00
Sat Flow, veh/h	792	1370	142	785	1193	239	37	973	221	76	1057	108
Grp Volume(v), veh/h	43	0	384	76	0	378	345	0	0	561	0	0
Grp Sat Flow(s),veh/h/ln	792	0	1512	785	0	1432	1231	0	0	1242	0	0
Q Serve(g_s), s	2.9	0.0	17.9	4.5	0.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	22.4	0.0	17.9	22.4	0.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.09	1.00		0.17	0.06		0.18	0.10		0.09
Lane Grp Cap(c), veh/h	126	0	452	143	0	428	763	0	0	771	0	0
V/C Ratio(X)	0.34	0.00	0.85	0.53	0.00	0.88	0.45	0.00	0.00	0.73	0.00	0.00
Avail Cap(c_a), veh/h	126	0	452	143	0	428	763	0	0	771	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.94	0.00	0.94	0.86	0.00	0.00	0.38	0.00	0.00
Uniform Delay (d), s/veh	36.5	0.0	24.7	43.6	0.0	32.5	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	7.2	0.0	17.9	12.7	0.0	21.4	1.7	0.0	0.0	2.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	9.7	2.1	0.0	10.3	0.4	0.0	0.0	0.5	0.0	0.0
LnGrp Delay(d),s/veh	43.7	0.0	42.6	56.3	0.0	54.0	1.7	0.0	0.0	2.3	0.0	0.0
LnGrp LOS	D		D	E		D	A			A		
Approach Vol, veh/h		427			454			345			561	
Approach Delay, s/veh		42.7			54.3			1.7			2.3	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.0		48.0		27.0		48.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		22.4		43.4		22.4		43.4
Max Q Clear Time (g_c+I1), s		24.4		2.0		24.4		2.0
Green Ext Time (p_c), s		0.0		1.7		0.0		3.0

Intersection Summary	
HCM 2010 Ctrl Delay	25.1
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	260	180	40	245	0	0	0	0	50	1052	125
Future Volume (vph)	0	260	180	40	245	0	0	0	0	50	1052	125
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.94			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1665			1769						4119	1127
Flt Permitted		1.00			0.90						1.00	1.00
Satd. Flow (perm)		1665			1604						4119	1127
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	283	196	43	266	0	0	0	0	54	1143	136
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	468	0	0	309	0	0	0	0	0	1197	136
Confl. Peds. (#/hr)			15	15		14			22	22		10
Confl. Bikes (#/hr)			4			2			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		35.8			35.8						30.4	23.4
Effective Green, g (s)		35.8			35.8						30.4	23.4
Actuated g/C Ratio		0.48			0.48						0.41	0.31
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		794			765						1669	351
v/s Ratio Prot		c0.28										
v/s Ratio Perm					0.19						0.29	0.12
v/c Ratio		0.59			0.40						0.72	0.39
Uniform Delay, d1		14.2			12.7						18.7	20.2
Progression Factor		0.45			1.32						0.61	0.69
Incremental Delay, d2		3.0			0.9						1.3	1.6
Delay (s)		9.5			17.6						12.7	15.5
Level of Service		A			B						B	B
Approach Delay (s)		9.5			17.6			0.0			13.0	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	110	0	0	160	130	150	1190	20	0	0	0
Future Volume (veh/h)	150	110	0	0	160	130	150	1190	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	0.89	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1620	1573	1620			
Adj Flow Rate, veh/h	163	120	0	0	174	103	163	1293	21			
Adj No. of Lanes	1	1	0	0	1	0	0	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	0	3	0			
Cap, veh/h	218	491	0	0	254	151	165	1381	23			
Arrive On Green	0.10	0.10	0.00	0.00	0.31	0.31	0.19	0.19	0.19			
Sat Flow, veh/h	976	1573	0	0	816	483	292	2443	41			
Grp Volume(v), veh/h	163	120	0	0	0	277	772	0	705			
Grp Sat Flow(s),veh/h/ln	976	1573	0	0	0	1299	1385	0	1392			
Q Serve(g_s), s	9.4	5.3	0.0	0.0	0.0	14.0	41.7	0.0	37.1			
Cycle Q Clear(g_c), s	23.4	5.3	0.0	0.0	0.0	14.0	41.7	0.0	37.1			
Prop In Lane	1.00		0.00	0.00		0.37	0.21		0.03			
Lane Grp Cap(c), veh/h	218	491	0	0	0	405	783	0	787			
V/C Ratio(X)	0.75	0.24	0.00	0.00	0.00	0.68	0.99	0.00	0.90			
Avail Cap(c_a), veh/h	218	491	0	0	0	405	783	0	787			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	0.77	0.77	0.00	0.00	0.00	1.00	0.09	0.00	0.09			
Uniform Delay (d), s/veh	41.8	25.5	0.0	0.0	0.0	22.6	30.2	0.0	28.3			
Incr Delay (d2), s/veh	10.4	0.2	0.0	0.0	0.0	4.7	6.9	0.0	1.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	2.3	0.0	0.0	0.0	5.5	17.5	0.0	14.7			
LnGrp Delay(d),s/veh	52.2	25.7	0.0	0.0	0.0	27.3	37.1	0.0	30.1			
LnGrp LOS	D	C				C	D		C			
Approach Vol, veh/h		283			277			1477				
Approach Delay, s/veh		41.0			27.3			33.7				
Approach LOS		D			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		28.0		47.0		28.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		23.4		42.4		23.4		
Max Q Clear Time (g_c+I1), s		25.4		43.7		16.0		
Green Ext Time (p_c), s		0.0		0.0		0.7		

Intersection Summary		
HCM 2010 Ctrl Delay		33.9
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	265	20	80	340	60	20	240	70	85	371	80
Future Volume (veh/h)	40	265	20	80	340	60	20	240	70	85	371	80
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.90	0.97		0.91	0.97		0.92	0.99		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln	1573	1510	1620	1573	1573	1620	1620	1573	1555	1620	1573	1555
Adj Flow Rate, veh/h	43	288	19	87	370	56	22	261	62	92	403	78
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	117	423	28	209	400	60	74	598	136	144	541	99
Arrive On Green	0.30	0.30	0.30	0.10	0.10	0.10	0.19	0.19	0.19	1.00	1.00	1.00
Sat Flow, veh/h	853	1390	92	925	1314	199	39	1024	233	151	927	170
Grp Volume(v), veh/h	43	0	307	87	0	426	345	0	0	573	0	0
Grp Sat Flow(s),veh/h/ln	853	0	1482	925	0	1513	1296	0	0	1248	0	0
Q Serve(g_s), s	1.9	0.0	13.6	7.0	0.0	20.9	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	22.8	0.0	13.6	20.6	0.0	20.9	17.1	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.06	1.00		0.13	0.06		0.18	0.16		0.14
Lane Grp Cap(c), veh/h	117	0	450	209	0	460	808	0	0	784	0	0
V/C Ratio(X)	0.37	0.00	0.68	0.42	0.00	0.93	0.43	0.00	0.00	0.73	0.00	0.00
Avail Cap(c_a), veh/h	117	0	450	209	0	460	808	0	0	784	0	0
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.92	0.00	0.92	0.75	0.00	0.00	0.48	0.00	0.00
Uniform Delay (d), s/veh	37.0	0.0	22.9	39.5	0.0	32.9	19.5	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	8.7	0.0	8.1	5.5	0.0	25.5	1.2	0.0	0.0	2.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	6.6	2.1	0.0	12.1	6.6	0.0	0.0	0.6	0.0	0.0
LnGrp Delay(d),s/veh	45.7	0.0	31.0	45.1	0.0	58.4	20.8	0.0	0.0	2.9	0.0	0.0
LnGrp LOS	D		C	D		E	C			A		
Approach Vol, veh/h		350			513			345			573	
Approach Delay, s/veh		32.8			56.1			20.8			2.9	
Approach LOS		C			E			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.0		48.0		27.0		48.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 23		* 44		* 23		* 44
Max Q Clear Time (g_c+I1), s		24.8		19.1		22.9		2.0
Green Ext Time (p_c), s		0.0		3.3		0.0		7.4

Intersection Summary	
HCM 2010 Ctrl Delay	27.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	500	430	0	0	55
Future Volume (vph)	0	500	430	0	0	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6	5.6			5.2
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00			0.87
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1573	1573			1188
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1573	1573			1188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	543	467	0	0	60
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	0	543	467	0	0	11
Confl. Peds. (#/hr)				39		46
Confl. Bikes (#/hr)				4		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		50.3	50.4			13.8
Effective Green, g (s)		50.3	50.4			13.8
Actuated g/C Ratio		0.67	0.67			0.18
Clearance Time (s)						5.2
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1054	1057			218
v/s Ratio Prot		c0.35	c0.30			
v/s Ratio Perm						0.01
v/c Ratio		0.52	0.44			0.05
Uniform Delay, d1		6.2	5.7			25.2
Progression Factor		1.32	0.48			1.00
Incremental Delay, d2		0.3	0.2			0.1
Delay (s)		8.6	2.9			25.3
Level of Service		A	A			C
Approach Delay (s)		8.6	2.9		25.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	7.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	305	200	200	305	0	0	0	0	110	972	190
Future Volume (vph)	0	305	200	200	305	0	0	0	0	110	972	190
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00						1.00	0.89
Flpb, ped/bikes		1.00	1.00	0.98	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1625	1181	1607	1520						4265	1184
Flt Permitted		1.00	1.00	0.49	1.00						0.99	1.00
Satd. Flow (perm)		1625	1181	824	1520						4265	1184
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	332	217	217	332	0	0	0	0	120	1057	207
RTOR Reduction (vph)	0	0	27	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	332	190	217	332	0	0	0	0	0	1177	207
Confl. Peds. (#/hr)			40	40		22			9	9		30
Confl. Bikes (#/hr)			8			4						2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		35.8	35.8	35.8	35.8						30.4	23.4
Effective Green, g (s)		35.8	35.8	35.8	35.8						30.4	23.4
Actuated g/C Ratio		0.48	0.48	0.48	0.48						0.41	0.31
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		775	563	393	725						1728	369
v/s Ratio Prot		0.20			0.22							
v/s Ratio Perm			0.16	c0.26							0.28	0.17
v/c Ratio		0.43	0.34	0.55	0.46						0.68	0.56
Uniform Delay, d1		12.9	12.2	13.9	13.1						18.3	21.5
Progression Factor		0.49	0.42	1.03	1.07						0.32	0.42
Incremental Delay, d2		1.5	1.4	3.8	1.4						1.6	4.4
Delay (s)		7.9	6.6	18.2	15.4						7.4	13.3
Level of Service		A	A	B	B						A	B
Approach Delay (s)		7.4			16.5			0.0			8.3	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	170	240	0	0	380	70	130	1150	50	0	0	0
Future Volume (veh/h)	170	240	0	0	380	70	130	1150	50	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.89	1.00	1.00	0.89			
Adj Sat Flow, veh/h/ln	1573	1573	0	0	1573	1620	1510	1573	1620			
Adj Flow Rate, veh/h	185	261	0	0	413	66	141	1250	50			
Adj No. of Lanes	1	1	0	0	1	0	1	2	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	137	625	0	0	465	74	706	1356	54			
Arrive On Green	0.79	0.79	0.00	0.00	0.13	0.13	0.16	0.16	0.16			
Sat Flow, veh/h	813	1573	0	0	1170	187	1438	2763	110			
Grp Volume(v), veh/h	185	261	0	0	0	479	141	675	625			
Grp Sat Flow(s),veh/h/ln	813	1573	0	0	0	1357	1438	1494	1380			
Q Serve(g_s), s	3.8	3.8	0.0	0.0	0.0	26.0	6.4	33.4	33.5			
Cycle Q Clear(g_c), s	29.8	3.8	0.0	0.0	0.0	26.0	6.4	33.4	33.5			
Prop In Lane	1.00		0.00	0.00		0.14	1.00		0.08			
Lane Grp Cap(c), veh/h	137	625	0	0	0	539	706	733	677			
V/C Ratio(X)	1.35	0.42	0.00	0.00	0.00	0.89	0.20	0.92	0.92			
Avail Cap(c_a), veh/h	137	625	0	0	0	539	706	733	677			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.91	0.91	0.00	0.00	0.00	1.00	0.16	0.16	0.16			
Uniform Delay (d), s/veh	22.0	5.0	0.0	0.0	0.0	31.0	18.7	30.0	30.0			
Incr Delay (d2), s/veh	196.0	1.9	0.0	0.0	0.0	19.3	0.1	4.1	4.5			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	10.2	1.8	0.0	0.0	0.0	12.7	2.6	14.7	13.6			
LnGrp Delay(d),s/veh	218.1	6.9	0.0	0.0	0.0	50.2	18.8	34.1	34.6			
LnGrp LOS	F	A				D	B	C	C			
Approach Vol, veh/h		446			479			1441				
Approach Delay, s/veh		94.5			50.2			32.8				
Approach LOS		F			D			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		34.0		41.0		34.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 30		* 37		* 30		
Max Q Clear Time (g_c+I1), s		31.8		35.5		28.0		
Green Ext Time (p_c), s		0.0		0.9		0.4		

Intersection Summary		
HCM 2010 Ctrl Delay		48.0
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	320	1222	0	0	0	0	0	240	30
Future Volume (veh/h)	0	0	0	320	1222	0	0	0	0	0	240	30
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.98
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1530	1485	0				0	1485	1530
Adj Flow Rate, veh/h				348	1328	0				0	261	17
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				586	2029	0				0	525	34
Arrive On Green				0.22	0.22	0.00				0.00	0.21	0.21
Sat Flow, veh/h				754	3124	0				0	2611	164
Grp Volume(v), veh/h				598	1078	0				0	144	134
Grp Sat Flow(s),veh/h/ln				1297	1230	0				0	1411	1290
Q Serve(g_s), s				31.7	29.8	0.0				0.0	6.8	6.9
Cycle Q Clear(g_c), s				31.7	29.8	0.0				0.0	6.8	6.9
Prop In Lane				0.58		0.00				0.00		0.13
Lane Grp Cap(c), veh/h				952	1662	0				0	292	267
V/C Ratio(X)				0.63	0.65	0.00				0.00	0.49	0.50
Avail Cap(c_a), veh/h				952	1662	0				0	440	402
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.68	0.68	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				21.8	21.0	0.0				0.0	26.3	26.3
Incr Delay (d2), s/veh				2.2	1.3	0.0				0.0	1.3	1.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.0	10.5	0.0				0.0	2.8	2.6
LnGrp Delay(d),s/veh				23.9	22.4	0.0				0.0	27.6	27.8
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1676						278	
Approach Delay, s/veh					22.9						27.6	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.9		20.1				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 43		23.4				
Max Q Clear Time (g_c+I1), s		33.7		8.9				
Green Ext Time (p_c), s		5.6		0.9				

Intersection Summary	
HCM 2010 Ctrl Delay	23.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1417	120	110	250	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1417	120	110	250	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1398	1398	1440	1398	0			
Adj Flow Rate, veh/h				0	1540	97	120	272	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	2536	774	218	404	0			
Arrive On Green				0.00	0.22	0.22	0.07	0.07	0.00			
Sat Flow, veh/h				0	3943	1164	640	1870	0			
Grp Volume(v), veh/h				0	1540	97	216	176	0			
Grp Sat Flow(s),veh/h/ln				0	1272	1164	1238	1209	0			
Q Serve(g_s), s				0.0	27.3	5.0	11.7	10.7	0.0			
Cycle Q Clear(g_c), s				0.0	27.3	5.0	12.8	10.7	0.0			
Prop In Lane				0.00		1.00	0.56		0.00			
Lane Grp Cap(c), veh/h				0	2536	774	351	270	0			
V/C Ratio(X)				0.00	0.61	0.13	0.61	0.65	0.00			
Avail Cap(c_a), veh/h				0	2536	774	421	338	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	0.56	0.56	0.79	0.79	0.00			
Uniform Delay (d), s/veh				0.0	20.5	11.8	32.8	31.9	0.0			
Incr Delay (d2), s/veh				0.0	0.6	0.2	1.5	2.5	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	9.8	1.7	4.6	3.7	0.0			
LnGrp Delay(d),s/veh				0.0	21.1	12.0	34.3	34.4	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1637			392				
Approach Delay, s/veh					20.5			34.3				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		54.0		21.0				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 46		* 21				
Max Q Clear Time (g_c+I1), s		29.3		14.8				
Green Ext Time (p_c), s		8.4		0.9				

Intersection Summary			
HCM 2010 Ctrl Delay			23.2
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	90	1472	0	0	0	0	0	200	60
Future Volume (veh/h)	0	0	0	90	1472	0	0	0	0	0	200	60
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1398	0				0	1398	1440
Adj Flow Rate, veh/h				98	1600	0				0	217	45
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				165	2266	0				0	486	97
Arrive On Green				0.21	0.21	0.00				0.00	0.24	0.24
Sat Flow, veh/h				170	3616	0				0	2091	401
Grp Volume(v), veh/h				631	1067	0				0	139	123
Grp Sat Flow(s),veh/h/ln				1356	1158	0				0	1328	1094
Q Serve(g_s), s				23.2	32.0	0.0				0.0	6.7	7.2
Cycle Q Clear(g_c), s				32.3	32.0	0.0				0.0	6.7	7.2
Prop In Lane				0.16		0.00				0.00		0.37
Lane Grp Cap(c), veh/h				933	1499	0				0	320	263
V/C Ratio(X)				0.68	0.71	0.00				0.00	0.44	0.47
Avail Cap(c_a), veh/h				933	1499	0				0	411	338
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.69	0.69	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				23.0	23.0	0.0				0.0	24.2	24.3
Incr Delay (d2), s/veh				2.7	2.0	0.0				0.0	0.9	1.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.9	10.7	0.0				0.0	2.5	2.3
LnGrp Delay(d),s/veh				25.7	25.0	0.0				0.0	25.1	25.6
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					1698						262	
Approach Delay, s/veh					25.3						25.3	
Approach LOS					C						C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4								
Phs Duration (G+Y+Rc), s		52.7		22.3								
Change Period (Y+Rc), s		* 4.2		* 4.2								
Max Green Setting (Gmax), s		* 43		* 23								
Max Q Clear Time (g_c+I1), s		34.3		9.2								
Green Ext Time (p_c), s		5.6		0.9								
Intersection Summary												
HCM 2010 Ctrl Delay			25.3									
HCM 2010 LOS			C									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	1312	80	210	135	0	0	140	30
Future Volume (veh/h)	0	0	0	40	1312	80	210	135	0	0	140	30
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				43	1426	78	228	147	0	0	152	21
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				73	2568	145	303	606	0	0	302	42
Arrive On Green				0.56	0.56	0.56	0.02	0.11	0.00	0.00	0.22	0.22
Sat Flow, veh/h				131	4618	261	1748	1835	0	0	1389	192
Grp Volume(v), veh/h				571	475	501	228	147	0	0	0	173
Grp Sat Flow(s),veh/h/ln				1741	1590	1679	1748	1835	0	0	0	1581
Q Serve(g_s), s				16.2	14.2	14.2	0.6	5.5	0.0	0.0	0.0	7.2
Cycle Q Clear(g_c), s				16.2	14.2	14.2	0.6	5.5	0.0	0.0	0.0	7.2
Prop In Lane				0.08		0.16	1.00		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				968	885	934	303	606	0	0	0	344
V/C Ratio(X)				0.59	0.54	0.54	0.75	0.24	0.00	0.00	0.00	0.50
Avail Cap(c_a), veh/h				968	885	934	443	807	0	0	0	390
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.84	0.84	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				11.0	10.5	10.5	33.1	24.8	0.0	0.0	0.0	25.8
Incr Delay (d2), s/veh				2.6	2.3	2.2	6.8	0.4	0.0	0.0	0.0	2.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				8.5	6.8	7.1	5.2	2.9	0.0	0.0	0.0	3.4
LnGrp Delay(d),s/veh				13.6	12.9	12.7	40.0	25.2	0.0	0.0	0.0	28.2
LnGrp LOS				B	B	B	D	C				C
Approach Vol, veh/h					1547			375			173	
Approach Delay, s/veh					13.1			34.2			28.2	
Approach LOS					B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.0	20.8		46.2		28.8
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			10.0	18.5		33.5		33.0
Max Q Clear Time (g_c+I1), s			2.6	9.2		18.2		7.5
Green Ext Time (p_c), s			1.0	0.8		11.2		1.1

Intersection Summary			
HCM 2010 Ctrl Delay			18.1
HCM 2010 LOS			B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative + Project Buildout Conditions (w/ WB LT at 3rd/Brooks)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	21	16	75.4%	7.5	4.0	A
	Through	5	3	51.5%	16.5	17.3	C
	Right Turn						
	Subtotal	26	18	70.8%	10.6	4.7	B
SB	Left Turn						
	Through	5	6	110.4%	13.6	13.1	B
	Right Turn	10	9	88.3%	19.8	13.6	C
	Subtotal	15	14	95.7%	18.8	11.8	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	51	39	76.5%	2.4	0.2	A
	Through	1,401	1,338	95.5%	1.9	0.4	A
	Right Turn	10	10	95.7%	1.7	1.1	A
	Subtotal	1,462	1,387	94.9%	2.0	0.4	A
Total		1,503	1,420	94.5%	2.3	0.3	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	86	85	99.3%	24.0	6.5	C
	Through	10	8	81.0%	19.4	18.3	B
	Right Turn						
	Subtotal	96	93	97.4%	23.9	6.3	C
SB	Left Turn						
	Through	40	39	98.4%	51.0	25.2	D
	Right Turn	10	10	95.7%	37.4	38.5	D
	Subtotal	50	49	97.9%	48.6	27.8	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	431	90.4%	29.6	10.7	C
	Through	1,396	1,319	94.5%	9.0	3.0	A
	Right Turn	30	31	101.8%	8.3	2.6	A
	Subtotal	1,903	1,781	93.6%	13.9	4.8	B
Total		2,049	1,924	93.9%	15.3	4.7	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	175	1775	75	42	195	0	0	290	166
Future Volume (veh/h)	0	0	0	175	1775	75	42	195	0	0	290	166
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	1.00		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88
Adj Sat Flow, veh/h/ln				1620	1573	1620	1620	1573	0	0	1510	1555
Adj Flow Rate, veh/h				190	1929	77	46	212	0	0	315	179
Adj No. of Lanes				0	3	0	0	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				174	1884	77	57	184	0	0	315	179
Arrive On Green				0.16	0.16	0.16	0.13	0.13	0.00	0.00	0.13	0.13
Sat Flow, veh/h				367	3980	163	0	452	0	0	774	440
Grp Volume(v), veh/h				804	671	721	258	0	0	0	0	494
Grp Sat Flow(s),veh/h/ln				1554	1431	1525	452	0	0	0	0	1214
Q Serve(g_s), s				35.5	35.1	35.4	0.0	0.0	0.0	0.0	0.0	30.5
Cycle Q Clear(g_c), s				35.5	35.1	35.4	30.5	0.0	0.0	0.0	0.0	30.5
Prop In Lane				0.24		0.11	0.18		0.00	0.00		0.36
Lane Grp Cap(c), veh/h				736	677	722	240	0	0	0	0	494
V/C Ratio(X)				1.09	0.99	1.00	1.07	0.00	0.00	0.00	0.00	1.00
Avail Cap(c_a), veh/h				736	677	722	240	0	0	0	0	494
HCM Platoon Ratio				0.33	0.33	0.33	0.33	0.33	1.00	1.00	0.33	0.33
Upstream Filter(I)				0.24	0.24	0.24	1.00	0.00	0.00	0.00	0.00	0.44
Uniform Delay (d), s/veh				31.6	31.5	31.6	27.7	0.0	0.0	0.0	0.0	32.5
Incr Delay (d2), s/veh				47.7	14.9	16.2	79.2	0.0	0.0	0.0	0.0	26.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				25.0	16.7	18.2	10.3	0.0	0.0	0.0	0.0	13.9
LnGrp Delay(d),s/veh				79.3	46.4	47.8	106.9	0.0	0.0	0.0	0.0	59.3
LnGrp LOS				F	D	D	F					F
Approach Vol, veh/h					2196			258			494	
Approach Delay, s/veh					58.9			106.9			59.3	
Approach LOS					E			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				35.0		40.0		35.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				30.5		35.5		30.5
Max Q Clear Time (g_c+I1), s				32.5		37.5		32.5
Green Ext Time (p_c), s				0.0		0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	63.2
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	295	1960	30	50	50	0	0	0	0
Future Volume (vph)	0	0	0	295	1960	30	50	50	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6				
Lane Util. Factor					0.91		1.00	1.00				
Frpb, ped/bikes					1.00		1.00	1.00				
Flpb, ped/bikes					0.98		0.93	1.00				
Frt					1.00		1.00	1.00				
Flt Protected					0.99		0.95	1.00				
Satd. Flow (prot)					3699		1057	1237				
Flt Permitted					0.99		0.95	1.00				
Satd. Flow (perm)					3699		1057	1237				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	321	2130	33	54	54	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2482	0	54	54	0	0	0	0
Confl. Peds. (#/hr)			73	73		38	49		63			49
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA				
Protected Phases					6			4				
Permitted Phases				6			4					
Actuated Green, G (s)					51.8		19.0	19.0				
Effective Green, g (s)					51.8		19.0	19.0				
Actuated g/C Ratio					0.58		0.21	0.21				
Clearance Time (s)					11.6		7.6	7.6				
Vehicle Extension (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					2128		223	261				
v/s Ratio Prot								0.04				
v/s Ratio Perm					0.67		c0.05					
v/c Ratio					1.17		0.24	0.21				
Uniform Delay, d1					19.1		29.5	29.3				
Progression Factor					1.00		1.00	1.00				
Incremental Delay, d2					80.4		1.2	0.8				
Delay (s)					99.5		30.7	30.1				
Level of Service					F		C	C				
Approach Delay (s)		0.0			99.5			30.4			0.0	
Approach LOS		A			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	96.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	150.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	455	1688	0	0	0	0	0	825	547
Future Volume (veh/h)	0	0	0	455	1688	0	0	0	0	0	825	547
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.84
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1545	1573	0				0	1573	1485
Adj Flow Rate, veh/h				495	1835	0				0	897	586
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %				3	3	0				0	3	3
Cap, veh/h				721	2006	0				0	1954	481
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1471	4718	0				0	4435	1057
Grp Volume(v), veh/h				495	1835	0				0	897	586
Grp Sat Flow(s),veh/h/ln				1471	1573	0				0	1431	1057
Q Serve(g_s), s				24.4	28.8	0.0				0.0	14.3	34.1
Cycle Q Clear(g_c), s				24.4	28.8	0.0				0.0	14.3	34.1
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				721	2006	0				0	1954	481
V/C Ratio(X)				0.69	0.91	0.00				0.00	0.46	1.22
Avail Cap(c_a), veh/h				724	2013	0				0	1954	481
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				0.17	0.17	0.00				0.00	0.75	0.75
Uniform Delay (d), s/veh				29.0	30.9	0.0				0.0	23.4	31.9
Incr Delay (d2), s/veh				0.5	1.4	0.0				0.0	0.6	112.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				10.1	12.8	0.0				0.0	5.8	24.9
LnGrp Delay(d),s/veh				29.5	32.3	0.0				0.0	24.0	143.9
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2330						1483	
Approach Delay, s/veh					31.7						71.4	
Approach LOS					C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						35.9		39.1
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						32.0		34.0
Max Q Clear Time (g_c+I1), s						30.8		36.1
Green Ext Time (p_c), s						1.1		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	47.1
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1101	120	1052	1215	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1101	120	1052	1215	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.94	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1485	1485	1398	1398	0			
Adj Flow Rate, veh/h				0	1197	104	1143	1321	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %				0	3	3	3	3	0			
Cap, veh/h				0	1333	389	1468	1542	0			
Arrive On Green				0.00	0.33	0.33	0.18	0.18	0.00			
Sat Flow, veh/h				0	4189	1184	2663	2796	0			
Grp Volume(v), veh/h				0	1197	104	1143	1321	0			
Grp Sat Flow(s),veh/h/ln				0	1352	1184	1331	1398	0			
Q Serve(g_s), s				0.0	21.1	4.8	30.7	34.3	0.0			
Cycle Q Clear(g_c), s				0.0	21.1	4.8	30.7	34.3	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1333	389	1468	1542	0			
V/C Ratio(X)				0.00	0.90	0.27	0.78	0.86	0.00			
Avail Cap(c_a), veh/h				0	1379	403	1468	1542	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	0.09	0.09	0.00			
Uniform Delay (d), s/veh				0.0	24.0	18.5	26.3	27.8	0.0			
Incr Delay (d2), s/veh				0.0	8.0	0.4	0.4	0.6	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	8.9	1.6	11.4	13.4	0.0			
LnGrp Delay(d),s/veh				0.0	32.0	18.9	26.7	28.4	0.0			
LnGrp LOS					C	B	C	C				
Approach Vol, veh/h					1301			2464				
Approach Delay, s/veh					31.0			27.6				
Approach LOS					C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				45.8		29.2		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				40.5		25.5		
Max Q Clear Time (g_c+I1), s				36.3		23.1		
Green Ext Time (p_c), s				3.7		1.6		

Intersection Summary	
HCM 2010 Ctrl Delay	28.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2062	90	0	0	0	0	0	270	80	475	0
Future Volume (veh/h)	0	2062	90	0	0	0	0	0	270	80	475	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1660	1710				0	1573	1620	1748	1748	0
Adj Flow Rate, veh/h	0	2241	91				0	0	277	87	516	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	420	246	565	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.32	0.11	0.11	0.00
Sat Flow, veh/h		0					0	0	1300	1072	1748	0
Grp Volume(v), veh/h		0.0					0	0	277	87	516	0
Grp Sat Flow(s),veh/h/ln							0	0	1300	1072	1748	0
Q Serve(g_s), s							0.0	0.0	13.7	6.0	21.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	13.7	19.7	21.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	420	246	565	0
V/C Ratio(X)							0.00	0.00	0.66	0.35	0.91	0.00
Avail Cap(c_a), veh/h							0	0	440	263	592	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.86	0.86	0.00
Uniform Delay (d), s/veh							0.0	0.0	21.8	38.2	32.5	0.0
Incr Delay (d2), s/veh							0.0	0.0	2.6	0.3	15.7	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	5.2	1.8	13.1	0.0
LnGrp Delay(d),s/veh							0.0	0.0	24.4	38.5	48.2	0.0
LnGrp LOS									C	D	D	
Approach Vol, veh/h								277			603	
Approach Delay, s/veh								24.4			46.8	
Approach LOS								C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				28.8				28.8
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				25.4				25.4
Max Q Clear Time (g_c+I1), s				23.9				15.7
Green Ext Time (p_c), s				0.3				0.6

Intersection Summary			
HCM 2010 Ctrl Delay			39.8
HCM 2010 LOS			D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2302	0	0	0	0	0	225	100	0	0	0
Future Volume (veh/h)	110	2302	0	0	0	0	0	225	100	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1485	0				0	1485	1440			
Adj Flow Rate, veh/h	120	2502	0				0	245	107			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	166	2789	0				0	361	152			
Arrive On Green	0.23	0.23	0.00				0.00	0.18	0.18			
Sat Flow, veh/h	159	3990	0				0	1966	827			
Grp Volume(v), veh/h	928	1694	0				0	183	169			
Grp Sat Flow(s),veh/h/ln	1446	1352	0				0	1485	1308			
Q Serve(g_s), s	39.4	45.6	0.0				0.0	8.6	9.1			
Cycle Q Clear(g_c), s	46.9	45.6	0.0				0.0	8.6	9.1			
Prop In Lane	0.13		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	1065	1890	0				0	273	240			
V/C Ratio(X)	0.87	0.90	0.00				0.00	0.67	0.70			
Avail Cap(c_a), veh/h	1065	1890	0				0	412	363			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.15	0.15	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	26.6	26.2	0.0				0.0	28.5	28.7			
Incr Delay (d2), s/veh	1.7	1.2	0.0				0.0	6.0	7.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	19.3	17.4	0.0				0.0	4.0	3.8			
LnGrp Delay(d),s/veh	28.4	27.4	0.0				0.0	34.5	36.5			
LnGrp LOS	C	C						C	D			
Approach Vol, veh/h		2622						352				
Approach Delay, s/veh		27.8						35.5				
Approach LOS		C						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				18.0		57.0		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		45.4		
Max Q Clear Time (g_c+I1), s				11.1		48.9		
Green Ext Time (p_c), s				2.0		0.0		

Intersection Summary			
HCM 2010 Ctrl Delay			28.7
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2327	70	0	0	0	0	0	170	70	230	0
Future Volume (veh/h)	0	2327	70	0	0	0	0	0	170	70	230	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.93	0.97		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1382				0	1573	1591	1545	1485	0
Adj Flow Rate, veh/h	0	2529	72				0	0	165	76	250	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	0	0	0				0	0	291	216	346	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.23	0.08	0.08	0.00
Sat Flow, veh/h		0					0	0	1247	1036	1485	0
Grp Volume(v), veh/h		0.0					0	0	165	76	250	0
Grp Sat Flow(s),veh/h/ln							0	0	1247	1036	1485	0
Q Serve(g_s), s							0.0	0.0	8.8	5.4	12.3	0.0
Cycle Q Clear(g_c), s							0.0	0.0	8.8	14.2	12.3	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	291	216	346	0
V/C Ratio(X)							0.00	0.00	0.57	0.35	0.72	0.00
Avail Cap(c_a), veh/h							0	0	357	272	426	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.90	0.90	0.00
Uniform Delay (d), s/veh							0.0	0.0	25.4	37.4	32.2	0.0
Incr Delay (d2), s/veh							0.0	0.0	0.7	0.3	2.8	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	3.1	1.6	5.3	0.0
LnGrp Delay(d),s/veh							0.0	0.0	26.1	37.7	35.1	0.0
LnGrp LOS									C	D	D	
Approach Vol, veh/h								165			326	
Approach Delay, s/veh								26.1			35.7	
Approach LOS								C			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs				4				8				
Phs Duration (G+Y+Rc), s				22.0				22.0				
Change Period (Y+Rc), s				4.5				4.5				
Max Green Setting (Gmax), s				21.5				21.5				
Max Q Clear Time (g_c+I1), s				16.2				10.8				
Green Ext Time (p_c), s				0.4				0.3				
Intersection Summary												
HCM 2010 Ctrl Delay			32.5									
HCM 2010 LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	2252	205	0	0	0	0	260	20	50	125	0
Future Volume (veh/h)	100	2252	205	0	0	0	0	260	20	50	125	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	109	2448	210				0	283	13	54	136	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	124	2931	253				0	448	20	156	366	0
Arrive On Green	0.22	0.22	0.22				0.00	0.15	0.15	0.01	0.07	0.00
Sat Flow, veh/h	187	4424	382				0	3147	140	1581	1660	0
Grp Volume(v), veh/h	1013	840	914				0	145	151	54	136	0
Grp Sat Flow(s),veh/h/ln	1738	1590	1664				0	1577	1627	1581	1660	0
Q Serve(g_s), s	42.3	37.5	39.3				0.0	6.5	6.6	0.0	5.9	0.0
Cycle Q Clear(g_c), s	42.3	37.5	39.3				0.0	6.5	6.6	0.0	5.9	0.0
Prop In Lane	0.11		0.23				0.00		0.09	1.00		0.00
Lane Grp Cap(c), veh/h	1152	1054	1103				0	231	238	156	366	0
V/C Ratio(X)	0.88	0.80	0.83				0.00	0.63	0.64	0.35	0.37	0.00
Avail Cap(c_a), veh/h	1152	1054	1103				0	336	347	170	487	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.81	0.81	0.00
Uniform Delay (d), s/veh	26.4	24.5	25.2				0.0	30.1	30.1	35.9	29.8	0.0
Incr Delay (d2), s/veh	1.0	0.6	0.7				0.0	5.9	5.9	2.3	1.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.7	16.7	18.4				0.0	3.2	3.3	1.2	2.8	0.0
LnGrp Delay(d),s/veh	27.4	25.1	25.9				0.0	36.0	36.0	38.2	30.9	0.0
LnGrp LOS	C	C	C					D	D	D	C	
Approach Vol, veh/h		2767						296			190	
Approach Delay, s/veh		26.2						36.0			33.0	
Approach LOS		C						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		54.3		20.7			5.6	15.2
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		44.2		* 22			* 2	* 16
Max Q Clear Time (g_c+I1), s		44.3		7.9			2.0	8.6
Green Ext Time (p_c), s		0.0		0.8			0.0	1.3

Intersection Summary			
HCM 2010 Ctrl Delay			27.5
HCM 2010 LOS			C

Notes

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative + Project Buildout Conditions (w/ WB LT at 3rd/Brooks)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 | **Brooks St/2nd St** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	50	44	88.3%	22.0	9.9	C
	Through						
	Right Turn						
	Subtotal	50	44	88.3%	22.0	9.9	C
EB	Left Turn	25	17	67.7%	2.6	0.8	A
	Through	2,307	2,281	98.9%	2.5	0.2	A
	Right Turn						
	Subtotal	2,332	2,298	98.5%	2.5	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,382	2,342	98.3%	2.9	0.4	A

Intersection 26 | **Lindaro St/2nd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	57	104.9%	18.0	2.8	B
	Right Turn	281	276	98.1%	18.7	4.6	B
	Subtotal	335	332	99.2%	18.7	3.9	B
SB	Left Turn	72	62	86.4%	39.3	5.7	D
	Through	442	406	91.8%	37.4	2.8	D
	Right Turn						
	Subtotal	514	468	91.0%	37.7	2.7	D
EB	Left Turn	42	37	88.5%	16.0	3.5	B
	Through	2,289	2,233	97.5%	14.7	2.5	B
	Right Turn	61	74	121.9%	14.1	3.2	B
	Subtotal	2,392	2,344	98.0%	14.7	2.4	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,241	3,144	97.0%	18.6	2.2	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	2461	41	0	0	0	0	112	50	140	270	0
Future Volume (veh/h)	140	2461	41	0	0	0	0	112	50	140	270	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1398	1382	1342	0
Adj Flow Rate, veh/h	152	2675	28				0	122	41	152	293	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	145	2752	656				0	430	354	245	459	0
Arrive On Green	0.19	0.19	0.19				0.00	0.31	0.31	0.10	0.10	0.00
Sat Flow, veh/h	251	4742	1130				0	1398	1149	537	1554	0
Grp Volume(v), veh/h	840	1987	28				0	122	41	229	216	0
Grp Sat Flow(s),veh/h/ln	1386	1202	1130				0	1398	1149	870	1160	0
Q Serve(g_s), s	43.5	40.8	1.5				0.0	5.0	1.9	15.1	13.3	0.0
Cycle Q Clear(g_c), s	43.5	40.8	1.5				0.0	5.0	1.9	20.1	13.3	0.0
Prop In Lane	0.18		1.00				0.00		1.00	0.66		0.00
Lane Grp Cap(c), veh/h	804	2093	656				0	430	354	347	357	0
V/C Ratio(X)	1.04	0.95	0.04				0.00	0.28	0.12	0.66	0.60	0.00
Avail Cap(c_a), veh/h	804	2093	656				0	500	411	399	415	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	29.2	13.3				0.0	19.7	18.6	33.8	29.3	0.0
Incr Delay (d2), s/veh	24.2	1.4	0.0				0.0	0.4	0.1	3.3	1.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.1	13.9	0.5				0.0	1.9	0.6	5.0	4.5	0.0
LnGrp Delay(d),s/veh	54.5	30.6	13.3				0.0	20.1	18.8	37.1	31.2	0.0
LnGrp LOS	F	C	B					C	B	D	C	
Approach Vol, veh/h		2855						163			445	
Approach Delay, s/veh		37.4						19.7			34.3	
Approach LOS		D						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		47.7		27.3				27.3
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 40		* 27				* 27
Max Q Clear Time (g_c+I1), s		45.5		7.0				22.1
Green Ext Time (p_c), s		0.0		0.6				0.9

Intersection Summary			
HCM 2010 Ctrl Delay			36.2
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	2516	70	0	0	0	0	50	270	100	200	0
Future Volume (veh/h)	50	2516	70	0	0	0	0	50	270	100	200	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1398	1398				0	1398	1454	1398	1398	0
Adj Flow Rate, veh/h	54	2735	48				0	54	254	109	217	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3				0	3	3	3	3	0
Cap, veh/h	53	2867	633				0	339	292	275	339	0
Arrive On Green	0.19	0.19	0.19				0.00	0.24	0.24	0.08	0.08	0.00
Sat Flow, veh/h	90	4910	1084				0	1398	1204	845	1398	0
Grp Volume(v), veh/h	832	1957	48				0	54	254	109	217	0
Grp Sat Flow(s),veh/h/ln	1394	1202	1084				0	1398	1204	845	1398	0
Q Serve(g_s), s	43.8	40.0	2.7				0.0	2.3	15.2	9.4	11.3	0.0
Cycle Q Clear(g_c), s	43.8	40.0	2.7				0.0	2.3	15.2	11.7	11.3	0.0
Prop In Lane	0.06		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	814	2106	633				0	339	292	275	339	0
V/C Ratio(X)	1.02	0.93	0.08				0.00	0.16	0.87	0.40	0.64	0.00
Avail Cap(c_a), veh/h	814	2106	633				0	513	441	380	513	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.3	28.8	13.7				0.0	22.4	27.3	32.6	31.3	0.0
Incr Delay (d2), s/veh	15.7	1.0	0.0				0.0	0.2	11.5	0.9	2.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.5	13.6	0.8				0.0	0.9	5.9	2.3	4.6	0.0
LnGrp Delay(d),s/veh	46.0	29.7	13.7				0.0	22.6	38.7	33.5	33.3	0.0
LnGrp LOS	F	C	B					C	D	C	C	
Approach Vol, veh/h		2837						308			326	
Approach Delay, s/veh		34.2						35.9			33.4	
Approach LOS		C						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		50.3		24.7				24.7
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		34.5		27.5				27.5
Max Q Clear Time (g_c+I1), s		45.8		17.2				13.7
Green Ext Time (p_c), s		0.0		1.0				1.4

Intersection Summary	
HCM 2010 Ctrl Delay	34.3
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1270	1456	0	0	0	0	0	0	220	1060	0
Future Volume (veh/h)	0	1270	1456	0	0	0	0	0	0	220	1060	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1485	1485							1485	1485	0
Adj Flow Rate, veh/h	0	1380	1570							239	1152	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.92	0.92	0.92							0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3							3	3	0
Cap, veh/h	0	2406	1364							406	852	0
Arrive On Green	0.00	0.18	0.18							0.09	0.09	0.00
Sat Flow, veh/h	0	4456	2525							1415	2971	0
Grp Volume(v), veh/h	0	1380	1570							239	1152	0
Grp Sat Flow(s),veh/h/ln	0	1485	1263							1415	1485	0
Q Serve(g_s), s	0.0	21.3	40.5							12.1	21.5	0.0
Cycle Q Clear(g_c), s	0.0	21.3	40.5							12.1	21.5	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2406	1364							406	852	0
V/C Ratio(X)	0.00	0.57	1.15							0.59	1.35	0.00
Avail Cap(c_a), veh/h	0	2406	1364							406	852	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.78	0.78	0.00
Uniform Delay (d), s/veh	0.0	22.9	30.8							29.7	34.0	0.0
Incr Delay (d2), s/veh	0.0	0.1	69.0							1.8	164.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.8	27.2							5.0	28.3	0.0
LnGrp Delay(d),s/veh	0.0	23.0	99.8							31.5	198.7	0.0
LnGrp LOS		C	F							C	F	
Approach Vol, veh/h		2950									1391	
Approach Delay, s/veh		63.9									170.0	
Approach LOS		E									F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		49.0		26.0				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		40.5		21.5				
Max Q Clear Time (g_c+I1), s		42.5		23.5				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary	
HCM 2010 Ctrl Delay	97.9
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	780	880	0	0	0	0	0	1497	500	0	0	0
Future Volume (veh/h)	780	880	0	0	0	0	0	1497	500	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1454	1485	0				0	1398	1398			
Adj Flow Rate, veh/h	848	957	0				0	1627	513			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92			
Percent Heavy Veh, %	3	3	0				0	3	3			
Cap, veh/h	1326	1216	0				0	1952	553			
Arrive On Green	0.14	0.14	0.00				0.00	0.47	0.47			
Sat Flow, veh/h	2769	2971	0				0	4194	1188			
Grp Volume(v), veh/h	848	957	0				0	1627	513			
Grp Sat Flow(s),veh/h/ln	1385	1485	0				0	1398	1188			
Q Serve(g_s), s	22.1	23.4	0.0				0.0	25.4	30.5			
Cycle Q Clear(g_c), s	22.1	23.4	0.0				0.0	25.4	30.5			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1326	1216	0				0	1952	553			
V/C Ratio(X)	0.64	0.79	0.00				0.00	0.83	0.93			
Avail Cap(c_a), veh/h	1326	1216	0				0	1957	555			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.34	0.34	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	28.7	29.3	0.0				0.0	17.5	18.9			
Incr Delay (d2), s/veh	0.8	1.8	0.0				0.0	3.6	22.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.6	9.9	0.0				0.0	10.4	13.3			
LnGrp Delay(d),s/veh	29.5	31.1	0.0				0.0	21.1	41.5			
LnGrp LOS	C	C						C	D			
Approach Vol, veh/h		1805						2140				
Approach Delay, s/veh		30.4						26.0				
Approach LOS		C						C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		34.9		40.1				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 31		* 35				
Max Q Clear Time (g_c+I1), s		25.4		32.5				
Green Ext Time (p_c), s		4.7		2.4				

Intersection Summary			
HCM 2010 Ctrl Delay			28.0
HCM 2010 LOS			C

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	20	330	50	10	80	220	64	60	300	160	71	222
Future Volume (veh/h)	20	330	50	10	80	220	64	60	300	160	71	222
Number	5	2	12		1	6	16	3	8	18	7	4
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.94		1.00		0.97	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2019	2019	2000		1942	1942	2000	1845	1845	1900	1845	1845
Adj Flow Rate, veh/h	22	359	46		87	239	58	65	326	150	77	241
Adj No. of Lanes	1	1	0		1	1	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3		3	3	3	3	3	3	3	3
Cap, veh/h	58	433	56		153	453	110	164	376	173	178	548
Arrive On Green	0.03	0.25	0.25		0.08	0.30	0.30	0.09	0.32	0.32	0.10	0.33
Sat Flow, veh/h	1923	1741	223		1849	1501	364	1757	1183	545	1757	1683
Grp Volume(v), veh/h	22	0	405		87	0	297	65	0	476	77	0
Grp Sat Flow(s),veh/h/ln	1923	0	1965		1849	0	1865	1757	0	1728	1757	0
Q Serve(g_s), s	0.8	0.0	13.4		3.1	0.0	9.1	2.4	0.0	17.8	2.8	0.0
Cycle Q Clear(g_c), s	0.8	0.0	13.4		3.1	0.0	9.1	2.4	0.0	17.8	2.8	0.0
Prop In Lane	1.00		0.11		1.00		0.20	1.00		0.32	1.00	
Lane Grp Cap(c), veh/h	58	0	489		153	0	562	164	0	549	178	0
V/C Ratio(X)	0.38	0.00	0.83		0.57	0.00	0.53	0.40	0.00	0.87	0.43	0.00
Avail Cap(c_a), veh/h	225	0	634		270	0	657	231	0	677	231	0
HCM Platoon Ratio	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00		1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.6	0.0	24.3		30.2	0.0	19.9	29.2	0.0	22.0	28.9	0.0
Incr Delay (d2), s/veh	1.5	0.0	7.1		1.2	0.0	0.8	0.6	0.0	9.9	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	8.2		1.6	0.0	4.7	1.2	0.0	10.0	1.4	0.0
LnGrp Delay(d),s/veh	34.1	0.0	31.4		31.5	0.0	20.6	29.8	0.0	31.9	29.5	0.0
LnGrp LOS	C		C		C		C	C		C	C	
Approach Vol, veh/h		427				384			541			336
Approach Delay, s/veh		31.5				23.1			31.6			21.2
Approach LOS		C				C			C			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.7	21.9	10.4	26.5	6.1	25.5	10.9	25.9
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	22.1	9.0	* 27	8.0	24.1	9.0	* 27
Max Q Clear Time (g_c+I1), s	5.1	15.4	4.4	9.7	2.8	11.1	4.8	19.8
Green Ext Time (p_c), s	0.1	1.0	0.0	0.9	0.0	0.9	0.0	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	27.6
HCM 2010 LOS	C

Notes

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	20
Future Volume (veh/h)	20
Number	14
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.92
Parking Bus, Adj	1.00
Adj Sat Flow, veh/h/ln	1900
Adj Flow Rate, veh/h	18
Adj No. of Lanes	0
Peak Hour Factor	0.92
Percent Heavy Veh, %	3
Cap, veh/h	41
Arrive On Green	0.33
Sat Flow, veh/h	126
Grp Volume(v), veh/h	259
Grp Sat Flow(s),veh/h/ln	1809
Q Serve(g_s), s	7.7
Cycle Q Clear(g_c), s	7.7
Prop In Lane	0.07
Lane Grp Cap(c), veh/h	589
V/C Ratio(X)	0.44
Avail Cap(c_a), veh/h	708
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	18.2
Incr Delay (d2), s/veh	0.5
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	3.9
LnGrp Delay(d),s/veh	18.7
LnGrp LOS	B
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	

Timer

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	585	75	0	740	0	0
Future Volume (vph)	585	75	0	740	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			3.0		
Lane Util. Factor	1.00			1.00		
Frpb, ped/bikes	0.99			1.00		
Flpb, ped/bikes	1.00			1.00		
Frt	0.98			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	1540			1573		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	1540			1573		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	636	82	0	804	0	0
RTOR Reduction (vph)	6	0	0	0	0	0
Lane Group Flow (vph)	712	0	0	804	0	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA		
Protected Phases	2			3 4 6		
Permitted Phases						
Actuated Green, G (s)	34.4			51.8		
Effective Green, g (s)	34.4			46.2		
Actuated g/C Ratio	0.46			0.62		
Clearance Time (s)	5.6					
Vehicle Extension (s)	3.0					
Lane Grp Cap (vph)	706			968		
v/s Ratio Prot	c0.46			c0.51		
v/s Ratio Perm						
v/c Ratio	1.01			0.83		
Uniform Delay, d1	20.3			11.3		
Progression Factor	0.97			0.51		
Incremental Delay, d2	30.6			0.6		
Delay (s)	50.4			6.3		
Level of Service	D			A		
Approach Delay (s)	50.4			6.3	0.0	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	390	50	0	380	0	0	0	0	20	20	30
Future Volume (vph)	0	390	50	0	380	0	0	0	0	20	20	30
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6						5.6	
Lane Util. Factor		1.00			1.00						1.00	
Frpb, ped/bikes		0.99			1.00						0.98	
Flpb, ped/bikes		1.00			1.00						1.00	
Frt		0.98			1.00						0.94	
Flt Protected		1.00			1.00						0.99	
Satd. Flow (prot)		1541			1573						1432	
Flt Permitted		1.00			1.00						0.99	
Satd. Flow (perm)		1541			1573						1432	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	424	54	0	413	0	0	0	0	22	22	33
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	29	0
Lane Group Flow (vph)	0	473	0	0	413	0	0	0	0	0	48	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA					Perm	NA	
Protected Phases		2			4 6						8	
Permitted Phases										8		
Actuated Green, G (s)		39.3			55.7						8.1	
Effective Green, g (s)		39.3			55.7						8.1	
Actuated g/C Ratio		0.52			0.74						0.11	
Clearance Time (s)		5.6									5.6	
Vehicle Extension (s)		3.0									1.5	
Lane Grp Cap (vph)		807			1168						154	
v/s Ratio Prot		c0.31			c0.26							
v/s Ratio Perm											0.03	
v/c Ratio		0.59			0.35						0.31	
Uniform Delay, d1		12.3			3.4						30.9	
Progression Factor		0.57			0.09						0.85	
Incremental Delay, d2		1.8			0.1						0.0	
Delay (s)		8.8			0.4						26.2	
Level of Service		A			A						C	
Approach Delay (s)		8.8			0.4			0.0			26.2	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	6.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	585	0	0	730	10	20
Future Volume (vph)	585	0	0	730	10	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.6			5.6	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1573			1573	1408	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1573			1573	1408	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	636	0	0	793	11	22
RTOR Reduction (vph)	0	0	0	0	19	0
Lane Group Flow (vph)	636	0	0	793	14	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	52.4			34.4	11.8	
Effective Green, g (s)	47.2			34.4	11.8	
Actuated g/C Ratio	0.63			0.46	0.16	
Clearance Time (s)				5.6		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	989			721	221	
v/s Ratio Prot	c0.40			c0.50	c0.01	
v/s Ratio Perm						
v/c Ratio	0.64			1.10	0.07	
Uniform Delay, d1	8.7			20.3	26.9	
Progression Factor	0.45			1.16	1.05	
Incremental Delay, d2	0.1			57.1	0.0	
Delay (s)	4.0			80.6	28.4	
Level of Service	A			F	C	
Approach Delay (s)	4.0			80.6	28.4	
Approach LOS	A			F	C	

Intersection Summary			
HCM 2000 Control Delay	46.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	410	0	0	350	20	30	10	30	0	0	0
Future Volume (vph)	0	410	0	0	350	20	30	10	30	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.98				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.94				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1557			1422				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1557			1422				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	446	0	0	380	22	33	11	33	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	28	0	0	0	0
Lane Group Flow (vph)	0	446	0	0	400	0	0	49	0	0	0	0
Confl. Peds. (#/hr)	10					10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		53.0			39.3			10.8				
Effective Green, g (s)		53.0			39.3			10.8				
Actuated g/C Ratio		0.71			0.52			0.14				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1111			815			204				
v/s Ratio Prot		c0.28			c0.26			c0.03				
v/s Ratio Perm												
v/c Ratio		0.40			0.49			0.24				
Uniform Delay, d1		4.5			11.4			28.5				
Progression Factor		0.02			0.65			1.26				
Incremental Delay, d2		0.1			2.0			0.1				
Delay (s)		0.1			9.3			36.1				
Level of Service		A			A			D				
Approach Delay (s)		0.1			9.3			36.1			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	500	0	0	420	70	10	10	10	0	0	0
Future Volume (vph)	0	500	0	0	420	70	10	10	10	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.6			5.6			5.6				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1573			1517			1464				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1573			1517			1464				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	543	0	0	457	76	11	11	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	543	0	0	525	0	0	24	0	0	0	0
Confl. Peds. (#/hr)	39		22			39			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		50.3			30.9			13.9				
Effective Green, g (s)		50.3			30.9			13.9				
Actuated g/C Ratio		0.67			0.41			0.19				
Clearance Time (s)					5.6			5.6				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1054			625			271				
v/s Ratio Prot		c0.35			c0.35			c0.02				
v/s Ratio Perm												
v/c Ratio		0.52			0.84			0.09				
Uniform Delay, d1		6.2			19.8			25.3				
Progression Factor		0.07			0.98			1.01				
Incremental Delay, d2		0.4			11.5			0.1				
Delay (s)		0.8			30.9			25.7				
Level of Service		A			C			C				
Approach Delay (s)		0.8			30.9			25.7			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	495	20	70	550	70	40	526	60	0	401	320
Future Volume (veh/h)	280	495	20	70	550	70	40	526	60	0	401	320
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.97	0.99		0.93	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1676	1676	1710	1676	1676	1710	1800	1694	1728	0	1765	1728
Adj Flow Rate, veh/h	292	516	19	73	573	67	42	548	52	0	418	144
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	2	2
Cap, veh/h	279	943	35	397	551	64	97	1036	96	0	938	318
Arrive On Green	0.17	0.59	0.59	0.75	0.75	0.75	0.77	0.77	0.77	0.00	0.39	0.39
Sat Flow, veh/h	1597	1606	59	819	1469	172	119	2673	248	0	2508	822
Grp Volume(v), veh/h	292	0	535	73	0	640	332	0	310	0	288	274
Grp Sat Flow(s),veh/h/ln	1597	0	1665	819	0	1641	1562	0	1477	0	1676	1565
Q Serve(g_s), s	14.0	0.0	15.6	2.2	0.0	30.0	0.0	0.0	6.5	0.0	10.2	10.4
Cycle Q Clear(g_c), s	14.0	0.0	15.6	2.2	0.0	30.0	5.8	0.0	6.5	0.0	10.2	10.4
Prop In Lane	1.00		0.04	1.00		0.10	0.13		0.17	0.00		0.53
Lane Grp Cap(c), veh/h	279	0	978	397	0	615	656	0	572	0	650	606
V/C Ratio(X)	1.05	0.00	0.55	0.18	0.00	1.04	0.51	0.00	0.54	0.00	0.44	0.45
Avail Cap(c_a), veh/h	279	0	978	397	0	615	656	0	572	0	650	606
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.76	0.00	0.76	0.75	0.00	0.75	0.00	1.00	1.00
Uniform Delay (d), s/veh	33.0	0.0	10.0	6.5	0.0	10.0	6.2	0.0	6.2	0.0	18.1	18.2
Incr Delay (d2), s/veh	66.1	0.0	2.2	0.8	0.0	42.5	2.1	0.0	2.7	0.0	2.2	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.3	0.0	7.7	0.6	0.0	19.9	3.0	0.0	2.8	0.0	5.1	4.9
LnGrp Delay(d),s/veh	99.1	0.0	12.2	7.3	0.0	52.5	8.3	0.0	9.0	0.0	20.3	20.6
LnGrp LOS	F		B	A		F	A		A		C	C
Approach Vol, veh/h		827			713			642			562	
Approach Delay, s/veh		42.9			47.9			8.6			20.5	
Approach LOS		D			D			A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		51.2		35.8	17.0	34.2		35.8
Change Period (Y+Rc), s		* 4.2		4.6	3.0	* 4.2		4.6
Max Green Setting (Gmax), s		* 47		24.4	14.0	* 30		24.4
Max Q Clear Time (g_c+I1), s		17.6		8.5	16.0	32.0		12.4
Green Ext Time (p_c), s		5.8		5.2	0.0	0.0		3.8

Intersection Summary	
HCM 2010 Ctrl Delay	31.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	490	50	40	180	0	0	0	0	250	1233	495
Future Volume (vph)	0	490	50	40	180	0	0	0	0	250	1233	495
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.98
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.99			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2769			1781						2992	1321
Flt Permitted		1.00			0.80						0.99	1.00
Satd. Flow (perm)		2769			1431						2992	1321
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	510	52	42	188	0	0	0	0	260	1284	516
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	553	0	0	230	0	0	0	0	0	1544	516
Confl. Peds. (#/hr)			15	15		4			11			
Confl. Bikes (#/hr)			3			3			3			2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		22.8			22.8						48.4	41.4
Effective Green, g (s)		22.8			22.8						48.4	41.4
Actuated g/C Ratio		0.29			0.29						0.60	0.52
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		789			407						1810	683
v/s Ratio Prot		c0.20									c0.52	
v/s Ratio Perm					0.16							0.39
v/c Ratio		0.70			0.57						0.85	0.76
Uniform Delay, d1		25.5			24.4						12.9	15.3
Progression Factor		0.47			0.44						1.00	1.00
Incremental Delay, d2		4.5			4.7						5.3	7.6
Delay (s)		16.6			15.5						18.2	22.9
Level of Service		B			B						B	C
Approach Delay (s)		16.6			15.5			0.0			19.4	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
Lane Configurations										
Traffic Volume (vph)	400	20	320	145	320	20	70	1630	200	60
Future Volume (vph)	400	20	320	145	320	20	70	1630	200	60
Ideal Flow (vphpl)	2200	1800	2200	2200	2200	1800	2200	2200	1800	2200
Lane Width	9	12	10	10	9	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Lane Util. Factor		1.00	1.00	1.00	1.00			0.95	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97	
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00	
Frt		1.00	1.00	1.00	0.85			1.00	0.85	
Flt Protected		0.95	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (prot)		1509	1812	1812	1485			3678	1316	
Flt Permitted		0.62	1.00	1.00	1.00			1.00	1.00	
Satd. Flow (perm)		986	1812	1812	1485			3678	1316	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	417	21	333	151	333	21	73	1698	208	62
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	39	0
Lane Group Flow (vph)	0	438	333	151	354	0	0	1771	232	0
Confl. Peds. (#/hr)							8			3
Confl. Bikes (#/hr)					4	4				
Turn Type	pm+pt	pm+pt	NA	NA	Prot		Perm	NA	Perm	
Protected Phases	5	5	2	6	6			4		
Permitted Phases	2	2					4		4	
Actuated Green, G (s)		33.8	33.8	18.8	18.8			37.8	37.8	
Effective Green, g (s)		33.8	33.8	18.8	18.8			37.8	37.8	
Actuated g/C Ratio		0.42	0.42	0.24	0.24			0.47	0.47	
Clearance Time (s)		4.2	4.2	4.2	4.2			4.2	4.2	
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0	
Lane Grp Cap (vph)		487	765	425	348			1737	621	
v/s Ratio Prot		c0.12	0.18	0.08	c0.24					
v/s Ratio Perm		0.26						0.48	0.18	
v/c Ratio		0.90	0.44	0.36	1.02			1.02	0.37	
Uniform Delay, d1		21.5	16.3	25.5	30.6			21.1	13.5	
Progression Factor		0.69	0.79	1.00	1.00			0.48	0.24	
Incremental Delay, d2		13.4	0.3	0.5	52.7			20.3	0.8	
Delay (s)		28.2	13.2	26.1	83.3			30.5	4.1	
Level of Service		C	B	C	F			C	A	
Approach Delay (s)			21.7	66.2				27.0		
Approach LOS			C	E				C		

Intersection Summary			
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	400	40	30	245	65	60	471	90	90	361	40
Future Volume (veh/h)	90	400	40	30	245	65	60	471	90	90	361	40
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	1.00		0.97	0.98		0.93	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1412	1560	1530	1412	1500	1530	1440	1500	1469	1440	1500	1469
Adj Flow Rate, veh/h	94	417	38	31	255	56	62	491	76	94	376	34
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	427	622	57	244	525	115	137	934	142	222	813	75
Arrive On Green	0.44	0.44	0.44	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Sat Flow, veh/h	846	1405	128	745	1185	260	188	2111	320	360	1837	169
Grp Volume(v), veh/h	94	0	455	31	0	311	325	0	304	239	0	265
Grp Sat Flow(s),veh/h/ln	846	0	1533	745	0	1446	1339	0	1280	1046	0	1321
Q Serve(g_s), s	6.0	0.0	18.8	2.1	0.0	3.5	0.0	0.0	4.2	0.9	0.0	3.1
Cycle Q Clear(g_c), s	9.5	0.0	18.8	20.9	0.0	3.5	3.5	0.0	4.2	5.1	0.0	3.1
Prop In Lane	1.00		0.08	1.00		0.18	0.19		0.25	0.39		0.13
Lane Grp Cap(c), veh/h	427	0	679	244	0	640	646	0	567	526	0	584
V/C Ratio(X)	0.22	0.00	0.67	0.13	0.00	0.49	0.50	0.00	0.54	0.45	0.00	0.45
Avail Cap(c_a), veh/h	427	0	679	244	0	640	646	0	567	526	0	584
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.97	0.00	0.97	0.82	0.00	0.82	0.68	0.00	0.68
Uniform Delay (d), s/veh	16.3	0.0	17.7	9.8	0.0	2.8	2.8	0.0	2.8	2.7	0.0	2.7
Incr Delay (d2), s/veh	1.2	0.0	5.2	1.0	0.0	2.5	2.3	0.0	3.0	1.9	0.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	8.8	0.5	0.0	1.7	1.7	0.0	1.7	1.1	0.0	1.3
LnGrp Delay(d),s/veh	17.4	0.0	22.9	10.8	0.0	5.3	5.1	0.0	5.8	4.6	0.0	4.5
LnGrp LOS	B		C	B		A	A		A	A		A
Approach Vol, veh/h		549			342			629			504	
Approach Delay, s/veh		22.0			5.8			5.4			4.5	
Approach LOS		C			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.0		40.0		40.0		40.0
Change Period (Y+Rc), s		4.6		4.6		4.6		4.6
Max Green Setting (Gmax), s		35.4		35.4		35.4		35.4
Max Q Clear Time (g_c+I1), s		20.8		6.2		22.9		7.1
Green Ext Time (p_c), s		2.4		3.0		1.2		2.5

Intersection Summary		
HCM 2010 Ctrl Delay		9.8
HCM 2010 LOS		A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	360	190	70	180	0	0	0	0	50	1133	140
Future Volume (vph)	0	360	190	70	180	0	0	0	0	50	1133	140
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.2			4.2						4.6	4.6
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.95
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1700			1773						4164	1147
Flt Permitted		1.00			0.66						1.00	1.00
Satd. Flow (perm)		1700			1178						4164	1147
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	375	198	73	188	0	0	0	0	52	1180	146
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	564	0	0	261	0	0	0	0	0	1232	146
Confl. Peds. (#/hr)	12		12	12		12			12	12		7
Confl. Bikes (#/hr)			6			4			2			2
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases				8						2		5
Actuated Green, G (s)		39.8			39.8						31.4	24.4
Effective Green, g (s)		39.8			39.8						31.4	24.4
Actuated g/C Ratio		0.50			0.50						0.39	0.30
Clearance Time (s)		4.2			4.2						4.6	4.6
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		845			586						1634	349
v/s Ratio Prot		c0.33										
v/s Ratio Perm					0.22						0.30	0.13
v/c Ratio		0.67			0.45						0.75	0.42
Uniform Delay, d1		15.1			13.0						21.0	22.1
Progression Factor		0.34			0.99						0.68	0.75
Incremental Delay, d2		3.9			1.9						1.7	1.9
Delay (s)		8.9			14.7						16.0	18.5
Level of Service		A			B						B	B
Approach Delay (s)		8.9			14.7			0.0			16.2	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	160	0	0	140	120	100	1555	20	0	0	0
Future Volume (veh/h)	270	160	0	0	140	120	100	1555	20	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	1.00		0.96			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1620	1588	1620			
Adj Flow Rate, veh/h	281	167	0	0	146	121	104	1620	19			
Adj No. of Lanes	1	1	0	0	1	0	0	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	0	2	0			
Cap, veh/h	365	683	0	0	296	245	117	1951	24			
Arrive On Green	0.72	0.72	0.00	0.00	0.43	0.43	0.15	0.15	0.15			
Sat Flow, veh/h	993	1588	0	0	688	570	258	4288	52			
Grp Volume(v), veh/h	281	167	0	0	0	267	635	530	578			
Grp Sat Flow(s),veh/h/ln	993	1588	0	0	0	1258	1575	1445	1577			
Q Serve(g_s), s	22.1	2.9	0.0	0.0	0.0	12.3	31.6	28.4	28.4			
Cycle Q Clear(g_c), s	34.4	2.9	0.0	0.0	0.0	12.3	31.6	28.4	28.4			
Prop In Lane	1.00		0.00	0.00		0.45	0.16		0.03			
Lane Grp Cap(c), veh/h	365	683	0	0	0	541	717	658	717			
V/C Ratio(X)	0.77	0.24	0.00	0.00	0.00	0.49	0.89	0.81	0.81			
Avail Cap(c_a), veh/h	365	683	0	0	0	541	717	658	717			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	0.33	0.33	0.33			
Upstream Filter(I)	0.69	0.69	0.00	0.00	0.00	1.00	0.48	0.48	0.48			
Uniform Delay (d), s/veh	17.7	6.8	0.0	0.0	0.0	16.5	32.0	30.6	30.6			
Incr Delay (d2), s/veh	6.9	0.1	0.0	0.0	0.0	0.7	8.1	5.2	4.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.8	1.3	0.0	0.0	0.0	4.3	15.4	12.3	13.3			
LnGrp Delay(d),s/veh	24.5	7.0	0.0	0.0	0.0	17.2	40.1	35.7	35.3			
LnGrp LOS	C	A				B	D	D	D			
Approach Vol, veh/h		448			267			1743				
Approach Delay, s/veh		18.0			17.2			37.2				
Approach LOS		B			B			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		39.0		41.0		39.0		
Change Period (Y+Rc), s		4.6		4.6		4.6		
Max Green Setting (Gmax), s		34.4		36.4		34.4		
Max Q Clear Time (g_c+I1), s		36.4		33.6		14.3		
Green Ext Time (p_c), s		0.0		2.1		1.1		

Intersection Summary	
HCM 2010 Ctrl Delay	31.5
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	245	40	115	280	155	30	431	90	50	311	70
Future Volume (veh/h)	50	245	40	115	280	155	30	431	90	50	311	70
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.91	0.97		0.90	0.93		0.83	0.97		0.83
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1588	1525	1620	1588	1588	1620	1620	1588	1555	1620	1588	1555
Adj Flow Rate, veh/h	52	255	34	120	292	135	31	449	73	52	324	52
Adj No. of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	284	647	86	446	493	228	83	934	147	122	720	125
Arrive On Green	0.50	0.50	0.50	0.16	0.16	0.16	0.13	0.13	0.13	0.80	0.80	0.80
Sat Flow, veh/h	861	1300	173	949	991	458	84	2351	370	167	1810	315
Grp Volume(v), veh/h	52	0	289	120	0	427	298	0	255	210	0	218
Grp Sat Flow(s),veh/h/ln	861	0	1473	949	0	1450	1513	0	1291	975	0	1316
Q Serve(g_s), s	4.0	0.0	9.8	9.3	0.0	21.8	0.0	0.0	14.7	4.4	0.0	4.1
Cycle Q Clear(g_c), s	25.8	0.0	9.8	19.1	0.0	21.8	13.9	0.0	14.7	19.1	0.0	4.1
Prop In Lane	1.00		0.12	1.00		0.32	0.10		0.29	0.25		0.24
Lane Grp Cap(c), veh/h	284	0	733	446	0	721	651	0	513	444	0	523
V/C Ratio(X)	0.18	0.00	0.39	0.27	0.00	0.59	0.46	0.00	0.50	0.47	0.00	0.42
Avail Cap(c_a), veh/h	284	0	733	446	0	721	651	0	513	444	0	523
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.93	0.00	0.93	0.80	0.00	0.80	0.80	0.00	0.80
Uniform Delay (d), s/veh	25.6	0.0	12.6	29.3	0.0	25.9	27.0	0.0	27.3	6.7	0.0	5.4
Incr Delay (d2), s/veh	1.4	0.0	1.6	1.4	0.0	3.3	1.8	0.0	2.7	2.9	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	4.3	2.6	0.0	9.4	6.5	0.0	5.6	1.6	0.0	1.6
LnGrp Delay(d),s/veh	27.0	0.0	14.2	30.6	0.0	29.2	28.8	0.0	30.0	9.5	0.0	7.3
LnGrp LOS	C		B	C		C	C		C	A		A
Approach Vol, veh/h		341			547			553			428	
Approach Delay, s/veh		16.1			29.5			29.4			8.4	
Approach LOS		B			C			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		44.0		36.0		44.0		36.0
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		* 4.2
Max Green Setting (Gmax), s		* 40		* 32		* 40		* 32
Max Q Clear Time (g_c+I1), s		27.8		16.7		23.8		21.1
Green Ext Time (p_c), s		2.3		4.3		4.8		2.7

Intersection Summary		
HCM 2010 Ctrl Delay		22.2
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	465	440	0	0	120
Future Volume (vph)	0	465	440	0	0	120
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0	6.0			5.6
Lane Util. Factor		1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00			0.78
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1588	1588			1074
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1588	1588			1074
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	484	458	0	0	125
RTOR Reduction (vph)	0	0	0	0	0	104
Lane Group Flow (vph)	0	484	458	0	0	21
Confl. Peds. (#/hr)				59		78
Confl. Bikes (#/hr)				14		
Turn Type		NA	NA			Perm
Protected Phases		2 8	4 6			
Permitted Phases						8
Actuated Green, G (s)		54.9	55.1			13.3
Effective Green, g (s)		54.9	55.1			13.3
Actuated g/C Ratio		0.69	0.69			0.17
Clearance Time (s)						5.6
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)		1089	1093			178
v/s Ratio Prot		c0.30	c0.29			
v/s Ratio Perm						0.02
v/c Ratio		0.44	0.42			0.12
Uniform Delay, d1		5.7	5.4			28.4
Progression Factor		0.95	0.15			1.00
Incremental Delay, d2		0.3	0.2			0.3
Delay (s)		5.7	1.0			28.6
Level of Service		A	A			C
Approach Delay (s)		5.7	1.0		28.6	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	6.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	285	190	80	260	0	0	0	0	135	1053	205
Future Volume (vph)	0	285	190	80	260	0	0	0	0	135	1053	205
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.93	1.00	1.00						1.00	0.92
Flpb, ped/bikes		1.00	1.00	0.97	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1172	1609	1535						4143	1102
Flt Permitted		1.00	1.00	0.47	1.00						0.99	1.00
Satd. Flow (perm)		1641	1172	792	1535						4143	1102
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	297	198	83	271	0	0	0	0	141	1097	214
RTOR Reduction (vph)	0	0	36	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	297	162	83	271	0	0	0	0	0	1238	214
Confl. Peds. (#/hr)			51	51		28			11	11		19
Confl. Bikes (#/hr)			10			16			1			1
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		29.8	29.8	29.8	29.8						41.4	34.4
Effective Green, g (s)		29.8	29.8	29.8	29.8						41.4	34.4
Actuated g/C Ratio		0.37	0.37	0.37	0.37						0.52	0.43
Clearance Time (s)		4.2	4.2	4.2	4.2						4.6	4.6
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		611	436	295	571						2144	473
v/s Ratio Prot		c0.18			0.18							
v/s Ratio Perm			0.14	0.10							0.30	0.19
v/c Ratio		0.49	0.37	0.28	0.47						0.58	0.45
Uniform Delay, d1		19.2	18.3	17.6	19.1						13.3	16.1
Progression Factor		0.56	0.40	0.93	0.95						0.36	0.49
Incremental Delay, d2		2.5	2.2	2.2	2.6						0.8	2.1
Delay (s)		13.3	9.5	18.5	20.7						5.5	10.0
Level of Service		B	A	B	C						A	B
Approach Delay (s)		11.8			20.2			0.0			6.2	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	230	0	0	210	90	120	1410	170	0	0	0
Future Volume (veh/h)	180	230	0	0	210	90	120	1410	170	0	0	0
Number	5	2	12	1	6	16	7	4	14			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.99			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1588	1588	0	0	1588	1620	1525	1588	1620			
Adj Flow Rate, veh/h	188	240	0	0	219	83	125	1469	157			
Adj No. of Lanes	1	1	0	0	1	0	1	3	0			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	262	631	0	0	374	142	722	1977	211			
Arrive On Green	0.13	0.13	0.00	0.00	0.13	0.13	0.16	0.16	0.16			
Sat Flow, veh/h	963	1588	0	0	941	356	1452	3973	424			
Grp Volume(v), veh/h	188	240	0	0	0	302	125	1068	558			
Grp Sat Flow(s),veh/h/ln	963	1588	0	0	0	1297	1452	1445	1507			
Q Serve(g_s), s	14.3	11.1	0.0	0.0	0.0	17.5	5.9	28.2	28.2			
Cycle Q Clear(g_c), s	31.8	11.1	0.0	0.0	0.0	17.5	5.9	28.2	28.2			
Prop In Lane	1.00		0.00	0.00		0.27	1.00		0.28			
Lane Grp Cap(c), veh/h	262	631	0	0	0	516	722	1438	750			
V/C Ratio(X)	0.72	0.38	0.00	0.00	0.00	0.59	0.17	0.74	0.74			
Avail Cap(c_a), veh/h	262	631	0	0	0	516	722	1438	750			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	0.33	0.33	0.33	0.33	0.33			
Upstream Filter(I)	0.87	0.87	0.00	0.00	0.00	1.00	0.35	0.35	0.35			
Uniform Delay (d), s/veh	44.1	25.7	0.0	0.0	0.0	28.6	19.3	28.6	28.6			
Incr Delay (d2), s/veh	13.7	1.5	0.0	0.0	0.0	4.8	0.2	1.2	2.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.2	5.1	0.0	0.0	0.0	7.0	2.4	11.5	12.3			
LnGrp Delay(d),s/veh	57.9	27.3	0.0	0.0	0.0	33.4	19.5	29.8	30.9			
LnGrp LOS	E	C				C	B	C	C			
Approach Vol, veh/h		428			302			1751				
Approach Delay, s/veh		40.7			33.4			29.4				
Approach LOS		D			C			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		36.0		44.0		36.0		
Change Period (Y+Rc), s		* 4.2		* 4.2		* 4.2		
Max Green Setting (Gmax), s		* 32		* 40		* 32		
Max Q Clear Time (g_c+I1), s		33.8		30.2		19.5		
Green Ext Time (p_c), s		0.0		6.0		1.0		

Intersection Summary		
HCM 2010 Ctrl Delay		31.8
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	335	1591	0	0	0	0	0	300	60
Future Volume (veh/h)	0	0	0	335	1591	0	0	0	0	0	300	60
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.94
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.82
Adj Sat Flow, veh/h/ln				1530	1500	0				0	1500	1530
Adj Flow Rate, veh/h				349	1657	0				0	312	43
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				509	2184	0				0	462	63
Arrive On Green				0.23	0.23	0.00				0.00	0.20	0.20
Sat Flow, veh/h				644	3302	0				0	2352	309
Grp Volume(v), veh/h				725	1281	0				0	193	162
Grp Sat Flow(s),veh/h/ln				1339	1242	0				0	1425	1161
Q Serve(g_s), s				40.8	38.4	0.0				0.0	10.0	10.3
Cycle Q Clear(g_c), s				40.8	38.4	0.0				0.0	10.0	10.3
Prop In Lane				0.48		0.00				0.00		0.27
Lane Grp Cap(c), veh/h				986	1707	0				0	289	236
V/C Ratio(X)				0.74	0.75	0.00				0.00	0.67	0.69
Avail Cap(c_a), veh/h				986	1707	0				0	417	339
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.45	0.45	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				25.5	24.5	0.0				0.0	29.4	29.5
Incr Delay (d2), s/veh				2.2	1.4	0.0				0.0	2.7	3.5
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.8	13.6	0.0				0.0	4.1	3.5
LnGrp Delay(d),s/veh				27.7	26.0	0.0				0.0	32.1	33.0
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					2006						355	
Approach Delay, s/veh					26.6						32.5	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		59.2		20.8				
Change Period (Y+Rc), s		* 4.2		4.6				
Max Green Setting (Gmax), s		* 48		23.4				
Max Q Clear Time (g_c+I1), s		42.8		12.3				
Green Ext Time (p_c), s		3.9		1.1				

Intersection Summary	
HCM 2010 Ctrl Delay	27.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑	↱		↰↑				
Traffic Volume (veh/h)	0	0	0	0	1786	160	150	330	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1786	160	150	330	0	0	0	0
Number				5	2	12	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.98	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1412	1412	1440	1412	0			
Adj Flow Rate, veh/h				0	1860	133	156	344	0			
Adj No. of Lanes				0	3	1	0	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	2	2	0			
Cap, veh/h				0	2481	757	247	442	0			
Arrive On Green				0.00	0.21	0.21	0.08	0.08	0.00			
Sat Flow, veh/h				0	3981	1175	700	1822	0			
Grp Volume(v), veh/h				0	1860	133	270	230	0			
Grp Sat Flow(s),veh/h/ln				0	1285	1175	1237	1220	0			
Q Serve(g_s), s				0.0	36.2	7.4	16.9	14.7	0.0			
Cycle Q Clear(g_c), s				0.0	36.2	7.4	17.3	14.7	0.0			
Prop In Lane				0.00		1.00	0.58		0.00			
Lane Grp Cap(c), veh/h				0	2481	757	382	307	0			
V/C Ratio(X)				0.00	0.75	0.18	0.71	0.75	0.00			
Avail Cap(c_a), veh/h				0	2481	757	408	333	0			
HCM Platoon Ratio				1.00	0.33	0.33	0.33	0.33	1.00			
Upstream Filter(I)				0.00	0.27	0.27	0.74	0.74	0.00			
Uniform Delay (d), s/veh				0.0	25.5	14.1	35.4	34.2	0.0			
Incr Delay (d2), s/veh				0.0	0.6	0.1	3.9	6.3	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	13.0	2.4	6.3	5.5	0.0			
LnGrp Delay(d),s/veh				0.0	26.1	14.3	39.3	40.6	0.0			
LnGrp LOS					C	B	D	D				
Approach Vol, veh/h					1993			500				
Approach Delay, s/veh					25.3			39.9				
Approach LOS					C			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		55.7		24.3				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 50		* 22				
Max Q Clear Time (g_c+I1), s		38.2		19.3				
Green Ext Time (p_c), s		8.0		0.6				

Intersection Summary		
HCM 2010 Ctrl Delay		28.2
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	195	1851	0	0	0	0	0	290	100
Future Volume (veh/h)	0	0	0	195	1851	0	0	0	0	0	290	100
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.85
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1440	1412	0				0	1412	1440
Adj Flow Rate, veh/h				203	1928	0				0	302	95
Adj No. of Lanes				0	3	0				0	2	0
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				272	2176	0				0	446	134
Arrive On Green				0.22	0.22	0.00				0.00	0.24	0.24
Sat Flow, veh/h				330	3453	0				0	1904	552
Grp Volume(v), veh/h				787	1344	0				0	217	180
Grp Sat Flow(s),veh/h/ln				1329	1169	0				0	1341	1044
Q Serve(g_s), s				44.3	44.6	0.0				0.0	11.7	12.6
Cycle Q Clear(g_c), s				46.2	44.6	0.0				0.0	11.7	12.6
Prop In Lane				0.26		0.00				0.00		0.53
Lane Grp Cap(c), veh/h				923	1524	0				0	326	254
V/C Ratio(X)				0.85	0.88	0.00				0.00	0.67	0.71
Avail Cap(c_a), veh/h				923	1524	0				0	389	303
HCM Platoon Ratio				0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.46	0.46	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				29.0	28.4	0.0				0.0	27.3	27.7
Incr Delay (d2), s/veh				4.8	3.8	0.0				0.0	3.3	6.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				18.2	15.3	0.0				0.0	4.6	4.0
LnGrp Delay(d),s/veh				33.8	32.2	0.0				0.0	30.7	33.7
LnGrp LOS				C	C						C	C
Approach Vol, veh/h					2131						397	
Approach Delay, s/veh					32.8						32.0	
Approach LOS					C						C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		56.4		23.6				
Change Period (Y+Rc), s		* 4.2		* 4.2				
Max Green Setting (Gmax), s		* 48		* 23				
Max Q Clear Time (g_c+I1), s		48.2		14.6				
Green Ext Time (p_c), s		0.2		1.1				

Intersection Summary	
HCM 2010 Ctrl Delay	32.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	80	1696	100	260	175	0	0	180	50
Future Volume (veh/h)	0	0	0	80	1696	100	260	175	0	0	180	50
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				83	1767	97	271	182	0	0	188	38
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				108	2451	139	315	666	0	0	275	56
Arrive On Green				0.53	0.53	0.53	0.03	0.12	0.00	0.00	0.21	0.21
Sat Flow, veh/h				203	4587	259	1765	1853	0	0	1308	264
Grp Volume(v), veh/h				718	598	632	271	182	0	0	0	226
Grp Sat Flow(s),veh/h/ln				1755	1606	1689	1765	1853	0	0	0	1572
Q Serve(g_s), s				25.8	22.1	22.3	5.3	7.2	0.0	0.0	0.0	10.6
Cycle Q Clear(g_c), s				25.8	22.1	22.3	5.3	7.2	0.0	0.0	0.0	10.6
Prop In Lane				0.12		0.15	1.00		0.00	0.00		0.17
Lane Grp Cap(c), veh/h				937	858	902	315	666	0	0	0	330
V/C Ratio(X)				0.77	0.70	0.70	0.86	0.27	0.00	0.00	0.00	0.68
Avail Cap(c_a), veh/h				937	858	902	327	718	0	0	0	364
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.73	0.73	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				14.7	13.8	13.9	35.8	25.7	0.0	0.0	0.0	29.2
Incr Delay (d2), s/veh				5.9	4.7	4.5	16.4	0.3	0.0	0.0	0.0	6.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				13.9	10.7	11.3	7.4	3.7	0.0	0.0	0.0	5.2
LnGrp Delay(d),s/veh				20.6	18.5	18.4	52.2	26.1	0.0	0.0	0.0	35.9
LnGrp LOS				C	B	B	D	C				D
Approach Vol, veh/h					1947			453			226	
Approach Delay, s/veh					19.2			41.7			35.9	
Approach LOS					B			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			11.5	21.3		47.2		32.8
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			8.0	18.5		40.5		31.0
Max Q Clear Time (g_c+I1), s			7.3	12.6		27.8		9.2
Green Ext Time (p_c), s			0.1	0.8		11.1		1.4

Intersection Summary	
HCM 2010 Ctrl Delay	24.5
HCM 2010 LOS	C

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+Project Buildout Conditions (With WB LT at 3rd/Brooks)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	40	94.2%	12.9	3.1	B
	Through	5	5	107.5%	12.9	13.1	B
	Right Turn						
	Subtotal	47	45	95.6%	13.3	2.6	B
SB	Left Turn						
	Through	15	13	84.5%	29.7	8.6	D
	Right Turn	10	7	65.3%	17.4	14.1	C
	Subtotal	25	19	76.8%	26.1	4.4	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	88	78	89.0%	2.8	0.2	A
	Through	1,829	1,782	97.4%	2.3	0.6	A
	Right Turn	10	10	96.0%	1.6	0.3	A
	Subtotal	1,927	1,870	97.0%	2.3	0.6	A
Total		1,999	1,934	96.8%	2.8	0.6	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	132	123	93.4%	31.7	2.2	C
	Through	20	27	134.4%	31.4	6.1	C
	Right Turn						
	Subtotal	152	150	98.8%	31.7	2.7	C
SB	Left Turn						
	Through	50	58	116.0%	30.0	6.0	C
	Right Turn	10	12	115.2%	18.4	11.3	B
	Subtotal	60	70	115.8%	28.6	5.5	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	256	105.8%	10.4	4.1	B
	Through	1,872	1,796	95.9%	6.7	1.5	A
	Right Turn	40	38	95.0%	6.2	2.4	A
	Subtotal	2,154	2,090	97.0%	7.1	1.7	A
Total		2,366	2,310	97.6%	9.4	1.7	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	110	1832	150	51	346	0	0	285	161
Future Volume (veh/h)	0	0	0	110	1832	150	51	346	0	0	285	161
Number				1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.98		1.00	1.00		0.82
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1620	1588	1620	1620	1588	0	0	1525	1555
Adj Flow Rate, veh/h				115	1908	145	53	360	0	0	297	162
Adj No. of Lanes				0	3	0	0	2	0	0	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				131	2303	179	102	660	0	0	532	273
Arrive On Green				0.19	0.19	0.19	0.62	0.62	0.00	0.00	0.10	0.10
Sat Flow, veh/h				227	3989	311	145	2200	0	0	1791	881
Grp Volume(v), veh/h				800	666	702	201	212	0	0	248	211
Grp Sat Flow(s),veh/h/ln				1577	1445	1504	900	1373	0	0	1448	1148
Q Serve(g_s), s				39.5	35.2	35.7	4.0	6.8	0.0	0.0	13.0	14.1
Cycle Q Clear(g_c), s				39.5	35.2	35.7	18.0	6.8	0.0	0.0	13.0	14.1
Prop In Lane				0.14		0.21	0.26		0.00	0.00		0.77
Lane Grp Cap(c), veh/h				911	835	869	336	426	0	0	449	356
V/C Ratio(X)				0.88	0.80	0.81	0.60	0.50	0.00	0.00	0.55	0.59
Avail Cap(c_a), veh/h				936	858	893	336	426	0	0	449	356
HCM Platoon Ratio				0.33	0.33	0.33	2.00	2.00	1.00	1.00	0.33	0.33
Upstream Filter(I)				0.28	0.28	0.28	1.00	1.00	0.00	0.00	0.88	0.88
Uniform Delay (d), s/veh				29.7	27.9	28.1	12.8	11.8	0.0	0.0	30.6	31.1
Incr Delay (d2), s/veh				2.9	1.5	1.6	7.7	4.1	0.0	0.0	4.3	6.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				18.0	14.5	15.3	2.9	3.0	0.0	0.0	5.8	5.1
LnGrp Delay(d),s/veh				32.6	29.4	29.7	20.5	15.9	0.0	0.0	34.9	37.4
LnGrp LOS				C	C	C	C	B			C	D
Approach Vol, veh/h					2168			413			459	
Approach Delay, s/veh					30.7			18.1			36.0	
Approach LOS					C			B			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				29.3		50.7		29.3
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				23.5		47.5		23.5
Max Q Clear Time (g_c+I1), s				20.0		41.5		16.1
Green Ext Time (p_c), s				0.6		4.7		1.3

Intersection Summary	
HCM 2010 Ctrl Delay	29.8
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	350	1952	50	125	55	0	0	0	0
Future Volume (vph)	0	0	0	350	1952	50	125	55	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1600	1600
Lane Width	12	12	12	12	12	12	11	12	12	12	12	12
Total Lost time (s)					11.6		7.6	7.6				
Lane Util. Factor					0.91		1.00	1.00				
Frpb, ped/bikes					1.00		1.00	1.00				
Flpb, ped/bikes					0.96		0.96	1.00				
Frt					1.00		1.00	1.00				
Flt Protected					0.99		0.95	1.00				
Satd. Flow (prot)					3669		1098	1249				
Flt Permitted					0.99		0.95	1.00				
Satd. Flow (perm)					3669		1098	1249				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	365	2033	52	130	57	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2447	0	130	57	0	0	0	0
Confl. Peds. (#/hr)			106	106		44	30		69			30
Confl. Bikes (#/hr)						2			3			8
Parking (#/hr)							3	3			3	3
Turn Type				Perm	NA		Perm	NA				
Protected Phases					6			4				
Permitted Phases				6			4					
Actuated Green, G (s)					51.6		19.2	19.2				
Effective Green, g (s)					51.6		19.2	19.2				
Actuated g/C Ratio					0.57		0.21	0.21				
Clearance Time (s)					11.6		7.6	7.6				
Vehicle Extension (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					2103		234	266				
v/s Ratio Prot								0.05				
v/s Ratio Perm					0.67		c0.12					
v/c Ratio					1.16		0.56	0.21				
Uniform Delay, d1					19.2		31.6	29.2				
Progression Factor					1.00		1.00	1.00				
Incremental Delay, d2					79.4		4.8	0.8				
Delay (s)					98.6		36.4	30.0				
Level of Service					F		D	C				
Approach Delay (s)		0.0			98.6			34.4			0.0	
Approach LOS		A			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	94.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	163.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	510	1739	0	0	0	0	0	725	598
Future Volume (veh/h)	0	0	0	510	1739	0	0	0	0	0	725	598
Number				1	6	16				3	8	18
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.86
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1560	1588	0				0	1588	1500
Adj Flow Rate, veh/h				531	1811	0				0	755	615
Adj No. of Lanes				1	3	0				0	3	1
Peak Hour Factor				0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %				2	2	0				0	2	2
Cap, veh/h				717	2011	0				0	2018	509
Arrive On Green				0.14	0.14	0.00				0.00	0.15	0.15
Sat Flow, veh/h				1486	4765	0				0	4479	1093
Grp Volume(v), veh/h				531	1811	0				0	755	615
Grp Sat Flow(s),veh/h/ln				1486	1588	0				0	1445	1093
Q Serve(g_s), s				27.9	29.9	0.0				0.0	12.5	37.2
Cycle Q Clear(g_c), s				27.9	29.9	0.0				0.0	12.5	37.2
Prop In Lane				1.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				717	2011	0				0	2018	509
V/C Ratio(X)				0.74	0.90	0.00				0.00	0.37	1.21
Avail Cap(c_a), veh/h				721	2025	0				0	2018	509
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				0.09	0.09	0.00				0.00	0.82	0.82
Uniform Delay (d), s/veh				31.9	32.8	0.0				0.0	23.4	33.9
Incr Delay (d2), s/veh				0.4	0.6	0.0				0.0	0.4	108.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				11.6	13.3	0.0				0.0	5.1	26.6
LnGrp Delay(d),s/veh				32.3	33.4	0.0				0.0	23.8	142.6
LnGrp LOS				C	C						C	F
Approach Vol, veh/h					2342						1370	
Approach Delay, s/veh					33.1						77.1	
Approach LOS					C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						37.8		42.2
Change Period (Y+Rc), s						4.0		5.0
Max Green Setting (Gmax), s						34.0		37.0
Max Q Clear Time (g_c+I1), s						31.9		39.2
Green Ext Time (p_c), s						1.8		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		49.4
HCM 2010 LOS		D

Notes

User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	1236	210	1008	1490	0	0	0	0
Future Volume (veh/h)	0	0	0	0	1236	210	1008	1490	0	0	0	0
Number				1	6	16	7	4	14			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.93	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1500	1500	1398	1398	0			
Adj Flow Rate, veh/h				0	1288	200	1134	1434	0			
Adj No. of Lanes				0	3	1	2	2	0			
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %				0	2	2	3	3	0			
Cap, veh/h				0	1254	363	1548	1625	0			
Arrive On Green				0.00	0.31	0.31	0.19	0.19	0.00			
Sat Flow, veh/h				0	4230	1184	2663	2796	0			
Grp Volume(v), veh/h				0	1288	200	1134	1434	0			
Grp Sat Flow(s),veh/h/ln				0	1365	1184	1331	1398	0			
Q Serve(g_s), s				0.0	24.5	11.3	32.0	39.9	0.0			
Cycle Q Clear(g_c), s				0.0	24.5	11.3	32.0	39.9	0.0			
Prop In Lane				0.00		1.00	1.00		0.00			
Lane Grp Cap(c), veh/h				0	1254	363	1548	1625	0			
V/C Ratio(X)				0.00	1.03	0.55	0.73	0.88	0.00			
Avail Cap(c_a), veh/h				0	1254	363	1548	1625	0			
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00			
Upstream Filter(I)				0.00	1.00	1.00	0.09	0.09	0.00			
Uniform Delay (d), s/veh				0.0	27.8	23.2	26.5	29.7	0.0			
Incr Delay (d2), s/veh				0.0	32.5	1.8	0.3	0.7	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	13.0	3.8	11.9	15.6	0.0			
LnGrp Delay(d),s/veh				0.0	60.3	25.0	26.8	30.4	0.0			
LnGrp LOS					F	C	C	C				
Approach Vol, veh/h					1488			2568				
Approach Delay, s/veh					55.5			28.8				
Approach LOS					E			C				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				51.0		29.0		
Change Period (Y+Rc), s				4.5		4.5		
Max Green Setting (Gmax), s				46.5		24.5		
Max Q Clear Time (g_c+I1), s				41.9		26.5		
Green Ext Time (p_c), s				4.1		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	38.6
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1627	110	0	0	0	0	0	435	185	470	0
Future Volume (veh/h)	0	1627	110	0	0	0	0	0	435	185	470	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.96	0.99		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1676	1710				0	1588	1620	1765	1765	0
Adj Flow Rate, veh/h	0	1695	106				0	0	439	193	490	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	575	238	781	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.44	0.15	0.15	0.00
Sat Flow, veh/h		0					0	0	1300	933	1765	0
Grp Volume(v), veh/h		0.0					0	0	439	193	490	0
Grp Sat Flow(s),veh/h/ln							0	0	1300	933	1765	0
Q Serve(g_s), s							0.0	0.0	22.7	12.7	20.9	0.0
Cycle Q Clear(g_c), s							0.0	0.0	22.7	35.4	20.9	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	575	238	781	0
V/C Ratio(X)							0.00	0.00	0.76	0.81	0.63	0.00
Avail Cap(c_a), veh/h							0	0	575	238	781	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.74	0.74	0.00
Uniform Delay (d), s/veh							0.0	0.0	18.8	47.0	28.0	0.0
Incr Delay (d2), s/veh							0.0	0.0	5.4	13.7	0.9	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	8.9	5.2	10.4	0.0
LnGrp Delay(d),s/veh							0.0	0.0	24.2	60.7	28.9	0.0
LnGrp LOS									C	E	C	
Approach Vol, veh/h								439			683	
Approach Delay, s/veh								24.2			37.9	
Approach LOS								C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				40.0				40.0
Change Period (Y+Rc), s				4.6				4.6
Max Green Setting (Gmax), s				35.4				35.4
Max Q Clear Time (g_c+I1), s				37.4				24.7
Green Ext Time (p_c), s				0.0				1.1

Intersection Summary		
HCM 2010 Ctrl Delay		32.5
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	200	2052	0	0	0	0	0	260	120	0	0	0
Future Volume (veh/h)	200	2052	0	0	0	0	0	260	120	0	0	0
Number	1	6	16				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.97			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1440	1500	0				0	1500	1440			
Adj Flow Rate, veh/h	208	2138	0				0	271	118			
Adj No. of Lanes	0	3	0				0	2	0			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	299	2662	0				0	376	158			
Arrive On Green	0.23	0.23	0.00				0.00	0.19	0.19			
Sat Flow, veh/h	345	3798	0				0	1986	837			
Grp Volume(v), veh/h	819	1527	0				0	202	187			
Grp Sat Flow(s),veh/h/ln	1414	1365	0				0	1500	1324			
Q Serve(g_s), s	42.0	42.2	0.0				0.0	10.1	10.6			
Cycle Q Clear(g_c), s	44.0	42.2	0.0				0.0	10.1	10.6			
Prop In Lane	0.25		0.00				0.00		0.63			
Lane Grp Cap(c), veh/h	1047	1913	0				0	284	250			
V/C Ratio(X)	0.78	0.80	0.00				0.00	0.71	0.75			
Avail Cap(c_a), veh/h	1047	1913	0				0	390	344			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.37	0.37	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	26.1	25.4	0.0				0.0	30.4	30.6			
Incr Delay (d2), s/veh	2.2	1.3	0.0				0.0	7.2	9.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	17.9	16.4	0.0				0.0	4.7	4.6			
LnGrp Delay(d),s/veh	28.3	26.7	0.0				0.0	37.6	40.5			
LnGrp LOS	C	C						D	D			
Approach Vol, veh/h		2346						389				
Approach Delay, s/veh		27.3						39.0				
Approach LOS		C						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		
Phs Duration (G+Y+Rc), s				19.3		60.7		
Change Period (Y+Rc), s				* 4.2		4.6		
Max Green Setting (Gmax), s				* 21		50.4		
Max Q Clear Time (g_c+I1), s				12.6		46.0		
Green Ext Time (p_c), s				2.0		4.2		

Intersection Summary		
HCM 2010 Ctrl Delay		28.9
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	2087	90	0	0	0	0	0	250	210	290	0
Future Volume (veh/h)	0	2087	90	0	0	0	0	0	250	210	290	0
Number	1	6	16				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.90	0.97		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1382				0	1588	1591	1560	1500	0
Adj Flow Rate, veh/h	0	2174	88				0	0	243	219	302	0
Adj No. of Lanes	0	3	0				0	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	0	0	0				0	0	359	205	441	0
Arrive On Green	0.00	0.00	0.00				0.00	0.00	0.29	0.10	0.10	0.00
Sat Flow, veh/h		0					0	0	1221	974	1500	0
Grp Volume(v), veh/h		0.0					0	0	243	219	302	0
Grp Sat Flow(s),veh/h/ln							0	0	1221	974	1500	0
Q Serve(g_s), s							0.0	0.0	14.0	9.5	15.6	0.0
Cycle Q Clear(g_c), s							0.0	0.0	14.0	23.5	15.6	0.0
Prop In Lane							0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h							0	0	359	205	441	0
V/C Ratio(X)							0.00	0.00	0.68	1.07	0.69	0.00
Avail Cap(c_a), veh/h							0	0	359	205	441	0
HCM Platoon Ratio							1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)							0.00	0.00	1.00	0.68	0.68	0.00
Uniform Delay (d), s/veh							0.0	0.0	24.9	45.2	32.5	0.0
Incr Delay (d2), s/veh							0.0	0.0	4.2	70.9	2.5	0.0
Initial Q Delay(d3),s/veh							0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln							0.0	0.0	5.1	8.6	6.8	0.0
LnGrp Delay(d),s/veh							0.0	0.0	29.1	116.1	35.1	0.0
LnGrp LOS									C	F	D	
Approach Vol, veh/h								243			521	
Approach Delay, s/veh								29.1			69.1	
Approach LOS								C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4				8
Phs Duration (G+Y+Rc), s				28.0				28.0
Change Period (Y+Rc), s				4.5				4.5
Max Green Setting (Gmax), s				23.5				23.5
Max Q Clear Time (g_c+I1), s				25.5				16.0
Green Ext Time (p_c), s				0.0				0.4

Intersection Summary		
HCM 2010 Ctrl Delay		56.4
HCM 2010 LOS		E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2252	185	0	0	0	0	335	30	120	140	0
Future Volume (veh/h)	110	2252	185	0	0	0	0	335	30	120	140	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.90	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	115	2346	182				0	349	23	125	146	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	134	2882	227				0	516	34	161	431	0
Arrive On Green	0.21	0.21	0.21				0.00	0.17	0.17	0.01	0.08	0.00
Sat Flow, veh/h	208	4484	352				0	3096	197	1597	1744	0
Grp Volume(v), veh/h	969	804	870				0	183	189	125	146	0
Grp Sat Flow(s),veh/h/ln	1754	1606	1684				0	1593	1616	1597	1744	0
Q Serve(g_s), s	42.6	37.8	39.2				0.0	8.6	8.8	0.0	6.3	0.0
Cycle Q Clear(g_c), s	42.6	37.8	39.2				0.0	8.6	8.8	0.0	6.3	0.0
Prop In Lane	0.12		0.21				0.00		0.12	1.00		0.00
Lane Grp Cap(c), veh/h	1127	1032	1082				0	273	277	161	431	0
V/C Ratio(X)	0.86	0.78	0.80				0.00	0.67	0.68	0.77	0.34	0.00
Avail Cap(c_a), veh/h	1127	1032	1082				0	321	325	164	482	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.16	0.16	0.16				0.00	1.00	1.00	0.63	0.63	0.00
Uniform Delay (d), s/veh	28.0	26.2	26.7				0.0	31.0	31.1	38.4	30.6	0.0
Incr Delay (d2), s/veh	1.5	1.0	1.0				0.0	7.0	7.3	15.6	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.1	17.1	18.6				0.0	4.3	4.4	3.5	3.1	0.0
LnGrp Delay(d),s/veh	29.5	27.1	27.8				0.0	38.0	38.4	54.0	31.2	0.0
LnGrp LOS	C	C	C					D	D	D	C	
Approach Vol, veh/h		2643						372			271	
Approach Delay, s/veh		28.2						38.2			41.7	
Approach LOS		C						D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		56.0		24.0			6.1	17.9
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		49.1		* 22			* 2	* 16
Max Q Clear Time (g_c+I1), s		44.6		8.3			2.0	10.8
Green Ext Time (p_c), s		4.4		0.8			0.0	1.3

Intersection Summary		
HCM 2010 Ctrl Delay		30.5
HCM 2010 LOS		C

Notes

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+Project Buildout Conditions (With WB LT at 3rd/Brooks)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	115	101	88.2%	27.7	5.4	D
	Through						
	Right Turn						
	Subtotal	115	101	88.2%	27.7	5.4	D
EB	Left Turn	45	43	94.7%	3.3	0.6	A
	Through	2,392	2,383	99.6%	2.8	0.3	A
	Right Turn						
	Subtotal	2,437	2,426	99.6%	2.8	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,552	2,527	99.0%	3.8	0.5	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	80	88.2%	18.9	5.2	B
	Right Turn	433	402	92.9%	34.5	9.3	C
	Subtotal	524	482	92.0%	32.1	7.6	C
SB	Left Turn	117	114	97.5%	34.5	15.4	C
	Through	180	200	111.1%	23.2	4.5	C
	Right Turn						
	Subtotal	297	314	105.8%	27.0	7.6	C
EB	Left Turn	61	66	107.6%	18.4	3.4	B
	Through	2,372	2,327	98.1%	18.0	2.7	B
	Right Turn	44	38	87.3%	12.0	4.3	B
	Subtotal	2,477	2,431	98.2%	17.9	2.7	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,298	3,228	97.9%	21.0	2.6	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	236	2564	62	0	0	0	0	211	140	150	190	0
Future Volume (veh/h)	236	2564	62	0	0	0	0	211	140	150	190	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1412	1382	1355	0
Adj Flow Rate, veh/h	246	2671	44				0	220	134	156	198	0
Adj No. of Lanes	0	4	1				0	1	1	0	2	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	222	2598	657				0	473	389	246	408	0
Arrive On Green	0.18	0.18	0.18				0.00	0.34	0.34	0.67	0.67	0.00
Sat Flow, veh/h	396	4638	1172				0	1412	1161	475	1281	0
Grp Volume(v), veh/h	865	2052	44				0	220	134	169	185	0
Grp Sat Flow(s),veh/h/ln	1392	1214	1172				0	1412	1161	523	1172	0
Q Serve(g_s), s	44.8	44.8	2.5				0.0	9.8	6.9	15.9	6.1	0.0
Cycle Q Clear(g_c), s	44.8	44.8	2.5				0.0	9.8	6.9	25.8	6.1	0.0
Prop In Lane	0.28		1.00				0.00		1.00	0.92		0.00
Lane Grp Cap(c), veh/h	780	2040	657				0	473	389	262	393	0
V/C Ratio(X)	1.11	1.01	0.07				0.00	0.47	0.34	0.65	0.47	0.00
Avail Cap(c_a), veh/h	780	2040	657				0	473	389	262	393	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.6	32.6	15.4				0.0	21.0	20.0	17.5	9.8	0.0
Incr Delay (d2), s/veh	51.4	7.5	0.0				0.0	0.7	0.5	5.4	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.4	16.5	0.8				0.0	3.9	2.3	4.0	1.9	0.0
LnGrp Delay(d),s/veh	84.0	40.1	15.4				0.0	21.7	20.5	22.9	10.7	0.0
LnGrp LOS	F	F	B					C	C	C	B	
Approach Vol, veh/h		2961						354			354	
Approach Delay, s/veh		52.6						21.2			16.5	
Approach LOS		D						C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		49.0		31.0				31.0
Change Period (Y+Rc), s		* 4.2		* 4.2				* 4.2
Max Green Setting (Gmax), s		* 45		* 27				* 27
Max Q Clear Time (g_c+I1), s		46.8		11.8				27.8
Green Ext Time (p_c), s		0.0		1.3				0.0

Intersection Summary			
HCM 2010 Ctrl Delay			46.1
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	2694	120	0	0	0	0	150	370	85	255	0
Future Volume (veh/h)	40	2694	120	0	0	0	0	150	370	85	255	0
Number	5	2	12				7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93				1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1440	1412	1412				0	1412	1468	1412	1412	0
Adj Flow Rate, veh/h	42	2806	80				0	156	351	89	266	0
Adj No. of Lanes	0	4	1				0	1	1	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	37	2621	587				0	439	379	250	439	0
Arrive On Green	0.17	0.17	0.17				0.00	0.31	0.31	0.62	0.62	0.00
Sat Flow, veh/h	70	4981	1116				0	1412	1217	710	1412	0
Grp Volume(v), veh/h	850	1998	80				0	156	351	89	266	0
Grp Sat Flow(s),veh/h/ln	1408	1214	1116				0	1412	1217	710	1412	0
Q Serve(g_s), s	42.1	42.1	4.9				0.0	6.8	22.3	7.3	9.1	0.0
Cycle Q Clear(g_c), s	42.1	42.1	4.9				0.0	6.8	22.3	14.2	9.1	0.0
Prop In Lane	0.05		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	741	1917	587				0	439	379	250	439	0
V/C Ratio(X)	1.15	1.04	0.14				0.00	0.35	0.93	0.36	0.61	0.00
Avail Cap(c_a), veh/h	741	1917	587				0	468	403	265	468	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	33.1	33.1	17.7				0.0	21.3	26.7	15.6	12.1	0.0
Incr Delay (d2), s/veh	67.6	21.1	0.0				0.0	0.5	26.6	0.9	2.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.3	17.9	1.5				0.0	2.7	10.3	1.5	3.6	0.0
LnGrp Delay(d),s/veh	100.7	54.1	17.7				0.0	21.8	53.2	16.4	14.1	0.0
LnGrp LOS	F	F	B					C	D	B	B	
Approach Vol, veh/h		2928						507			355	
Approach Delay, s/veh		66.6						43.6			14.7	
Approach LOS		E						D			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		48.6		31.4				31.4
Change Period (Y+Rc), s		6.5		6.5				6.5
Max Green Setting (Gmax), s		40.5		26.5				26.5
Max Q Clear Time (g_c+I1), s		44.1		24.3				16.2
Green Ext Time (p_c), s		0.0		0.6				1.3

Intersection Summary			
HCM 2010 Ctrl Delay			58.7
HCM 2010 LOS			E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1976	1168	0	0	0	0	0	0	390	845	0
Future Volume (veh/h)	0	1976	1168	0	0	0	0	0	0	390	845	0
Number	5	2	12							7	4	14
Initial Q (Qb), veh	0	0	0							0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00							1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00							1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1500	1500							1500	1500	0
Adj Flow Rate, veh/h	0	2058	1186							406	880	0
Adj No. of Lanes	0	3	2							1	2	0
Peak Hour Factor	0.96	0.96	0.96							0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2							2	2	0
Cap, veh/h	0	2303	1305							465	977	0
Arrive On Green	0.00	0.17	0.17							0.11	0.11	0.00
Sat Flow, veh/h	0	4500	2550							1429	3000	0
Grp Volume(v), veh/h	0	2058	1186							406	880	0
Grp Sat Flow(s),veh/h/ln	0	1500	1275							1429	1500	0
Q Serve(g_s), s	0.0	35.8	36.5							22.4	23.2	0.0
Cycle Q Clear(g_c), s	0.0	35.8	36.5							22.4	23.2	0.0
Prop In Lane	0.00		1.00							1.00		0.00
Lane Grp Cap(c), veh/h	0	2303	1305							465	977	0
V/C Ratio(X)	0.00	0.89	0.91							0.87	0.90	0.00
Avail Cap(c_a), veh/h	0	2303	1305							473	994	0
HCM Platoon Ratio	1.00	0.33	0.33							0.33	0.33	1.00
Upstream Filter(I)	0.00	0.09	0.09							0.87	0.87	0.00
Uniform Delay (d), s/veh	0.0	31.1	31.4							34.1	34.4	0.0
Incr Delay (d2), s/veh	0.0	0.6	1.2							14.4	9.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0							0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	15.0	13.1							10.7	11.0	0.0
LnGrp Delay(d),s/veh	0.0	31.7	32.6							48.5	44.2	0.0
LnGrp LOS		C	C							D	D	
Approach Vol, veh/h		3244									1286	
Approach Delay, s/veh		32.0									45.6	
Approach LOS		C									D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		49.4		30.6				
Change Period (Y+Rc), s		8.5		4.5				
Max Green Setting (Gmax), s		40.5		26.5				
Max Q Clear Time (g_c+I1), s		38.5		25.2				
Green Ext Time (p_c), s		1.9		0.9				

Intersection Summary		
HCM 2010 Ctrl Delay		35.9
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1020	1396	0	0	0	0	0	1498	600	0	0	0
Future Volume (veh/h)	1020	1396	0	0	0	0	0	1498	600	0	0	0
Number	5	2	12				7	4	14			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1468	1500	0				0	1412	1412			
Adj Flow Rate, veh/h	1099	1402	0				0	1658	542			
Adj No. of Lanes	2	2	0				0	3	1			
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0				0	2	2			
Cap, veh/h	1501	1418	0				0	1736	480			
Arrive On Green	0.16	0.16	0.00				0.00	0.41	0.41			
Sat Flow, veh/h	2797	3000	0				0	4235	1172			
Grp Volume(v), veh/h	1099	1402	0				0	1658	542			
Grp Sat Flow(s),veh/h/ln	1398	1500	0				0	1412	1172			
Q Serve(g_s), s	30.5	37.3	0.0				0.0	30.4	32.8			
Cycle Q Clear(g_c), s	30.5	37.3	0.0				0.0	30.4	32.8			
Prop In Lane	1.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	1501	1418	0				0	1736	480			
V/C Ratio(X)	0.73	0.99	0.00				0.00	0.95	1.13			
Avail Cap(c_a), veh/h	1501	1418	0				0	1736	480			
HCM Platoon Ratio	0.33	0.33	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.09	0.09	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	30.7	33.6	0.0				0.0	22.9	23.6			
Incr Delay (d2), s/veh	0.3	5.1	0.0				0.0	12.8	81.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	11.9	16.5	0.0				0.0	13.7	21.4			
LnGrp Delay(d),s/veh	31.0	38.6	0.0				0.0	35.7	104.8			
LnGrp LOS	C	D						D	F			
Approach Vol, veh/h		2501						2200				
Approach Delay, s/veh		35.3						52.7				
Approach LOS		D						D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		42.0		38.0				
Change Period (Y+Rc), s		* 4.2		* 5.2				
Max Green Setting (Gmax), s		* 38		* 33				
Max Q Clear Time (g_c+I1), s		39.3		34.8				
Green Ext Time (p_c), s		0.0		0.0				

Intersection Summary	
HCM 2010 Ctrl Delay	43.4
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	300	40	80	300	52	70	237	180	103	140	30
Future Volume (veh/h)	20	300	40	80	300	52	70	237	180	103	140	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		0.96	1.00		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	2039	2039	2000	1961	1961	2000	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	21	312	36	83	312	47	73	247	155	107	146	22
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	57	401	46	160	464	70	255	311	195	215	427	64
Arrive On Green	0.03	0.22	0.22	0.09	0.28	0.28	0.14	0.30	0.30	0.12	0.27	0.27
Sat Flow, veh/h	1942	1786	206	1867	1656	249	1774	1052	660	1774	1564	236
Grp Volume(v), veh/h	21	0	348	83	0	359	73	0	402	107	0	168
Grp Sat Flow(s),veh/h/ln	1942	0	1992	1867	0	1905	1774	0	1712	1774	0	1800
Q Serve(g_s), s	0.7	0.0	10.3	2.7	0.0	10.5	2.3	0.0	13.5	3.5	0.0	4.7
Cycle Q Clear(g_c), s	0.7	0.0	10.3	2.7	0.0	10.5	2.3	0.0	13.5	3.5	0.0	4.7
Prop In Lane	1.00		0.10	1.00		0.13	1.00		0.39	1.00		0.13
Lane Grp Cap(c), veh/h	57	0	447	160	0	534	255	0	506	215	0	492
V/C Ratio(X)	0.37	0.00	0.78	0.52	0.00	0.67	0.29	0.00	0.79	0.50	0.00	0.34
Avail Cap(c_a), veh/h	248	0	735	298	0	764	283	0	678	283	0	713
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.8	0.0	22.8	27.4	0.0	20.0	23.9	0.0	20.3	25.7	0.0	18.2
Incr Delay (d2), s/veh	1.5	0.0	3.0	1.0	0.0	1.5	0.2	0.0	4.7	0.7	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	6.0	1.4	0.0	5.7	1.1	0.0	7.0	1.8	0.0	2.4
LnGrp Delay(d),s/veh	31.3	0.0	25.8	28.4	0.0	21.4	24.2	0.0	25.0	26.4	0.0	18.6
LnGrp LOS	C		C	C		C	C		C	C		B
Approach Vol, veh/h		369			442			475			275	
Approach Delay, s/veh		26.1			22.7			24.9			21.6	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.3	18.9	13.0	21.3	5.8	22.4	11.6	22.7
Change Period (Y+Rc), s	4.0	4.9	4.0	* 4.2	4.0	4.9	4.0	* 4.2
Max Green Setting (Gmax), s	10.0	23.1	10.0	* 25	8.0	25.1	10.0	* 25
Max Q Clear Time (g_c+I1), s	4.7	12.3	4.3	6.7	2.7	12.5	5.5	15.5
Green Ext Time (p_c), s	0.1	1.1	0.0	0.6	0.0	1.2	0.1	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	24.0
HCM 2010 LOS	C

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	520	60	0	685	0	0
Future Volume (vph)	520	60	0	685	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			3.0		
Lane Util. Factor	1.00			1.00		
Frpb, ped/bikes	0.99			1.00		
Flpb, ped/bikes	1.00			1.00		
Frt	0.99			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	1557			1588		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	1557			1588		
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	542	62	0	714	0	0
RTOR Reduction (vph)	5	0	0	0	0	0
Lane Group Flow (vph)	600	0	0	714	0	0
Confl. Peds. (#/hr)		10	10		10	
Turn Type	NA			NA		
Protected Phases	2			3 4 6		
Permitted Phases						
Actuated Green, G (s)	36.4			56.5		
Effective Green, g (s)	36.4			50.5		
Actuated g/C Ratio	0.45			0.63		
Clearance Time (s)	6.0					
Vehicle Extension (s)	3.0					
Lane Grp Cap (vph)	708			1002		
v/s Ratio Prot	c0.38			c0.45		
v/s Ratio Perm						
v/c Ratio	0.85			0.71		
Uniform Delay, d1	19.3			9.9		
Progression Factor	0.62			0.37		
Incremental Delay, d2	10.2			0.6		
Delay (s)	22.2			4.3		
Level of Service	C			A		
Approach Delay (s)	22.2			4.3	0.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	500	60	0	330	0	0	0	0	30	20	20
Future Volume (vph)	0	500	60	0	330	0	0	0	0	30	20	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0						6.0	
Lane Util. Factor		1.00			1.00						1.00	
Frpb, ped/bikes		0.99			1.00						0.99	
Flpb, ped/bikes		1.00			1.00						1.00	
Frt		0.99			1.00						0.96	
Flt Protected		1.00			1.00						0.98	
Satd. Flow (prot)		1557			1588						1476	
Flt Permitted		1.00			1.00						0.98	
Satd. Flow (perm)		1557			1588						1476	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	521	62	0	344	0	0	0	0	31	21	21
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	19	0
Lane Group Flow (vph)	0	580	0	0	344	0	0	0	0	0	54	0
Confl. Peds. (#/hr)	10		10	10		10	10					10
Turn Type		NA			NA					Perm	NA	
Protected Phases		2			4 6						8	
Permitted Phases										8		
Actuated Green, G (s)		42.7			58.9						9.1	
Effective Green, g (s)		42.7			58.9						9.1	
Actuated g/C Ratio		0.53			0.74						0.11	
Clearance Time (s)		6.0									6.0	
Vehicle Extension (s)		3.0									1.5	
Lane Grp Cap (vph)		831			1169						167	
v/s Ratio Prot		c0.37			c0.22							
v/s Ratio Perm											0.04	
v/c Ratio		0.70			0.29						0.33	
Uniform Delay, d1		13.9			3.6						32.6	
Progression Factor		0.66			0.06						0.64	
Incremental Delay, d2		3.6			0.0						0.3	
Delay (s)		12.7			0.3						21.3	
Level of Service		B			A						C	
Approach Delay (s)		12.7			0.3			0.0			21.3	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	520	0	0	675	10	20
Future Volume (vph)	520	0	0	675	10	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0			6.0	3.0	
Lane Util. Factor	1.00			1.00	1.00	
Frpb, ped/bikes	1.00			1.00	1.00	
Flpb, ped/bikes	1.00			1.00	1.00	
Frt	1.00			1.00	0.91	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	1588			1588	1420	
Flt Permitted	1.00			1.00	0.98	
Satd. Flow (perm)	1588			1588	1420	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	542	0	0	703	10	21
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	542	0	0	703	14	0
Confl. Peds. (#/hr)		10				
Turn Type	NA			NA	Prot	
Protected Phases	2 8			6	3 4	
Permitted Phases						
Actuated Green, G (s)	54.3			36.4	14.1	
Effective Green, g (s)	48.7			36.4	14.1	
Actuated g/C Ratio	0.61			0.45	0.18	
Clearance Time (s)				6.0		
Vehicle Extension (s)				3.0		
Lane Grp Cap (vph)	966			722	250	
v/s Ratio Prot	c0.34			c0.44	c0.01	
v/s Ratio Perm						
v/c Ratio	0.56			0.97	0.05	
Uniform Delay, d1	9.3			21.3	27.4	
Progression Factor	0.22			1.04	1.94	
Incremental Delay, d2	0.4			22.3	0.0	
Delay (s)	2.4			44.5	53.1	
Level of Service	A			D	D	
Approach Delay (s)	2.4			44.5	53.1	
Approach LOS	A			D	D	

Intersection Summary			
HCM 2000 Control Delay	26.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.2
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

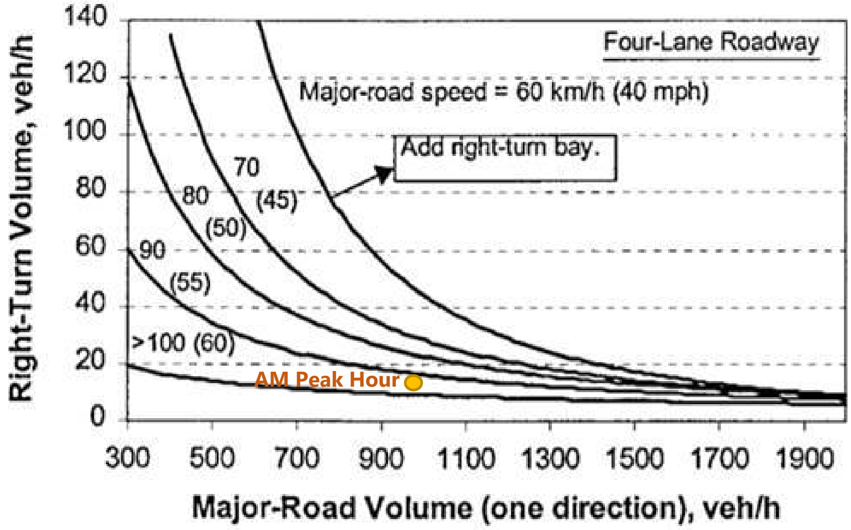
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	530	0	0	310	10	20	20	20	0	0	0
Future Volume (vph)	0	530	0	0	310	10	20	20	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			1.00			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1580			1470				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1580			1470				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	552	0	0	323	10	21	21	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	552	0	0	332	0	0	45	0	0	0	0
Confl. Peds. (#/hr)	10		10			10			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		57.8			42.7			10.2				
Effective Green, g (s)		57.8			42.7			10.2				
Actuated g/C Ratio		0.72			0.53			0.13				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			1.5				
Lane Grp Cap (vph)		1147			843			187				
v/s Ratio Prot		c0.35			0.21			c0.03				
v/s Ratio Perm												
v/c Ratio		0.48			0.39			0.24				
Uniform Delay, d1		4.7			11.0			31.4				
Progression Factor		0.15			0.61			1.16				
Incremental Delay, d2		0.1			1.3			0.2				
Delay (s)		0.8			7.9			36.7				
Level of Service		A			A			D				
Approach Delay (s)		0.8			7.9			36.7			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	5.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	465	0	0	420	40	20	15	20	0	0	0
Future Volume (vph)	0	465	0	0	420	40	20	15	20	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		6.0			6.0			6.0				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.99			0.95				
Flt Protected		1.00			1.00			0.98				
Satd. Flow (prot)		1588			1546			1469				
Flt Permitted		1.00			1.00			0.98				
Satd. Flow (perm)		1588			1546			1469				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	484	0	0	438	42	21	16	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	17	0	0	0	0
Lane Group Flow (vph)	0	484	0	0	476	0	0	41	0	0	0	0
Confl. Peds. (#/hr)	59		21			59			10			
Turn Type		NA			NA		Split	NA				
Protected Phases		2 8			6		4	4				
Permitted Phases												
Actuated Green, G (s)		54.9			35.6			13.5				
Effective Green, g (s)		54.9			35.6			13.5				
Actuated g/C Ratio		0.69			0.45			0.17				
Clearance Time (s)					6.0			6.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)		1089			687			247				
v/s Ratio Prot		c0.30			c0.31			c0.03				
v/s Ratio Perm												
v/c Ratio		0.44			0.69			0.16				
Uniform Delay, d1		5.7			17.8			28.4				
Progression Factor		0.18			0.63			1.01				
Incremental Delay, d2		0.3			5.1			0.2				
Delay (s)		1.3			16.3			29.0				
Level of Service		A			B			C				
Approach Delay (s)		1.3			16.3			29.0			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.6
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Left-Turn Lane Warrant Analysis @ 3rd Street/North Project Driveway
Cumulative Plus Project Conditions - AM Peak Hour



(b)

Figure 2-6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

Source: NCHRP 457 (TRB, 2001)

FEHR & PEERS

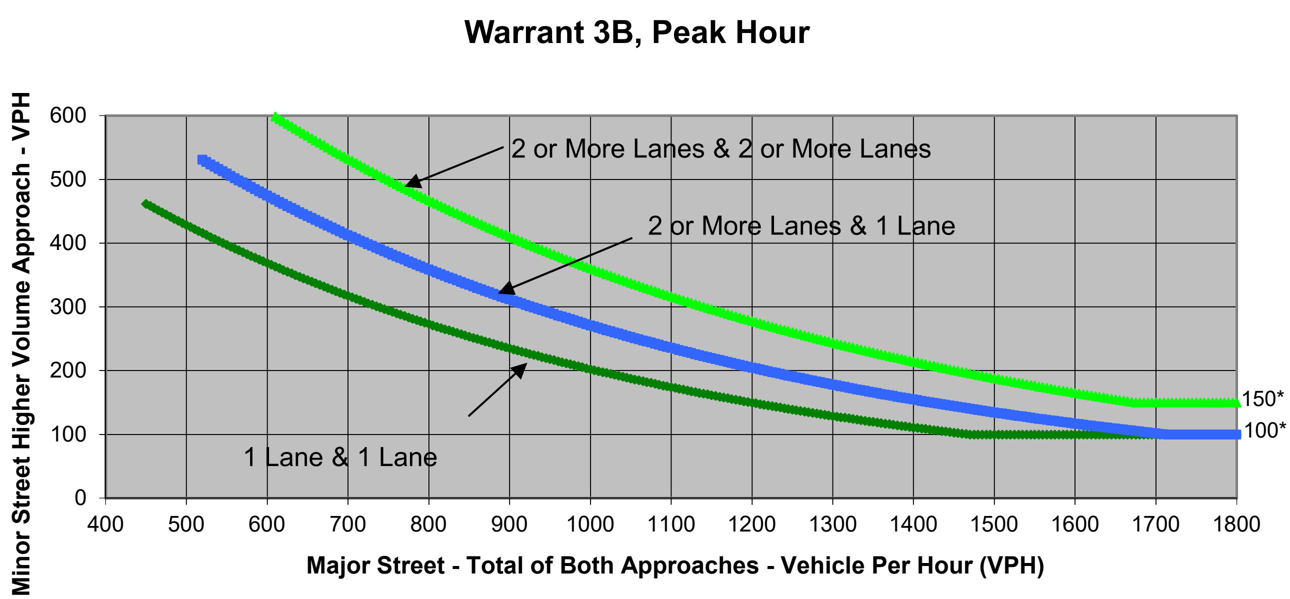
			Project	999 3rd Street - BioMarin
Major Street	2nd Street		Scenario	Cumulative Plus Project Buildout
Minor Street	Brooks Street		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left		45	15	
Through		0	2,307	
Right		0	0	
Total	0	45	2,322	0

Major Street Direction

	North/South
x	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street 2nd Street	Minor Street Brooks Street	Warrant Met
Number of Approach Lanes	**3**	**1**	**NO**
Traffic Volume (VPH) *	**2,322**	**45**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

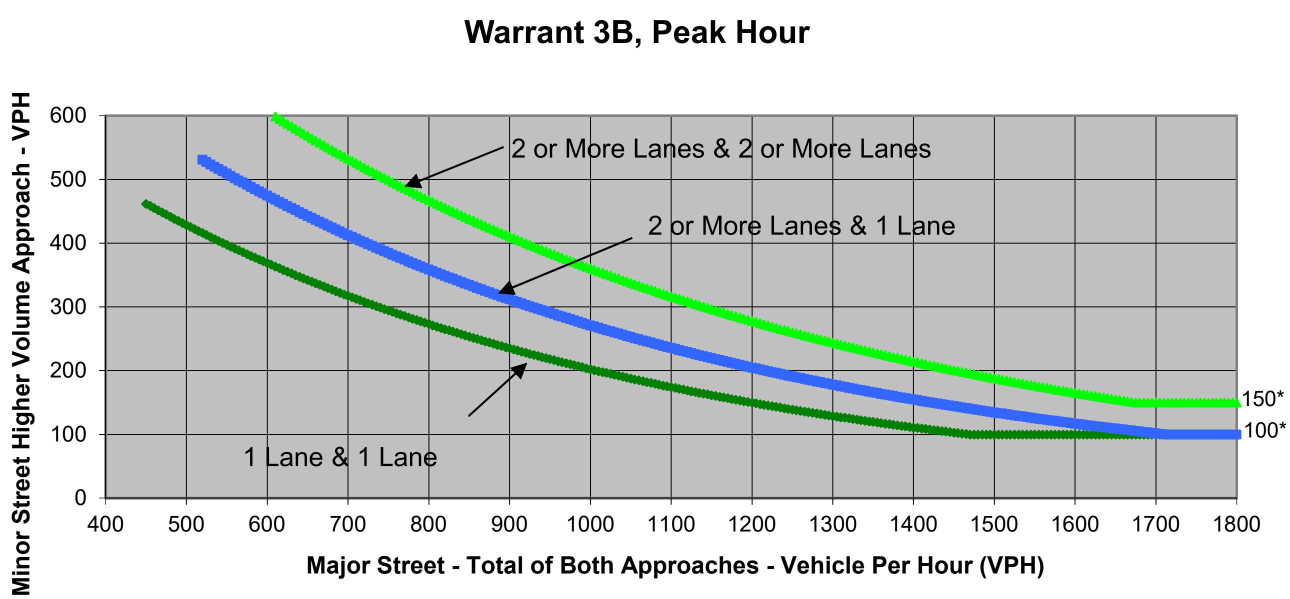
			Project	999 3rd Street - BioMarin
Major Street	2nd Street		Scenario	Cumulative Plus Project Buildout
Minor Street	Brooks Street		Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left		115	20	
Through			2,392	
Right			0	
Total	0	115	2,412	0

Major Street Direction

	North/South
x	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street 2nd Street	Minor Street Brooks Street	Warrant Met
Number of Approach Lanes	**3**	**1**	**YES**
Traffic Volume (VPH) *	**2,412**	**115**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

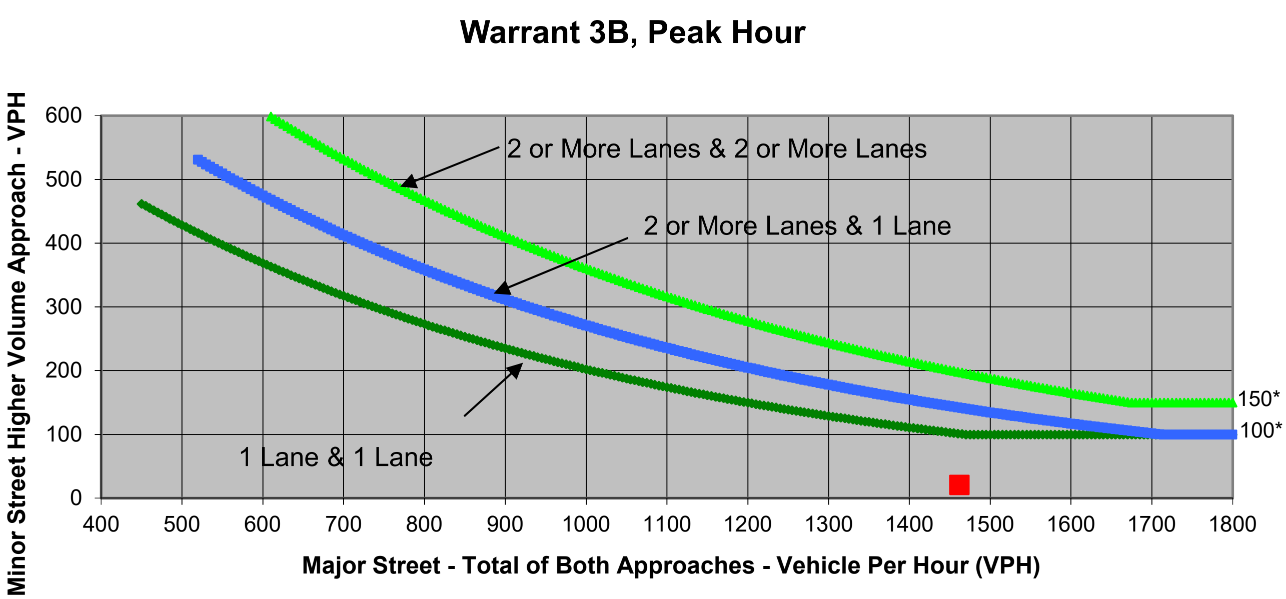
			Project	999 3rd Street - BioMarin
Major Street	3rd Street		Scenario	Cumulative Plus Project Buildout
Minor Street	Brooks Street		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	21			10
Through	0			1,401
Right	0			51
Total	21	0	0	1,462

Major Street Direction

	North/South
x	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street 3rd Street	Minor Street Brooks Street	Warrant Met
Number of Approach Lanes	**3**	**1**	**NO**
Traffic Volume (VPH) *	**1,462**	**21**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

			Project	999 3rd Street - BioMarin
Major Street	3rd Street		Scenario	Cumulative Plus Project Buildout
Minor Street	Brooks Street		Peak Hour	PM

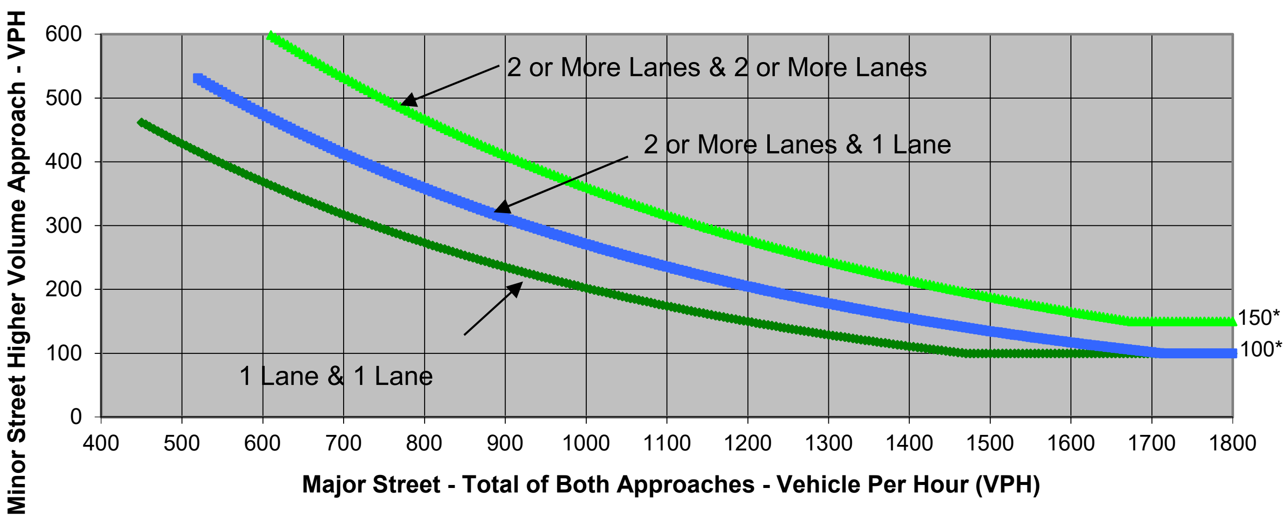
Turn Movement Volumes

	NB	SB	EB	WB
Left	42			88
Through				1,829
Right				10
Total	42	0	0	1,927

Major Street Direction

	North/South
x	East/West

Warrant 3B, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street	**Minor Street**	**Warrant Met**
	3rd Street	Brooks Street	
Number of Approach Lanes	**3**	**1**	**NO**
Traffic Volume (VPH) *	**1,927**	**42**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

Pedestrian Hybrid Beacon

California MUTCD 2014, Revision 3

Figures 4F-1 and 4F-2

Project: BioMarin 999 3rd Street TIS

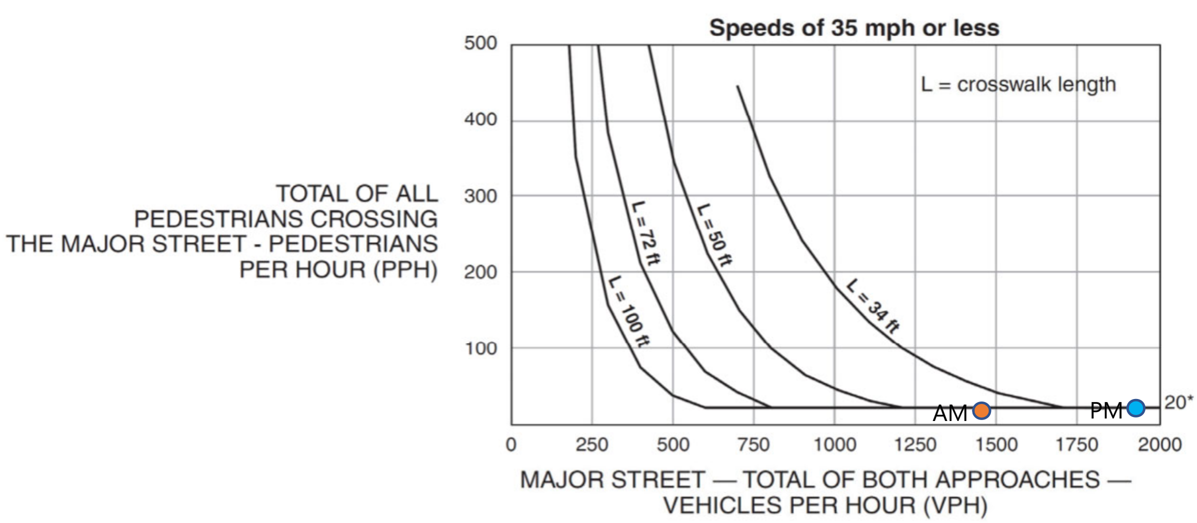
Scenario: Cumulative + Full Buildout

Location: East leg of 3rd St/Brooks St

Date: 1/14/2019

Analyst: DM

	AM Peak Hour	PM Peak Hour
Roadway Speed (mph)	25	25
Crosswalk Length (ft)	42	42
Pedestrians Crossing the Major Street (PPH)	17	20
Major Street Approach 1 Volume (vph)	0	0
Major Street Approach 2 Volume (vph)	1462	1927
Total Major Street Volume (vph)	1462	1927
Warrant Met?	**No**	**Yes**



* Note: 20 pph applies as the lower threshold volume

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **C+P Buildout Conditions (Signal at Brooks/2nd, w/ WB LT at 3rd/Brooks)**
Volume and Delay by Movement **AM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	21	23	110.4%	8.7	2.0	A
	Through	5	4	81.0%	16.5	15.9	C
	Right Turn						
	Subtotal	26	27	104.7%	11.0	3.0	B
SB	Left Turn						
	Through	5	4	73.6%	15.7	18.4	C
	Right Turn	10	13	125.1%	11.5	9.2	B
	Subtotal	15	16	107.9%	19.3	11.3	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	51	38	73.6%	2.5	0.3	A
	Through	1,401	1,353	96.6%	2.0	0.4	A
	Right Turn	10	6	62.6%	2.0	1.5	A
	Subtotal	1,462	1,397	95.5%	2.0	0.4	A
Total		1,503	1,440	95.8%	2.4	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	86	90	104.4%	21.8	4.9	C
	Through	10	11	106.7%	27.5	15.0	C
	Right Turn						
	Subtotal	96	100	104.7%	22.5	4.0	C
SB	Left Turn						
	Through	40	36	90.2%	48.0	12.8	D
	Right Turn	10	8	81.0%	9.0	7.6	A
	Subtotal	50	44	88.3%	41.0	9.3	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	446	93.6%	27.8	11.4	C
	Through	1,396	1,321	94.7%	8.3	3.3	A
	Right Turn	30	29	96.9%	8.0	3.0	A
	Subtotal	1,903	1,797	94.4%	13.2	5.4	B
Total		2,049	1,942	94.8%	14.3	5.1	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P Buildout Conditions (Signal at Brooks/2nd, w/ WB LT at 3rd/Brooks)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 | **Brooks St/2nd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	50	42	84.6%	31.5	8.9	C
	Through						
	Right Turn						
	Subtotal	50	42	84.6%	31.5	8.9	C
EB	Left Turn	25	28	111.9%	6.1	2.6	A
	Through	2,307	2,238	97.0%	6.0	1.1	A
	Right Turn						
	Subtotal	2,332	2,266	97.2%	6.0	1.1	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,382	2,308	96.9%	6.4	1.2	A

Intersection 26 | **Lindaro St/2nd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	58	107.7%	15.7	4.1	B
	Right Turn	281	278	99.0%	23.7	4.9	C
	Subtotal	335	336	100.4%	22.5	4.5	C
SB	Left Turn	72	72	100.7%	38.7	2.0	D
	Through	442	404	91.3%	36.6	3.5	D
	Right Turn						
	Subtotal	514	476	92.6%	37.0	2.9	D
EB	Left Turn	42	44	104.3%	13.5	4.3	B
	Through	2,289	2,197	96.0%	12.1	1.3	B
	Right Turn	61	67	109.2%	9.3	1.7	A
	Subtotal	2,392	2,308	96.5%	12.1	1.3	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,241	3,120	96.3%	17.0	1.3	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P Buildout Conditions (Signal at 2nd/Brooks, w/ WBLT at 3rd/Brooks)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 15 | **Brooks St/3rd St** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	40	94.2%	18.9	8.0	C
	Through	5	5	99.8%	34.0	27.1	D
	Right Turn						
	Subtotal	47	45	94.8%	20.1	7.8	C
SB	Left Turn						
	Through	15	17	115.2%	28.4	11.8	D
	Right Turn	10	10	103.7%	14.1	8.9	B
	Subtotal	25	28	110.6%	21.9	5.8	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	88	78	89.0%	2.9	0.4	A
	Through	1,829	1,811	99.0%	2.3	0.4	A
	Right Turn	10	12	115.2%	2.2	1.0	A
	Subtotal	1,927	1,900	98.6%	2.3	0.3	A
Total		1,999	1,973	98.7%	3.1	0.3	A

Intersection 16 | **Lindaro St/3rd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	132	118	89.0%	29.9	2.0	C
	Through	20	25	124.8%	33.2	7.8	C
	Right Turn						
	Subtotal	152	142	93.7%	30.4	2.5	C
SB	Left Turn						
	Through	50	53	106.0%	23.9	8.2	C
	Right Turn	10	12	122.9%	16.5	10.5	B
	Subtotal	60	65	108.8%	23.0	7.6	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	239	98.9%	9.1	1.6	A
	Through	1,872	1,834	98.0%	6.1	0.7	A
	Right Turn	40	46	114.2%	6.1	2.5	A
	Subtotal	2,154	2,119	98.4%	6.4	0.7	A
Total		2,366	2,327	98.3%	8.4	0.7	A

SimTraffic Post-Processor | BioMarin
Average Results from 10 Runs | C+P Buildout Conditions (Signal at 2nd/Brooks, w/ WBLT at 3rd/Brooks)
Volume and Delay by Movement | PM Peak Hour

Intersection 25 **Brooks St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	115	101	87.8%	31.5	5.3	C
	Through						
	Right Turn						
	Subtotal	115	101	87.8%	31.5	5.3	C
EB	Left Turn	45	43	96.4%	6.1	3.0	A
	Through	2,392	2,408	100.7%	7.2	0.7	A
	Right Turn						
	Subtotal	2,437	2,452	100.6%	7.2	0.7	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,552	2,553	100.0%	8.1	0.8	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	80	87.8%	20.1	3.6	C
	Right Turn	433	423	97.6%	37.6	10.5	D
	Subtotal	524	503	95.9%	34.9	9.3	C
SB	Left Turn	117	108	92.6%	25.5	4.3	C
	Through	180	181	100.7%	17.6	3.4	B
	Right Turn						
	Subtotal	297	290	97.5%	20.5	3.1	C
EB	Left Turn	61	61	100.7%	17.7	3.4	B
	Through	2,372	2,347	98.9%	14.9	1.7	B
	Right Turn	44	40	91.6%	11.0	2.9	B
	Subtotal	2,477	2,449	98.9%	14.9	1.7	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,298	3,241	98.3%	18.5	2.3	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	71	1312	84	210	135	0	0	140	30
Future Volume (veh/h)	0	0	0	71	1312	84	210	135	0	0	140	30
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.93	0.96		1.00	1.00		0.92
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1748	1800	1835	1835	0	0	1835	1890
Adj Flow Rate, veh/h				77	1426	82	228	147	0	0	152	21
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				0	3	0	3	3	0	0	3	3
Cap, veh/h				127	2497	148	306	610	0	0	302	42
Arrive On Green				0.55	0.55	0.55	0.02	0.11	0.00	0.00	0.22	0.22
Sat Flow, veh/h				229	4507	268	1748	1835	0	0	1389	192
Grp Volume(v), veh/h				584	487	514	228	147	0	0	0	173
Grp Sat Flow(s),veh/h/ln				1736	1590	1677	1748	1835	0	0	0	1581
Q Serve(g_s), s				17.0	14.8	14.8	0.6	5.5	0.0	0.0	0.0	7.2
Cycle Q Clear(g_c), s				17.0	14.8	14.8	0.6	5.5	0.0	0.0	0.0	7.2
Prop In Lane				0.13		0.16	1.00		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				962	881	929	306	610	0	0	0	344
V/C Ratio(X)				0.61	0.55	0.55	0.74	0.24	0.00	0.00	0.00	0.50
Avail Cap(c_a), veh/h				962	881	929	420	783	0	0	0	390
HCM Platoon Ratio				1.00	1.00	1.00	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.84	0.84	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				11.2	10.7	10.7	33.0	24.7	0.0	0.0	0.0	25.8
Incr Delay (d2), s/veh				2.8	2.5	2.4	6.9	0.4	0.0	0.0	0.0	2.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				8.7	7.0	7.3	5.3	2.9	0.0	0.0	0.0	3.4
LnGrp Delay(d),s/veh				14.1	13.2	13.1	39.9	25.1	0.0	0.0	0.0	28.2
LnGrp LOS				B	B	B	D	C				C
Approach Vol, veh/h					1585			375			173	
Approach Delay, s/veh					13.5			34.1			28.2	
Approach LOS					B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			8.1	20.8		46.1		28.9
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			9.0	18.5		34.5		32.0
Max Q Clear Time (g_c+I1), s			2.6	9.2		19.0		7.5
Green Ext Time (p_c), s			1.6	0.8		11.6		3.3

Intersection Summary	
HCM 2010 Ctrl Delay	18.3
HCM 2010 LOS	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative + Project Buildout Conditions (With One-Way NB Brooks)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 15 | **Brooks St/3rd St** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	36	33	92.0%	10.6	2.0	B
	Through	5	6	110.4%	20.2	19.0	C
	Right Turn						
	Subtotal	41	39	94.2%	13.4	3.5	B
SB	Left Turn						
	Through						
	Right Turn	15	13	85.9%	13.6	5.9	B
	Subtotal	15	13	85.9%	13.6	5.9	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn						
	Through	1,416	1,362	96.2%	1.7	0.2	A
	Right Turn	10	10	103.0%	1.8	1.0	A
	Subtotal	1,426	1,373	96.3%	1.7	0.2	A
Total		1,482	1,424	96.1%	2.1	0.2	A

Intersection 16 | **Lindaro St/3rd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	85	82	96.1%	23.4	5.4	C
	Through	10	9	88.3%	17.0	13.9	B
	Right Turn						
	Subtotal	95	91	95.3%	23.1	5.0	C
SB	Left Turn						
	Through	40	43	107.6%	43.4	8.2	D
	Right Turn	10	11	106.7%	21.5	13.8	C
	Subtotal	50	54	107.5%	40.0	7.2	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	491	438	89.3%	23.8	10.0	C
	Through	1,382	1,326	95.9%	7.6	2.0	A
	Right Turn	30	29	98.1%	7.3	2.6	A
	Subtotal	1,903	1,793	94.2%	11.6	4.0	B
Total		2,048	1,938	94.6%	13.0	3.8	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	2252	205	0	0	0	0	260	20	81	125	0
Future Volume (veh/h)	100	2252	205	0	0	0	0	260	20	81	125	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97				1.00		0.95	0.98		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1748	1800				0	1660	1710	1660	1660	0
Adj Flow Rate, veh/h	109	2448	209				0	283	13	88	136	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	0				0	3	3	3	3	0
Cap, veh/h	123	2912	251				0	448	20	163	373	0
Arrive On Green	0.22	0.22	0.22				0.00	0.15	0.15	0.01	0.07	0.00
Sat Flow, veh/h	187	4425	381				0	3147	140	1581	1660	0
Grp Volume(v), veh/h	1013	840	914				0	145	151	88	136	0
Grp Sat Flow(s),veh/h/ln	1738	1590	1665				0	1577	1627	1581	1660	0
Q Serve(g_s), s	42.4	37.5	39.3				0.0	6.5	6.6	0.0	5.8	0.0
Cycle Q Clear(g_c), s	42.4	37.5	39.3				0.0	6.5	6.6	0.0	5.8	0.0
Prop In Lane	0.11		0.23				0.00		0.09	1.00		0.00
Lane Grp Cap(c), veh/h	1144	1047	1096				0	231	238	163	373	0
V/C Ratio(X)	0.89	0.80	0.83				0.00	0.63	0.64	0.54	0.36	0.00
Avail Cap(c_a), veh/h	1144	1047	1096				0	336	347	170	487	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	0.09	0.09	0.09				0.00	1.00	1.00	0.81	0.81	0.00
Uniform Delay (d), s/veh	26.6	24.7	25.4				0.0	30.1	30.1	36.0	29.6	0.0
Incr Delay (d2), s/veh	1.1	0.6	0.7				0.0	5.9	5.9	4.9	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.7	16.8	18.4				0.0	3.2	3.3	2.0	2.8	0.0
LnGrp Delay(d),s/veh	27.7	25.4	26.2				0.0	36.0	36.0	40.9	30.7	0.0
LnGrp LOS	C	C	C					D	D	D	C	
Approach Vol, veh/h		2766						296			224	
Approach Delay, s/veh		26.5						36.0			34.7	
Approach LOS		C						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		54.0		21.0			5.9	15.2
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		44.2		* 22			* 2	* 16
Max Q Clear Time (g_c+I1), s		44.4		7.8			2.0	8.6
Green Ext Time (p_c), s		0.0		1.4			0.0	1.3

Intersection Summary			
HCM 2010 Ctrl Delay			27.9
HCM 2010 LOS			C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative + Project Buildout Conditions (With One-Way NB Brooks)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn	25	24	95.7%	2.9	0.6	A
	Through	2,338	2,275	97.3%	2.7	0.2	A
	Right Turn						
	Subtotal	2,363	2,299	97.3%	2.7	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,363	2,299	97.3%	2.7	0.2	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	50	92.7%	15.9	5.6	B
	Right Turn	281	276	98.4%	19.0	6.6	B
	Subtotal	335	326	97.4%	18.7	6.3	B
SB	Left Turn	86	84	97.6%	38.2	5.3	D
	Through	443	391	88.3%	34.6	4.3	C
	Right Turn						
	Subtotal	529	475	89.8%	35.3	4.1	D
EB	Left Turn	42	41	98.1%	14.9	3.8	B
	Through	2,271	2,189	96.4%	14.3	2.4	B
	Right Turn	60	60	100.6%	12.6	4.6	B
	Subtotal	2,373	2,291	96.5%	14.3	2.4	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,237	3,092	95.5%	18.0	2.5	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	189	1696	106	260	175	0	0	180	50
Future Volume (veh/h)	0	0	0	189	1696	106	260	175	0	0	180	50
Number				1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.91	0.96		1.00	1.00		0.91
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89
Adj Sat Flow, veh/h/ln				1800	1765	1800	1853	1853	0	0	1853	1890
Adj Flow Rate, veh/h				197	1767	103	271	182	0	0	188	38
Adj No. of Lanes				0	3	0	1	1	0	0	1	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				0	2	0	2	2	0	0	2	2
Cap, veh/h				243	2323	139	310	661	0	0	275	56
Arrive On Green				0.54	0.54	0.54	0.15	0.60	0.00	0.00	0.21	0.21
Sat Flow, veh/h				452	4327	259	1765	1853	0	0	1308	264
Grp Volume(v), veh/h				759	635	673	271	182	0	0	0	226
Grp Sat Flow(s),veh/h/ln				1742	1606	1690	1765	1853	0	0	0	1572
Q Serve(g_s), s				28.6	24.2	24.5	4.8	3.8	0.0	0.0	0.0	10.6
Cycle Q Clear(g_c), s				28.6	24.2	24.5	4.8	3.8	0.0	0.0	0.0	10.6
Prop In Lane				0.26		0.15	1.00		0.00	0.00		0.17
Lane Grp Cap(c), veh/h				935	862	907	310	661	0	0	0	330
V/C Ratio(X)				0.81	0.74	0.74	0.87	0.28	0.00	0.00	0.00	0.68
Avail Cap(c_a), veh/h				935	862	907	327	718	0	0	0	364
HCM Platoon Ratio				1.00	1.00	1.00	1.67	1.67	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	1.00	1.00	0.73	0.73	0.00	0.00	0.00	1.00
Uniform Delay (d), s/veh				15.2	14.2	14.3	31.1	11.2	0.0	0.0	0.0	29.2
Incr Delay (d2), s/veh				7.6	5.6	5.4	17.9	0.3	0.0	0.0	0.0	6.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.5	11.9	12.8	7.2	2.0	0.0	0.0	0.0	5.2
LnGrp Delay(d),s/veh				22.8	19.8	19.7	49.0	11.5	0.0	0.0	0.0	35.9
LnGrp LOS				C	B	B	D	B				D
Approach Vol, veh/h					2067			453			226	
Approach Delay, s/veh					20.8			34.0			35.9	
Approach LOS					C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs			3	4		6		8
Phs Duration (G+Y+Rc), s			11.2	21.3		47.5		32.5
Change Period (Y+Rc), s			4.0	4.5		4.5		4.0
Max Green Setting (Gmax), s			8.0	18.5		40.5		31.0
Max Q Clear Time (g_c+I1), s			6.8	12.6		30.6		5.8
Green Ext Time (p_c), s			0.4	0.8		9.0		4.2

Intersection Summary	
HCM 2010 Ctrl Delay	24.2
HCM 2010 LOS	C

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	77	76	99.2%	22.2	12.8	C
	Through	5	6	115.2%	20.2	17.1	C
	Right Turn						
	Subtotal	82	82	100.2%	22.6	12.8	C
SB	Left Turn						
	Through						
	Right Turn	25	24	95.2%	22.4	13.6	C
	Subtotal	25	24	95.2%	22.4	13.6	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn						
	Through	1,861	1,823	97.9%	2.9	1.1	A
	Right Turn	10	10	103.7%	1.9	0.8	A
	Subtotal	1,871	1,833	98.0%	2.9	1.1	A
Total		1,978	1,939	98.0%	3.9	1.5	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	132	119	90.2%	30.2	2.0	C
	Through	20	18	88.3%	29.2	9.3	C
	Right Turn						
	Subtotal	152	137	89.9%	30.2	2.4	C
SB	Left Turn						
	Through	50	53	106.0%	32.0	5.5	C
	Right Turn	10	9	92.2%	22.5	9.6	C
	Subtotal	60	62	103.7%	30.8	4.7	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	275	257	93.3%	9.8	2.7	A
	Through	1,839	1,793	97.5%	6.2	0.7	A
	Right Turn	40	42	105.6%	6.1	2.1	A
	Subtotal	2,154	2,092	97.1%	6.6	0.9	A
Total		2,366	2,291	96.8%	8.7	0.9	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	2252	185	0	0	0	0	335	30	226	143	0
Future Volume (veh/h)	110	2252	185	0	0	0	0	335	30	226	143	0
Number	5	2	12				3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96				1.00		0.90	0.96		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800				0	1676	1710	1676	1744	0
Adj Flow Rate, veh/h	115	2346	182				0	349	23	235	149	0
Adj No. of Lanes	0	3	0				0	2	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	0				0	2	2	2	2	0
Cap, veh/h	123	2651	208				0	515	34	243	521	0
Arrive On Green	0.20	0.20	0.20				0.00	0.17	0.17	0.13	0.50	0.00
Sat Flow, veh/h	208	4483	352				0	3096	197	1597	1744	0
Grp Volume(v), veh/h	969	804	869				0	183	189	235	149	0
Grp Sat Flow(s),veh/h/ln	1754	1606	1683				0	1593	1616	1597	1744	0
Q Serve(g_s), s	43.5	38.6	40.1				0.0	8.6	8.8	5.4	4.0	0.0
Cycle Q Clear(g_c), s	43.5	38.6	40.1				0.0	8.6	8.8	5.4	4.0	0.0
Prop In Lane	0.12		0.21				0.00		0.12	1.00		0.00
Lane Grp Cap(c), veh/h	1037	950	995				0	273	277	243	521	0
V/C Ratio(X)	0.93	0.85	0.87				0.00	0.67	0.68	0.97	0.29	0.00
Avail Cap(c_a), veh/h	1037	950	995				0	319	323	243	567	0
HCM Platoon Ratio	0.33	0.33	0.33				1.00	1.00	1.00	1.67	1.67	1.00
Upstream Filter(I)	0.16	0.16	0.16				0.00	1.00	1.00	0.63	0.63	0.00
Uniform Delay (d), s/veh	30.7	28.7	29.3				0.0	31.1	31.1	33.1	15.1	0.0
Incr Delay (d2), s/veh	3.4	1.6	1.9				0.0	7.0	7.3	37.1	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.1	17.6	19.2				0.0	4.3	4.5	7.6	2.0	0.0
LnGrp Delay(d),s/veh	34.1	30.3	31.2				0.0	38.1	38.4	70.2	15.5	0.0
LnGrp LOS	C	C	C					D	D	E	B	
Approach Vol, veh/h		2643						372			384	
Approach Delay, s/veh		32.0						38.3			49.0	
Approach LOS		C						D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4			7	8
Phs Duration (G+Y+Rc), s		51.9		28.1			10.2	17.9
Change Period (Y+Rc), s		4.6		* 4.2			* 4.2	* 4.2
Max Green Setting (Gmax), s		45.2		* 26			* 6	* 16
Max Q Clear Time (g_c+I1), s		45.5		6.0			7.4	10.8
Green Ext Time (p_c), s		0.0		3.2			0.0	1.3

Intersection Summary		
HCM 2010 Ctrl Delay		34.6
HCM 2010 LOS		C

Notes
User approved ignoring U-Turning movement.

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative Plus Project Buildout Conditions (With One-Way NB Brooks)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn	45	47	105.0%	3.0	0.3	A
	Through	2,465	2,383	96.7%	2.7	0.2	A
	Right Turn						
	Subtotal	2,510	2,430	96.8%	2.7	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,510	2,430	96.8%	2.7	0.2	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	84	92.4%	18.6	3.5	B
	Right Turn	433	414	95.6%	30.1	9.7	C
	Subtotal	524	498	95.0%	28.3	7.7	C
SB	Left Turn	149	138	92.5%	26.0	8.5	C
	Through	180	172	95.6%	18.9	4.3	B
	Right Turn						
	Subtotal	329	310	94.2%	22.2	5.9	C
EB	Left Turn	60	52	87.0%	17.0	4.6	B
	Through	2,334	2,242	96.0%	15.9	1.9	B
	Right Turn	41	46	111.5%	12.2	3.8	B
	Subtotal	2,435	2,340	96.1%	15.9	1.8	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,288	3,148	95.7%	18.5	1.9	B

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	21	19	89.4%	9.9	4.7	A
	Through	5	6	110.4%	16.2	12.6	C
	Right Turn						
	Subtotal	26	24	93.4%	11.7	4.6	B
SB	Left Turn						
	Through	5	3	58.9%	10.1	13.0	B
	Right Turn	10	9	92.0%	8.4	6.2	A
	Subtotal	15	12	81.0%	10.9	7.1	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	51	52	101.0%	3.3	0.9	A
	Through	1,401	1,331	95.0%	3.4	0.8	A
	Right Turn	10	9	88.3%	3.1	0.8	A
	Subtotal	1,462	1,391	95.2%	3.4	0.9	A
Total		1,503	1,428	95.0%	3.7	0.8	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	86	77	89.9%	23.3	7.1	C
	Through	10	10	103.0%	31.3	18.3	C
	Right Turn						
	Subtotal	96	88	91.2%	24.4	6.6	C
SB	Left Turn						
	Through	40	43	108.6%	46.4	12.0	D
	Right Turn	10	13	125.1%	27.5	10.1	C
	Subtotal	50	56	111.9%	41.7	11.1	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	436	91.5%	21.7	10.3	C
	Through	1,396	1,333	95.5%	7.1	1.7	A
	Right Turn	30	30	99.4%	6.2	2.2	A
	Subtotal	1,903	1,799	94.5%	10.7	3.9	B
Total		2,049	1,943	94.8%	12.3	3.4	B

SimTraffic Post-Processor **BioMarin**
Average Results from 10 RCnP Conditions (With PHB on east leg at 3rd/Brooks, w/WB LT Pocket at 3rd/Brooks)
Volume and Delay by Movement **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	50	52	103.0%	27.1	4.1	D
	Through						
	Right Turn						
	Subtotal	50	52	103.0%	27.1	4.1	D
EB	Left Turn	25	22	89.8%	2.9	0.6	A
	Through	2,307	2,254	97.7%	2.6	0.2	A
	Right Turn						
	Subtotal	2,332	2,277	97.6%	2.6	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,382	2,328	97.7%	3.1	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	55	102.2%	15.9	5.2	B
	Right Turn	281	277	98.5%	20.9	5.5	C
	Subtotal	335	332	99.1%	20.0	4.8	C
SB	Left Turn	72	65	90.5%	40.0	5.9	D
	Through	442	412	93.2%	35.6	3.6	D
	Right Turn						
	Subtotal	514	477	92.8%	36.2	3.5	D
EB	Left Turn	42	34	81.5%	15.3	5.6	B
	Through	2,289	2,228	97.3%	15.4	3.4	B
	Right Turn	61	72	118.2%	15.3	3.7	B
	Subtotal	2,392	2,335	97.6%	15.4	3.4	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,241	3,143	97.0%	19.1	2.6	B

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	42	46	108.8%	16.9	6.8	C
	Through	5	5	99.8%	10.4	9.2	B
	Right Turn						
	Subtotal	47	51	107.8%	16.6	6.6	C
SB	Left Turn						
	Through	15	15	97.3%	29.8	16.3	D
	Right Turn	10	11	111.4%	16.1	9.0	C
	Subtotal	25	26	102.9%	24.9	11.4	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	88	83	93.8%	6.8	1.8	A
	Through	1,829	1,798	98.3%	7.1	2.0	A
	Right Turn	10	10	96.0%	7.0	2.9	A
	Subtotal	1,927	1,890	98.1%	7.1	1.9	A
Total		1,999	1,966	98.4%	7.6	2.0	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	132	123	93.4%	31.1	2.9	C
	Through	20	19	94.1%	26.9	8.3	C
	Right Turn						
	Subtotal	152	142	93.5%	30.8	2.6	C
SB	Left Turn						
	Through	50	57	114.4%	27.6	4.5	C
	Right Turn	10	10	96.0%	15.1	11.4	B
	Subtotal	60	67	111.4%	26.4	4.9	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	227	93.6%	8.9	1.0	A
	Through	1,872	1,842	98.4%	5.9	0.4	A
	Right Turn	40	38	96.0%	6.1	1.6	A
	Subtotal	2,154	2,107	97.8%	6.2	0.4	A
Total		2,366	2,316	97.9%	8.3	0.4	A

SimTraffic Post-Processor **BioMarin**

Average Results from 10 Runs C+P Conditions (With PHB on east leg at 3rd/Brooks, w/ WBLT Pocket at 3rd/Brooks)

Volume and Delay by Movement **PM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	115	116	100.8%	30.8	4.5	D
	Through						
	Right Turn						
	Subtotal	115	116	100.8%	30.8	4.5	D
EB	Left Turn	45	48	106.7%	3.3	0.5	A
	Through	2,392	2,410	100.8%	2.8	0.2	A
	Right Turn						
	Subtotal	2,437	2,458	100.9%	2.8	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,552	2,574	100.9%	4.1	0.4	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn						
	Through	91	86	94.9%	21.9	6.0	C
	Right Turn	433	402	92.9%	36.1	16.7	D
	Subtotal	524	488	93.2%	33.7	15.0	C
SB	Left Turn	117	113	96.2%	28.3	9.2	C
	Through	180	168	93.2%	19.1	3.2	B
	Right Turn						
	Subtotal	297	280	94.4%	22.9	5.9	C
EB	Left Turn	61	52	85.6%	19.5	4.1	B
	Through	2,372	2,371	100.0%	18.8	2.3	B
	Right Turn	44	41	94.3%	13.1	5.0	B
	Subtotal	2,477	2,465	99.5%	18.7	2.4	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,298	3,233	98.0%	21.5	3.4	C

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative Plus Project Conditions - w/ Coordinated PHB on East Leg**
Volume and Delay by Movement | **Lunch Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	41	97.7%	10.4	4.7	B
	Through	5	5	98.8%	13.7	19.5	B
	Right Turn						
	Subtotal	47	46	97.8%	11.8	5.5	B
SB	Left Turn						
	Through	5	6	114.0%	33.6	20.4	D
	Right Turn	10	12	121.6%	19.7	13.4	C
	Subtotal	15	18	119.1%	25.6	12.4	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	81	68	84.4%	3.2	0.5	A
	Through	1,643	1,604	97.6%	3.0	0.5	A
	Right Turn	10	10	102.6%	2.8	0.4	A
	Subtotal	1,734	1,682	97.0%	3.0	0.5	A
Total		1,796	1,746	97.2%	3.5	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	120	113	94.1%	34.6	3.8	C
	Through	20	23	114.0%	30.0	6.3	C
	Right Turn						
	Subtotal	140	136	96.9%	33.7	4.0	C
SB	Left Turn						
	Through	40	41	103.6%	29.3	7.9	C
	Right Turn	10	10	98.8%	15.7	13.7	B
	Subtotal	50	51	102.6%	27.4	8.2	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	343	310	90.4%	9.1	2.8	A
	Through	1,636	1,588	97.0%	6.2	0.9	A
	Right Turn	50	42	83.6%	5.3	1.5	A
	Subtotal	2,029	1,940	95.6%	6.6	1.1	A
Total		2,219	2,126	95.8%	8.9	1.0	A

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **Cumulative Plus Project Conditions - w/ Coordinated PHB on East Leg**
Volume and Delay by Movement | **Lunch Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	88	75	85.1%	27.6	4.2	D
	Through						
	Right Turn						
	Subtotal	88	75	85.1%	27.6	4.2	D
EB	Left Turn	45	44	97.1%	2.9	0.4	A
	Through	2,034	2,066	101.6%	2.2	0.2	A
	Right Turn						
	Subtotal	2,079	2,110	101.5%	2.2	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,167	2,185	100.8%	3.0	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	87	89	101.8%	18.6	3.3	B
	Right Turn	293	293	99.9%	21.3	2.6	C
	Subtotal	380	381	100.3%	20.8	1.8	C
SB	Left Turn	110	103	93.3%	27.9	4.7	C
	Through	273	251	92.0%	20.5	2.2	C
	Right Turn						
	Subtotal	383	354	92.4%	22.8	2.0	C
EB	Left Turn	53	49	92.5%	17.4	5.4	B
	Through	2,030	2,054	101.2%	14.7	1.7	B
	Right Turn	59	59	99.8%	10.5	3.7	B
	Subtotal	2,142	2,162	100.9%	14.6	1.7	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,905	2,897	99.7%	16.5	1.3	B

Intersection 15 **Brooks St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	21	20	92.9%	30.4	14.0	C
	Through	5	7	139.8%	22.9	25.4	C
	Right Turn						
	Subtotal	26	26	101.9%	30.9	7.7	C
SB	Left Turn						
	Through	5	4	88.3%	15.1	15.7	B
	Right Turn	10	12	117.8%	10.9	10.8	B
	Subtotal	15	16	107.9%	14.0	10.4	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	51	47	92.4%	6.4	1.5	A
	Through	1,401	1,345	96.0%	5.9	0.8	A
	Right Turn	10	12	117.8%	4.7	2.5	A
	Subtotal	1,462	1,404	96.0%	5.9	0.8	A
Total		1,503	1,446	96.2%	6.5	0.8	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	86	83	96.3%	22.0	7.0	C
	Through	10	11	106.7%	26.5	23.7	C
	Right Turn						
	Subtotal	96	93	97.4%	21.9	6.6	C
SB	Left Turn						
	Through	40	41	102.1%	37.6	13.4	D
	Right Turn	10	11	106.7%	27.4	26.3	C
	Subtotal	50	52	103.0%	35.4	13.3	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	427	89.6%	26.9	12.6	C
	Through	1,396	1,337	95.7%	8.3	2.8	A
	Right Turn	30	26	88.3%	7.1	2.1	A
	Subtotal	1,903	1,790	94.1%	12.8	5.2	B
Total		2,049	1,935	94.5%	13.9	5.0	B

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **C+P Conditions (With Signal at 3rd/Brooks, w/ WB LT pocket at 3rd/Brooks**
Volume and Delay by Movement **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	50	42	84.6%	19.0	5.1	C
	Through						
	Right Turn						
	Subtotal	50	42	84.6%	19.0	5.1	C
EB	Left Turn	25	26	103.0%	3.1	0.7	A
	Through	2,307	2,283	99.0%	2.6	0.2	A
	Right Turn						
	Subtotal	2,332	2,309	99.0%	2.6	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,382	2,351	98.7%	2.9	0.2	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	53	98.8%	15.1	4.9	B
	Right Turn	281	273	97.2%	20.3	4.5	C
	Subtotal	335	326	97.4%	19.5	4.1	B
SB	Left Turn	72	64	88.9%	39.9	5.1	D
	Through	442	403	91.1%	36.5	5.0	D
	Right Turn						
	Subtotal	514	467	90.8%	37.0	4.8	D
EB	Left Turn	42	43	101.6%	13.5	3.0	B
	Through	2,289	2,244	98.0%	14.5	1.6	B
	Right Turn	61	58	95.3%	14.3	3.0	B
	Subtotal	2,392	2,345	98.0%	14.5	1.5	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,241	3,138	96.8%	18.4	2.0	B

Intersection 15 **Brooks St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	40	94.2%	26.8	8.4	C
	Through	5	5	99.8%	29.0	27.9	C
	Right Turn						
	Subtotal	47	45	94.8%	26.9	7.6	C
SB	Left Turn						
	Through	15	15	97.3%	25.2	10.0	C
	Right Turn	10	8	84.5%	12.6	11.6	B
	Subtotal	25	23	92.2%	22.8	8.1	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	88	80	91.2%	5.3	0.9	A
	Through	1,829	1,827	99.9%	4.3	1.1	A
	Right Turn	10	7	73.0%	6.1	7.6	A
	Subtotal	1,927	1,914	99.3%	4.3	1.1	A
Total		1,999	1,982	99.1%	5.0	1.1	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	132	122	92.8%	31.5	2.7	C
	Through	20	14	71.0%	29.3	6.9	C
	Right Turn						
	Subtotal	152	137	89.9%	31.6	2.4	C
SB	Left Turn						
	Through	50	53	106.8%	28.3	6.9	C
	Right Turn	10	8	84.5%	10.3	8.5	B
	Subtotal	60	62	103.0%	26.8	6.5	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	229	94.7%	10.1	1.1	B
	Through	1,872	1,844	98.5%	6.6	0.9	A
	Right Turn	40	44	110.4%	6.3	2.4	A
	Subtotal	2,154	2,118	98.3%	6.9	0.9	A
Total		2,366	2,316	97.9%	8.9	0.8	A

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P Conditions (With Signal at 3rd/Brooks, w/ WBLT Pocket at 3rd/Brooks)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	115	110	95.5%	28.9	4.5	D
	Through						
	Right Turn						
	Subtotal	115	110	95.5%	28.9	4.5	D
EB	Left Turn	45	41	92.2%	3.3	0.4	A
	Through	2,392	2,404	100.5%	2.8	0.2	A
	Right Turn						
	Subtotal	2,437	2,445	100.3%	2.8	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,552	2,555	100.1%	4.0	0.4	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	81	88.6%	19.2	4.4	B
	Right Turn	433	400	92.4%	27.0	7.4	C
	Subtotal	524	481	91.7%	25.7	6.3	C
SB	Left Turn	117	104	88.6%	25.7	4.9	C
	Through	180	181	100.5%	18.8	3.4	B
	Right Turn						
	Subtotal	297	285	95.8%	21.3	2.7	C
EB	Left Turn	61	60	97.6%	18.8	5.2	B
	Through	2,372	2,356	99.3%	18.3	2.2	B
	Right Turn	44	40	89.9%	14.0	2.8	B
	Subtotal	2,477	2,455	99.1%	18.2	2.2	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,298	3,221	97.7%	19.6	2.1	B

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **Cumulative Plus Project Conditions - w/ Signal at 3rd/Brooks**
Volume and Delay by Movement **Lunch Peak Hour**

Intersection 15 **Brooks St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	39	92.3%	23.2	6.5	C
	Through	5	6	129.2%	13.0	16.0	B
	Right Turn						
	Subtotal	47	45	96.2%	22.8	6.1	C
SB	Left Turn						
	Through	5	4	83.6%	20.1	22.0	C
	Right Turn	10	10	102.6%	13.0	11.0	B
	Subtotal	15	14	96.3%	18.7	9.8	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	81	82	101.3%	4.4	0.9	A
	Through	1,643	1,568	95.4%	3.5	0.5	A
	Right Turn	10	9	87.4%	1.9	0.8	A
	Subtotal	1,734	1,659	95.7%	3.6	0.5	A
Total		1,796	1,718	95.7%	4.2	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	120	117	97.2%	33.0	4.0	C
	Through	20	22	112.1%	29.9	9.5	C
	Right Turn						
	Subtotal	140	139	99.3%	32.6	3.6	C
SB	Left Turn						
	Through	40	41	103.6%	31.1	9.3	C
	Right Turn	10	11	114.0%	10.5	8.9	B
	Subtotal	50	53	105.6%	27.9	8.8	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	343	316	92.2%	8.7	1.5	A
	Through	1,636	1,555	95.0%	5.6	0.3	A
	Right Turn	50	37	73.7%	6.1	2.4	A
	Subtotal	2,029	1,908	94.0%	6.2	0.4	A
Total		2,219	2,100	94.6%	8.5	0.8	A

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	88	86	97.6%	32.6	5.7	D
	Through						
	Right Turn						
	Subtotal	88	86	97.6%	32.6	5.7	D
EB	Left Turn	45	43	94.6%	3.4	0.4	A
	Through	2,034	2,060	101.3%	2.3	0.3	A
	Right Turn						
	Subtotal	2,079	2,103	101.1%	2.3	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,167	2,188	101.0%	3.5	0.5	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	87	88	100.9%	20.0	5.4	B
	Right Turn	293	301	102.6%	24.6	9.3	C
	Subtotal	380	388	102.2%	23.7	7.9	C
SB	Left Turn	110	103	93.6%	31.5	4.5	C
	Through	273	253	92.8%	22.1	2.2	C
	Right Turn						
	Subtotal	383	356	93.1%	24.9	2.1	C
EB	Left Turn	53	53	99.7%	18.7	7.4	B
	Through	2,030	2,041	100.5%	15.8	2.7	B
	Right Turn	59	67	113.4%	14.0	2.0	B
	Subtotal	2,142	2,161	100.9%	15.8	2.7	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,905	2,905	100.0%	18.0	2.7	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P (w/ WB LT at 3rd/Brooks, Crossing on west leg of 3rd/Lindaro)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	21	21	98.1%	9.3	4.0	A
	Through	5	4	88.3%	15.0	13.0	C
	Right Turn						
	Subtotal	26	25	96.2%	10.9	4.6	B
SB	Left Turn						
	Through	5	4	81.0%	15.8	14.9	C
	Right Turn	10	10	95.7%	15.9	14.1	C
	Subtotal	15	14	90.8%	20.7	12.0	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	51	44	85.9%	2.6	0.3	A
	Through	1,401	1,357	96.8%	1.9	0.3	A
	Right Turn	10	9	88.3%	1.5	1.3	A
	Subtotal	1,462	1,409	96.4%	1.9	0.3	A
Total		1,503	1,448	96.3%	2.2	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	86	72	83.9%	29.4	4.0	C
	Through	10	9	88.3%	22.7	21.6	C
	Right Turn						
	Subtotal	96	81	84.3%	28.4	4.7	C
SB	Left Turn						
	Through	40	34	85.6%	37.3	9.2	D
	Right Turn	10	14	143.5%	28.8	30.0	C
	Subtotal	50	49	97.2%	33.0	10.3	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	427	89.5%	20.7	10.0	C
	Through	1,396	1,350	96.7%	7.1	2.0	A
	Right Turn	30	33	110.4%	6.0	2.1	A
	Subtotal	1,903	1,810	95.1%	10.4	4.0	B
Total		2,049	1,940	94.7%	11.7	4.0	B

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **C+P (w/ WB LT at 3rd/Brooks, Crossing on west leg of 3rd/Lindaro)**
Volume and Delay by Movement **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	50	44	87.6%	16.1	5.4	C
	Through						
	Right Turn						
	Subtotal	50	44	87.6%	16.1	5.4	C
EB	Left Turn	25	25	98.6%	2.9	0.3	A
	Through	2,307	2,266	98.2%	2.6	0.3	A
	Right Turn						
	Subtotal	2,332	2,291	98.2%	2.6	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,382	2,335	98.0%	2.9	0.4	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	48	89.3%	16.9	2.3	B
	Right Turn	281	268	95.3%	22.6	3.9	C
	Subtotal	335	316	94.4%	21.8	3.0	C
SB	Left Turn	72	61	85.4%	33.9	5.8	C
	Through	442	390	88.2%	34.7	4.6	C
	Right Turn						
	Subtotal	514	451	87.8%	34.6	4.2	C
EB	Left Turn	42	35	84.1%	14.6	4.2	B
	Through	2,289	2,229	97.4%	14.1	2.2	B
	Right Turn	61	57	94.1%	14.3	5.2	B
	Subtotal	2,392	2,321	97.0%	14.1	2.2	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,241	3,089	95.3%	17.9	1.9	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P (With WB LT at 3rd/Brooks, w/ Crossing on West Leg of 3rd/Lindaro)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	39	93.3%	16.8	5.6	C
	Through	5	4	76.8%	11.7	13.4	B
	Right Turn						
	Subtotal	47	43	91.5%	17.5	6.0	C
SB	Left Turn						
	Through	15	12	79.4%	35.0	20.6	D
	Right Turn	10	13	134.4%	24.6	16.5	C
	Subtotal	25	25	101.4%	27.9	6.6	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	88	100	113.5%	3.0	0.4	A
	Through	1,829	1,842	100.7%	2.8	0.8	A
	Right Turn	10	9	92.2%	2.1	0.8	A
	Subtotal	1,927	1,951	101.3%	2.8	0.8	A
Total		1,999	2,019	101.0%	3.4	0.9	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	132	124	94.3%	30.6	2.7	C
	Through	20	23	113.3%	28.4	9.0	C
	Right Turn						
	Subtotal	152	147	96.8%	30.3	2.3	C
SB	Left Turn						
	Through	50	57	113.7%	26.3	4.5	C
	Right Turn	10	8	76.8%	18.4	13.7	B
	Subtotal	60	65	107.5%	25.5	4.5	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	226	93.5%	8.5	1.6	A
	Through	1,872	1,882	100.6%	6.3	0.7	A
	Right Turn	40	43	106.6%	5.3	1.5	A
	Subtotal	2,154	2,151	99.9%	6.5	0.8	A
Total		2,366	2,363	99.9%	8.5	0.9	A

SimTraffic Post-Processor **BioMarin**
Average Results from 10 Runs **C+P (With WB LT at 3rd/Brooks, w/ Crossing on West Leg of 3rd/Lindaro)**
Volume and Delay by Movement **PM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	115	119	103.8%	30.8	5.2	D
	Through						
	Right Turn						
	Subtotal	115	119	103.8%	30.8	5.2	D
EB	Left Turn	45	42	93.0%	3.3	0.8	A
	Through	2,392	2,401	100.4%	2.9	0.2	A
	Right Turn						
	Subtotal	2,437	2,443	100.2%	2.9	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,552	2,562	100.4%	4.2	0.5	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	91	99.6%	15.4	3.5	B
	Right Turn	433	415	96.0%	31.6	11.4	C
	Subtotal	524	506	96.6%	28.9	10.3	C
SB	Left Turn	117	105	89.9%	28.0	8.9	C
	Through	180	177	98.3%	19.8	4.0	B
	Right Turn						
	Subtotal	297	282	95.0%	22.6	5.0	C
EB	Left Turn	61	61	100.1%	20.3	2.8	C
	Through	2,372	2,351	99.1%	19.6	1.7	B
	Right Turn	44	45	103.0%	12.6	3.3	B
	Subtotal	2,477	2,458	99.2%	19.5	1.7	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,298	3,246	98.4%	21.3	1.9	C

Intersection 15 | **Brooks St/3rd St** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	42	37	88.7%	9.3	2.3	A
	Through	5	6	114.0%	15.2	17.9	C
	Right Turn						
	Subtotal	47	43	91.4%	10.4	3.1	B
SB	Left Turn						
	Through	5	5	91.2%	14.8	12.6	B
	Right Turn	10	12	117.8%	21.0	9.4	C
	Subtotal	15	16	108.9%	20.4	6.6	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	81	75	92.9%	1.6	0.2	A
	Through	1,643	1,598	97.2%	0.8	0.2	A
	Right Turn	10	11	106.4%	0.2	0.3	A
	Subtotal	1,734	1,683	97.1%	0.8	0.2	A
Total		1,796	1,743	97.0%	1.2	0.2	A

Intersection 16 | **Lindaro St/3rd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	120	116	96.9%	36.5	4.1	D
	Through	20	26	131.1%	36.1	6.9	D
	Right Turn						
	Subtotal	140	143	101.8%	36.3	3.8	D
SB	Left Turn						
	Through	40	37	92.2%	24.0	8.3	C
	Right Turn	10	12	121.6%	16.9	12.4	B
	Subtotal	50	49	98.0%	22.8	8.3	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	343	322	93.8%	9.8	2.3	A
	Through	1,636	1,587	97.0%	6.2	0.9	A
	Right Turn	50	52	104.1%	6.0	1.3	A
	Subtotal	2,029	1,961	96.6%	6.8	1.0	A
Total		2,219	2,152	97.0%	9.1	1.0	A

Intersection 25 | **Brooks St/2nd St** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	88	78	88.5%	27.9	5.2	D
	Through						
	Right Turn						
	Subtotal	88	78	88.5%	27.9	5.2	D
EB	Left Turn	45	41	91.2%	3.0	0.4	A
	Through	2,034	2,049	100.7%	2.2	0.2	A
	Right Turn						
	Subtotal	2,079	2,090	100.5%	2.2	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,167	2,168	100.0%	3.2	0.3	A

Intersection 26 | **Lindaro St/2nd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	87	86	98.3%	21.7	3.5	C
	Right Turn	293	293	100.0%	21.7	3.3	C
	Subtotal	380	378	99.6%	21.7	2.8	C
SB	Left Turn	110	107	97.1%	34.5	9.2	C
	Through	273	255	93.3%	21.5	2.7	C
	Right Turn						
	Subtotal	383	361	94.4%	25.5	3.1	C
EB	Left Turn	53	58	109.7%	15.1	2.5	B
	Through	2,030	2,022	99.6%	14.7	1.5	B
	Right Turn	59	57	96.6%	11.3	4.1	B
	Subtotal	2,142	2,138	99.8%	14.6	1.5	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,905	2,877	99.0%	16.9	1.2	B

SimTraffic Post-Processor — **BioMarin**

Average Results from 10 Runs — **C+P Conditions w/ WB LT pocket at 3rd/Brooks (Crossing at Lootens/3rd)**

Volume and Delay by Movement — **AM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	21	18	84.1%	11.4	6.5	B
	Through	5	4	88.3%	17.1	17.0	C
	Right Turn						
	Subtotal	26	22	84.9%	12.9	5.7	B
SB	Left Turn						
	Through	5	2	44.2%	8.5	13.5	A
	Right Turn	10	11	106.7%	20.4	15.4	C
	Subtotal	15	13	85.9%	20.6	13.3	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	51	40	79.4%	3.4	0.8	A
	Through	1,401	1,340	95.6%	4.4	0.8	A
	Right Turn	10	12	117.8%	4.2	2.9	A
	Subtotal	1,462	1,392	95.2%	4.4	0.8	A
Total		1,503	1,427	95.0%	4.7	0.8	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	86	90	104.8%	29.4	3.2	C
	Through	10	9	88.3%	20.7	15.3	C
	Right Turn						
	Subtotal	96	99	103.1%	28.9	3.0	C
SB	Left Turn						
	Through	40	33	81.9%	77.8	58.4	E
	Right Turn	10	8	81.0%	43.8	49.7	D
	Subtotal	50	41	81.7%	72.1	54.3	E
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	433	90.7%	37.9	8.1	D
	Through	1,396	1,335	95.7%	28.2	8.1	C
	Right Turn	30	32	105.5%	30.3	10.2	C
	Subtotal	1,903	1,800	94.6%	30.6	7.8	C
Total		2,049	1,940	94.7%	31.3	7.4	C

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P Conditions w/ WB LT pocket at 3rd/Brooks (Crossing at Lootens/3rd)**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	50	40	81.0%	18.8	5.3	C
	Through						
	Right Turn						
	Subtotal	50	40	81.0%	18.8	5.3	C
EB	Left Turn	25	21	83.9%	3.0	0.4	A
	Through	2,307	2,248	97.4%	2.4	0.2	A
	Right Turn						
	Subtotal	2,332	2,269	97.3%	2.4	0.2	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,382	2,310	97.0%	2.7	0.1	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	57	105.6%	15.6	3.8	B
	Right Turn	281	278	98.9%	20.4	6.5	C
	Subtotal	335	335	100.0%	19.6	5.9	B
SB	Left Turn	72	64	88.9%	39.8	4.0	D
	Through	442	399	90.3%	38.5	2.8	D
	Right Turn						
	Subtotal	514	463	90.1%	38.7	2.8	D
EB	Left Turn	42	43	103.4%	13.5	3.7	B
	Through	2,289	2,204	96.3%	13.4	1.8	B
	Right Turn	61	58	95.3%	12.5	3.7	B
	Subtotal	2,392	2,306	96.4%	13.4	1.9	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,241	3,104	95.8%	17.9	1.7	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P w/ WBLT pocket at 3rd/Brooks (With Lootens Ped Crossing)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	41	96.9%	20.8	7.8	C
	Through	5	7	138.2%	29.5	19.6	D
	Right Turn						
	Subtotal	47	48	101.3%	22.8	7.7	C
SB	Left Turn						
	Through	15	15	99.8%	20.8	10.6	C
	Right Turn	10	10	96.0%	14.2	8.2	B
	Subtotal	25	25	98.3%	18.2	7.3	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	88	78	88.1%	3.6	0.2	A
	Through	1,829	1,764	96.5%	3.9	0.4	A
	Right Turn	10	9	92.2%	3.1	1.9	A
	Subtotal	1,927	1,851	96.1%	3.8	0.4	A
Total		1,999	1,923	96.2%	4.5	0.4	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	132	126	95.7%	23.1	2.9	C
	Through	20	19	96.0%	25.3	13.3	C
	Right Turn						
	Subtotal	152	146	95.7%	23.3	2.8	C
SB	Left Turn						
	Through	50	45	90.6%	25.9	4.4	C
	Right Turn	10	12	119.0%	22.8	7.9	C
	Subtotal	60	57	95.4%	25.4	3.9	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	237	97.9%	24.6	7.2	C
	Through	1,872	1,768	94.5%	22.4	6.2	C
	Right Turn	40	35	86.4%	18.7	5.8	B
	Subtotal	2,154	2,040	94.7%	22.6	6.2	C
Total		2,366	2,243	94.8%	22.7	5.7	C

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	115	101	87.5%	30.1	7.0	D
	Through						
	Right Turn						
	Subtotal	115	101	87.5%	30.1	7.0	D
EB	Left Turn	45	44	97.3%	3.4	0.6	A
	Through	2,392	2,347	98.1%	2.7	0.3	A
	Right Turn						
	Subtotal	2,437	2,390	98.1%	2.7	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,552	2,491	97.6%	3.8	0.4	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	86	94.9%	20.5	6.4	C
	Right Turn	433	398	92.0%	39.3	14.0	D
	Subtotal	524	485	92.5%	35.8	12.3	D
SB	Left Turn	117	111	94.5%	25.9	7.5	C
	Through	180	176	97.7%	17.9	3.6	B
	Right Turn						
	Subtotal	297	286	96.5%	20.8	4.4	C
EB	Left Turn	61	51	84.4%	17.4	2.8	B
	Through	2,372	2,316	97.6%	17.3	2.0	B
	Right Turn	44	40	90.8%	11.9	4.2	B
	Subtotal	2,477	2,407	97.2%	17.2	1.9	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,298	3,178	96.4%	20.3	2.8	C

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

BioMarin
CPP - Clustered Lootens/Lindaro w/ West ped crossing
Lunch Peak Hour

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	37	88.7%	7.5	2.7	A
	Through	5	6	114.0%	10.3	14.4	B
	Right Turn						
	Subtotal	47	43	91.4%	8.3	2.5	A
SB	Left Turn						
	Through	5	5	98.8%	23.8	24.1	C
	Right Turn	10	11	114.0%	14.6	14.7	B
	Subtotal	15	16	108.9%	15.7	8.9	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	81	70	86.8%	1.6	0.2	A
	Through	1,668	1,516	90.9%	0.6	0.1	A
	Right Turn	10	10	102.6%	0.1	0.1	A
	Subtotal	1,759	1,596	90.8%	0.6	0.1	A
Total		1,821	1,656	90.9%	0.9	0.2	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	120	126	105.3%	32.1	3.2	C
	Through	20	23	116.0%	29.4	11.4	C
	Right Turn						
	Subtotal	140	150	106.9%	31.7	3.9	C
SB	Left Turn						
	Through	40	40	101.0%	40.4	7.9	D
	Right Turn	35	38	108.6%	28.4	10.8	C
	Subtotal	75	78	104.5%	34.4	6.9	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	343	291	84.8%	41.5	8.5	D
	Through	1,636	1544	94.4%	38.7	8.2	D
	Right Turn	70	64	92.0%	36.8	12.1	D
	Subtotal	2,049	1,899	92.7%	39.0	8.3	D
Total		2,264	2,127	93.9%	38.3	7.4	D

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	88	78	88.5%	32.3	3.5	D
	Through						
	Right Turn						
	Subtotal	88	78	88.5%	32.3	3.5	D
EB	Left Turn	45	41	90.4%	3.5	1.0	A
	Through	2,034	2,010	98.8%	2.3	0.3	A
	Right Turn						
	Subtotal	2,079	2,051	98.6%	2.3	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,167	2,129	98.2%	3.4	0.5	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	87	89	101.8%	20.3	3.7	C
	Right Turn	293	282	96.4%	20.7	5.5	C
	Subtotal	380	371	97.6%	20.7	4.7	C
SB	Left Turn	110	87	78.8%	24.3	5.0	C
	Through	273	229	83.9%	17.3	2.9	B
	Right Turn						
	Subtotal	383	316	82.4%	19.3	3.1	B
EB	Left Turn	53	55	104.0%	16.4	4.9	B
	Through	2,030	1,986	97.8%	14.4	4.8	B
	Right Turn	59	54	92.1%	8.9	4.4	A
	Subtotal	2,142	2,095	97.8%	14.4	4.8	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,905	2,782	95.8%	15.8	3.9	B

Intersection 15 | **Brooks St/3rd St** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	21	19	91.1%	11.1	4.1	B
	Through	5	4	81.0%	13.9	12.0	B
	Right Turn						
	Subtotal	26	23	89.2%	12.7	5.6	B
SB	Left Turn						
	Through	5	3	66.2%	20.1	24.6	C
	Right Turn	10	11	110.4%	23.9	17.7	C
	Subtotal	15	14	95.7%	29.7	19.2	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	56	49	87.4%	3.2	0.4	A
	Through	1,435	1,400	97.6%	4.3	1.1	A
	Right Turn	10	7	66.2%	3.7	3.2	A
	Subtotal	1,501	1,456	97.0%	4.2	1.1	A
Total		1,542	1,493	96.8%	4.6	1.1	A

Intersection 16 | **Lindaro St/3rd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	96	98	102.4%	30.0	3.2	C
	Through						
	Right Turn						
	Subtotal	96	98	102.4%	30.0	3.2	C
SB	Left Turn						
	Through						
	Right Turn	49	48	98.4%	12.5	2.5	B
	Subtotal	49	48	98.4%	12.5	2.5	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	477	427	89.4%	29.9	6.0	C
	Through	1,426	1,379	96.7%	24.5	5.4	C
	Right Turn	55	46	84.3%	0.4	0.2	A
	Subtotal	1,958	1,852	94.6%	25.1	5.3	C
Total		2,103	1,998	95.0%	25.0	4.8	C

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	55	49	89.0%	21.5	4.4	C
	Through						
	Right Turn						
	Subtotal	55	49	89.0%	21.5	4.4	C
EB	Left Turn	25	24	94.2%	2.5	0.9	A
	Through	2,307	2,257	97.8%	2.6	0.3	A
	Right Turn						
	Subtotal	2,332	2,280	97.8%	2.6	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,387	2,329	97.6%	3.0	0.3	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	54	53	98.8%	16.6	3.9	B
	Right Turn	281	282	100.4%	25.4	8.6	C
	Subtotal	335	336	100.2%	24.3	7.6	C
SB	Left Turn	66	52	78.6%	37.2	9.8	D
	Through	408	365	89.6%	34.0	3.0	C
	Right Turn						
	Subtotal	474	417	88.0%	34.4	3.1	C
EB	Left Turn	42	45	107.8%	16.8	6.3	B
	Through	2,294	2,219	96.7%	14.6	2.8	B
	Right Turn	61	58	95.3%	11.7	4.5	B
	Subtotal	2,397	2,323	96.9%	14.6	2.8	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,206	3,076	95.9%	18.3	2.8	B

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **C+P Buildout (w/ WBLT at Brooks/3rd, Lootens Crossing, No Walgreens Access)**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 15 | **Brooks St/3rd St** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	42	46	108.8%	20.9	6.4	C
	Through	5	3	69.1%	28.3	27.2	D
	Right Turn						
	Subtotal	47	49	104.6%	21.9	7.3	C
SB	Left Turn						
	Through	15	18	120.3%	21.0	8.3	C
	Right Turn	10	11	111.4%	23.6	12.6	C
	Subtotal	25	29	116.7%	23.4	5.6	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	104	85	82.0%	4.1	0.6	A
	Through	1,859	1,820	97.9%	4.7	0.9	A
	Right Turn	10	10	99.8%	3.9	1.5	A
	Subtotal	1,973	1,915	97.1%	4.7	0.9	A
Total		2,045	1,993	97.5%	5.4	0.9	A

Intersection 16 | **Lindaro St/3rd St** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	152	147	96.5%	22.6	1.9	C
	Through						
	Right Turn						
	Subtotal	152	147	96.5%	22.6	1.9	C
SB	Left Turn						
	Through						
	Right Turn	81	80	99.1%	16.8	4.6	B
	Subtotal	81	80	99.1%	16.8	4.6	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	242	235	97.0%	28.7	5.4	C
	Through	1,912	1,821	95.2%	26.0	6.8	C
	Right Turn	170	163	96.0%	0.8	0.2	A
	Subtotal	2,324	2,218	95.5%	24.4	6.1	C
Total		2,557	2,445	95.6%	24.1	5.5	C

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	131	113	85.9%	31.0	5.3	D
	Through						
	Right Turn						
	Subtotal	131	113	85.9%	31.0	5.3	D
EB	Left Turn	45	45	99.0%	3.2	0.5	A
	Through	2,392	2,409	100.7%	2.9	0.3	A
	Right Turn						
	Subtotal	2,437	2,454	100.7%	2.9	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,568	2,566	99.9%	4.1	0.4	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	91	81	89.0%	19.2	4.6	B
	Right Turn	433	413	95.4%	43.4	16.9	D
	Subtotal	524	494	94.3%	39.4	14.7	D
SB	Left Turn	97	98	100.6%	20.2	20.7	C
	Through	150	141	94.2%	13.6	15.2	B
	Right Turn						
	Subtotal	247	239	96.7%	16.3	17.8	B
EB	Left Turn	61	61	100.1%	19.3	5.0	B
	Through	2,388	2,360	98.8%	19.5	3.0	B
	Right Turn	44	44	100.4%	15.9	5.5	B
	Subtotal	2,493	2,465	98.9%	19.5	3.1	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		3,264	3,198	98.0%	22.3	4.4	C

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **CPP - Clustered Lootens/Lindaro w/ West ped , No Walgreens Dwy**
Volume and Delay by Movement | **Lunch Peak Hour**

Intersection 15 **Brooks St/3rd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	42	48	114.9%	12.4	4.5	B
	Through	5	5	106.4%	18.3	20.8	C
	Right Turn						
	Subtotal	47	54	114.0%	13.8	6.7	B
SB	Left Turn						
	Through	5	3	53.2%	28.6	26.8	D
	Right Turn	10	8	83.6%	12.5	10.0	B
	Subtotal	15	11	73.5%	26.6	15.2	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	91	82	90.6%	1.6	0.2	A
	Through	1,698	1,575	92.7%	0.7	0.1	A
	Right Turn	10	11	110.2%	0.2	0.2	A
	Subtotal	1,799	1,668	92.7%	0.7	0.1	A
Total		1,861	1,733	93.1%	1.2	0.3	A

Intersection 16 **Lindaro St/3rd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	140	142	101.4%	33.4	4.2	C
	Through						
	Right Turn						
	Subtotal	140	142	101.4%	33.4	4.2	C
SB	Left Turn						
	Through						
	Right Turn	75	88	116.8%	13.9	2.5	B
	Subtotal	75	88	116.8%	13.9	2.5	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	343	305	88.9%	42.9	6.1	D
	Through	1,686	1633	96.9%	39.0	4.3	D
	Right Turn	90	90	100.0%	38.4	4.3	D
	Subtotal	2,119	2,028	95.7%	39.5	4.4	D
Total		2,334	2,258	96.7%	38.1	3.9	D

SimTraffic Post-Processor | **BioMarin**
Average Results from 10 Runs | **CPP - Clustered Lootens/Lindaro w/ West ped , No Walgreens Dwy**
Volume and Delay by Movement | **Lunch Peak Hour**

Intersection 25 **Brooks St/2nd St** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn	98	92	93.4%	34.1	8.1	D
	Through						
	Right Turn						
	Subtotal	98	92	93.4%	34.1	8.1	D
EB	Left Turn	45	49	109.8%	2.9	0.6	A
	Through	2,034	2,038	100.2%	2.2	0.3	A
	Right Turn						
	Subtotal	2,079	2,087	100.4%	2.2	0.3	A
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,177	2,179	100.1%	3.5	0.6	A

Intersection 26 **Lindaro St/2nd St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	87	84	96.1%	21.5	5.0	C
	Right Turn	293	291	99.2%	24.4	8.5	C
	Subtotal	380	374	98.5%	23.9	6.4	C
SB	Left Turn	100	84	84.0%	20.5	5.5	C
	Through	243	207	85.1%	9.7	3.8	A
	Right Turn						
	Subtotal	343	291	84.8%	12.9	2.6	B
EB	Left Turn	53	51	95.4%	15.5	7.8	B
	Through	2,040	2,026	99.3%	15.2	3.9	B
	Right Turn	59	62	104.3%	10.2	3.6	B
	Subtotal	2,152	2,138	99.3%	15.0	3.9	B
WB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
Total		2,875	2,803	97.5%	16.0	3.4	B

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	36.1	54.2	0.07	4.5	F
C	IV	25	18.9	8.9	27.8	0.07	9.2	D
B	IV	25	17.9	30.9	48.8	0.07	5.0	F
A	IV	25	18.5	9.7	28.2	0.07	8.9	E
Lindaro	IV	25	25.3	41.9	67.2	0.14	7.5	E
Lincoln	IV	25	21.4	46.9	68.3	0.10	5.1	F
Francisco W.	IV	25	12.2	71.5	83.7	0.05	2.0	F
101 SBOn 2nd	IV	25	14.2	11.7	25.9	0.05	7.4	E
Total	IV		146.5	257.6	404.1	0.61	5.5	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	102.6	121.6	0.07	2.1	F
Tamalpais	IV	25	14.4	101.5	115.9	0.05	1.7	F
Lincoln	IV	25	13.2	77.0	90.2	0.05	2.0	F
Lindaro	IV	25	21.4	1.1	22.5	0.10	15.6	C
A	IV	25	19.5	10.1	29.6	0.07	8.9	E
B	IV	25	17.9	9.3	27.2	0.07	8.9	E
C	IV	25	19.0	3.6	22.6	0.07	11.4	D
D	IV	25	18.7	1.7	20.4	0.07	12.4	D
Total	IV		143.1	306.9	450.0	0.56	4.5	F

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	29	24.0	21.5	45.5	0.16	12.6	D
5th	IV	25	16.3	12.9	29.2	0.06	7.6	E
4th	IV	25	14.6	7.5	22.1	0.05	8.9	E
3rd	IV	25	17.7	7.5	25.2	0.07	9.5	D
2nd	IV	25	15.6	261.4	277.0	0.06	0.8	F
Total	IV		88.2	310.8	399.0	0.40	3.6	F

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	30	25.2	44.7	69.9	0.17	8.7	E
3rd St	IV	25	14.8	31.5	46.3	0.06	4.3	F
4th	IV	25	18.3	30.6	48.9	0.07	5.1	F
5th	IV	25	14.6	8.5	23.1	0.06	8.6	E
Mission	IV	25	15.7	6.9	22.6	0.06	9.4	D
Total	IV		88.6	122.2	210.8	0.41	7.0	F

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	15.7	44.2	0.16	12.9	D
Tamalpais	IV	25	16.0	52.8	68.8	0.06	3.2	F
Tamalpais	IV	25	3.1	2.9	6.0	0.01	7.0	E
Hetherton	IV	25	8.7	21.6	30.3	0.03	3.9	F
Irwin	IV	25	18.9	12.1	31.0	0.07	8.3	E
Total	IV		75.2	105.1	180.3	0.33	6.7	F

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	26.8	48.4	0.10	7.3	E
Hetherton	IV	25	18.9	36.1	55.0	0.07	4.7	F
Tamalpais	IV	25	8.7	82.6	91.3	0.03	1.3	F
Tamalpais	IV	25	3.1	3.7	6.8	0.01	6.2	F
Lincoln	IV	25	16.0	88.7	104.7	0.06	2.1	F
Total	IV		68.3	237.9	306.2	0.27	3.2	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	24.8	42.9	0.07	5.7	F
C	IV	25	18.9	8.5	27.4	0.07	9.4	D
B	IV	25	17.9	19.0	36.9	0.07	6.6	F
A	IV	25	18.5	9.7	28.2	0.07	8.9	E
Lindaro	IV	25	25.3	43.6	68.9	0.14	7.3	E
Lincoln	IV	25	21.4	26.7	48.1	0.10	7.3	E
Francisco W.	IV	25	12.2	89.5	101.7	0.05	1.6	F
101 SBOn Hetherton	IV	25	14.2	82.3	96.5	0.05	2.0	F
Total	IV		146.5	304.1	450.6	0.61	4.9	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	96.2	115.2	0.07	2.2	F
Tamalpais	IV	25	14.4	100.0	114.4	0.05	1.7	F
Lincoln	IV	25	13.2	18.9	32.1	0.05	5.6	F
Lindaro	IV	25	21.4	4.1	25.5	0.10	13.7	C
A	IV	25	19.5	11.1	30.6	0.07	8.6	E
B	IV	25	17.9	10.2	28.1	0.07	8.6	E
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		143.1	248.8	391.9	0.56	5.1	F

Arterial Level of Service: SB Hetherton

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Mission	IV	35	22.2	19.0	41.2	0.16	13.9	C
5th	IV	25	16.3	16.2	32.5	0.06	6.8	F
4th	IV	25	14.6	5.6	20.2	0.05	9.8	D
3rd	IV	25	17.7	21.9	39.6	0.07	6.1	F
2nd	IV	25	15.6	55.6	71.2	0.06	3.0	F
Total	IV		86.4	118.3	204.7	0.40	7.1	E

Arterial Level of Service: NB Irwin

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
2nd St	IV	38	19.3	99.1	118.4	0.17	5.1	F
3rd St	IV	25	14.8	14.0	28.8	0.06	7.0	F
4th	IV	25	18.9	12.0	30.9	0.07	8.3	E
5th	IV	25	14.0	14.3	28.3	0.05	6.7	F
Mission	IV	25	15.7	3.4	19.1	0.06	11.2	D
Total	IV		82.7	142.8	225.5	0.41	6.5	F

Arterial Level of Service: EB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Lincoln	IV	25	28.5	12.8	41.3	0.16	13.8	C
Tamalpais	IV	25	16.1	24.0	40.1	0.06	5.5	F
Tamalpais	IV	25	4.3	2.3	6.6	0.02	8.9	E
Hetherton	IV	25	7.5	16.6	24.1	0.03	4.2	F
Irwin	IV	25	18.9	14.5	33.4	0.07	7.7	E
Total	IV		75.3	70.2	145.5	0.33	8.3	E

Arterial Level of Service: WB Mission

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Irwin	IV	25	21.6	28.4	50.0	0.10	7.1	E
Hetherton	IV	25	18.9	15.9	34.8	0.07	7.4	E
Tamalpais	IV	25	7.5	47.1	54.6	0.03	1.9	F
Tamalpais	IV	25	4.3	2.7	7.0	0.02	8.4	E
Lincoln	IV	25	16.1	88.2	104.3	0.06	2.1	F
Total	IV		68.4	182.3	250.7	0.27	3.9	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	36.1	54.2	0.07	4.5	F
C	IV	25	18.9	8.9	27.8	0.07	9.2	D
B	IV	25	17.9	30.9	48.8	0.07	5.0	F
A	IV	25	18.5	9.7	28.2	0.07	8.9	E
Brooks	IV	25	12.3	3.9	16.2	0.05	10.4	D
Lindaro	IV	25	20.6	44.5	65.1	0.09	5.2	F
Lincoln	IV	25	21.4	46.9	68.3	0.10	5.1	F
Francisco W.	IV	25	12.2	71.5	83.7	0.05	2.0	F
101 SBOn 2nd	IV	25	14.2	11.7	25.9	0.05	7.4	E
Total	IV		154.1	264.1	418.2	0.61	5.3	F

Arterial Level of Service: EB 2nd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
D	IV	25	18.1	24.8	42.9	0.07	5.7	F
C	IV	25	18.9	8.5	27.4	0.07	9.4	D
B	IV	25	17.9	19.0	36.9	0.07	6.6	F
A	IV	25	18.5	9.7	28.2	0.07	8.9	E
Brooks	IV	25	12.3	4.8	17.1	0.05	9.8	D
Lindaro	IV	25	20.6	44.6	65.2	0.09	5.2	F
Lincoln	IV	25	21.4	26.7	48.1	0.10	7.3	E
Francisco W.	IV	25	12.2	89.5	101.7	0.05	1.6	F
101 SBOn Hetherton	IV	25	14.2	82.3	96.5	0.05	2.0	F
Total	IV		154.1	309.9	464.0	0.61	4.8	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	102.2	121.2	0.07	2.1	F
Tamalpais	IV	25	14.4	101.5	115.9	0.05	1.7	F
Lincoln	IV	25	13.2	74.4	87.6	0.05	2.1	F
Lindaro	IV	25	21.4	1.1	22.5	0.10	15.6	C
A	IV	25	19.5	5.2	24.7	0.07	10.7	D
B	IV	25	17.9	5.4	23.3	0.07	10.4	D
C	IV	25	19.0	1.8	20.8	0.07	12.4	D
D	IV	25	18.7	2.3	21.0	0.07	12.1	D
Total	IV		143.1	293.9	437.0	0.56	4.6	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	96.2	115.2	0.07	2.2	F
Tamalpais	IV	25	14.4	100.0	114.4	0.05	1.7	F
Lincoln	IV	25	13.2	18.9	32.1	0.05	5.6	F
Lindaro	IV	25	21.4	4.1	25.5	0.10	13.7	C
A	IV	25	19.5	14.5	34.0	0.07	7.8	E
B	IV	25	17.9	8.8	26.7	0.07	9.1	D
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		143.1	250.8	393.9	0.56	5.1	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	102.2	121.2	0.07	2.1	F
Tamalpais	IV	25	14.4	101.5	115.9	0.05	1.7	F
Lincoln	IV	25	13.2	77.0	90.2	0.05	2.0	F
Lindaro	IV	25	21.4	1.1	22.5	0.10	15.6	C
Pedestrian Hybrid Be	IV	25	4.3	0.2	4.5	0.02	12.9	D
A	IV	25	15.2	6.2	21.4	0.06	9.7	D
B	IV	25	17.9	5.5	23.4	0.07	10.4	D
C	IV	25	19.0	1.8	20.8	0.07	12.4	D
D	IV	25	18.7	2.3	21.0	0.07	12.1	D
Total	IV		143.1	297.8	440.9	0.56	4.5	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	96.2	115.2	0.07	2.2	F
Tamalpais	IV	25	14.4	100.0	114.4	0.05	1.7	F
Lincoln	IV	25	13.2	18.9	32.1	0.05	5.6	F
Lindaro	IV	25	21.4	4.1	25.5	0.10	13.7	C
Pedestrian Hybrid Be	IV	25	4.3	2.1	6.4	0.02	9.1	D
A	IV	25	15.2	20.8	36.0	0.06	5.7	F
B	IV	25	17.9	10.3	28.2	0.07	8.6	E
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		143.1	260.7	403.8	0.56	5.0	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	102.2	121.2	0.07	2.1	F
Tamalpais	IV	25	14.4	101.5	115.9	0.05	1.7	F
Lincoln	IV	25	13.2	77.0	90.2	0.05	2.0	F
Lindaro	IV	25	21.4	1.1	22.5	0.10	15.6	C
Brooks	IV	25	6.7	1.3	8.0	0.03	11.4	D
A	IV	25	12.7	4.1	16.8	0.05	10.3	D
B	IV	25	17.9	5.5	23.4	0.07	10.4	D
C	IV	25	19.0	1.8	20.8	0.07	12.4	D
D	IV	25	18.7	2.3	21.0	0.07	12.1	D
Total	IV		143.0	296.8	439.8	0.56	4.6	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	96.2	115.2	0.07	2.2	F
Tamalpais	IV	25	14.4	100.0	114.4	0.05	1.7	F
Lincoln	IV	25	13.2	18.9	32.1	0.05	5.6	F
Lindaro	IV	25	21.4	4.1	25.5	0.10	13.7	C
Brooks	IV	25	6.7	1.0	7.7	0.03	11.9	D
A	IV	25	12.7	11.7	24.4	0.05	7.1	E
B	IV	25	17.9	10.2	28.1	0.07	8.6	E
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		143.0	250.4	393.4	0.56	5.1	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	102.2	121.2	0.07	2.1	F
Tamalpais	IV	25	14.4	101.5	115.9	0.05	1.7	F
Lincoln	IV	25	13.2	77.0	90.2	0.05	2.0	F
Lindaro	IV	25	21.4	1.0	22.4	0.10	15.6	C
A	IV	25	19.5	4.9	24.4	0.07	10.8	D
B	IV	25	17.9	5.5	23.4	0.07	10.4	D
C	IV	25	19.0	1.9	20.9	0.07	12.3	D
D	IV	25	18.7	2.4	21.1	0.07	12.0	D
Total	IV		143.1	296.4	439.5	0.56	4.6	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	96.2	115.2	0.07	2.2	F
Tamalpais	IV	25	14.4	100.0	114.4	0.05	1.7	F
Lincoln	IV	25	13.2	18.9	32.1	0.05	5.6	F
Lindaro	IV	25	21.4	3.8	25.2	0.10	13.9	C
A	IV	25	19.5	11.1	30.6	0.07	8.6	E
B	IV	25	17.9	10.2	28.1	0.07	8.6	E
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		143.1	248.5	391.6	0.56	5.1	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	102.2	121.2	0.07	2.1	F
Tamalpais	IV	25	14.4	101.5	115.9	0.05	1.7	F
Lincoln	IV	25	13.2	74.4	87.6	0.05	2.1	F
Lindaro	IV	25	21.4	6.8	28.2	0.10	12.4	D
Lootens	IV	25	5.1	1.0	6.1	0.02	11.4	D
A	IV	25	19.5	5.5	25.0	0.07	10.6	D
B	IV	25	17.9	6.2	24.1	0.07	10.1	D
C	IV	25	19.0	1.9	20.9	0.07	12.3	D
D	IV	25	18.7	2.4	21.1	0.07	12.0	D
Total	IV		148.2	301.9	450.1	0.58	4.6	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	96.2	115.2	0.07	2.2	F
Tamalpais	IV	25	14.4	100.0	114.4	0.05	1.7	F
Lincoln	IV	25	13.2	18.9	32.1	0.05	5.6	F
Lindaro	IV	25	21.4	24.9	46.3	0.10	7.6	E
Lootens	IV	25	5.1	1.8	6.9	0.02	10.1	D
A	IV	25	19.5	11.0	30.5	0.07	8.7	E
B	IV	25	17.9	10.4	28.3	0.07	8.6	E
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		148.2	271.5	419.7	0.58	4.9	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	102.2	121.2	0.07	2.1	F
Tamalpais	IV	25	14.4	101.5	115.9	0.05	1.7	F
Lincoln	IV	25	13.2	85.2	98.4	0.05	1.8	F
Lindaro	IV	25	21.4	1.0	22.4	0.10	15.6	C
A	IV	25	19.5	5.4	24.9	0.07	10.6	D
B	IV	25	17.9	5.4	23.3	0.07	10.4	D
C	IV	25	19.0	1.8	20.8	0.07	12.4	D
D	IV	25	18.7	2.3	21.0	0.07	12.1	D
Total	IV		143.1	304.8	447.9	0.56	4.5	F

Arterial Level of Service: WB 3rd

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hetherton	IV	25	19.0	96.2	115.2	0.07	2.2	F
Tamalpais	IV	25	14.4	100.0	114.4	0.05	1.7	F
Lincoln	IV	25	13.2	18.9	32.1	0.05	5.6	F
Lindaro	IV	25	21.4	25.3	46.7	0.10	7.5	E
Lootens	IV	25	5.1	1.4	6.5	0.02	10.7	D
A	IV	25	19.5	12.4	31.9	0.07	8.3	E
B	IV	25	17.9	10.1	28.0	0.07	8.7	E
C	IV	25	19.0	4.4	23.4	0.07	11.0	D
D	IV	25	18.7	3.9	22.6	0.07	11.2	D
Total	IV		148.2	272.6	420.8	0.58	4.9	F

Leisch Method for Weaving Analysis

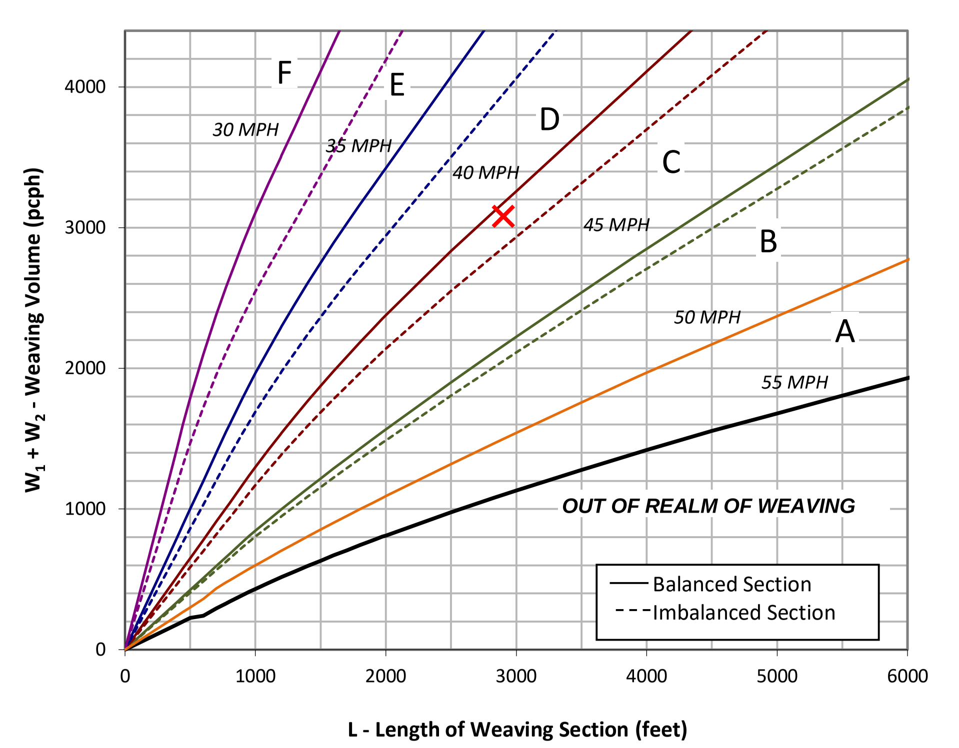
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

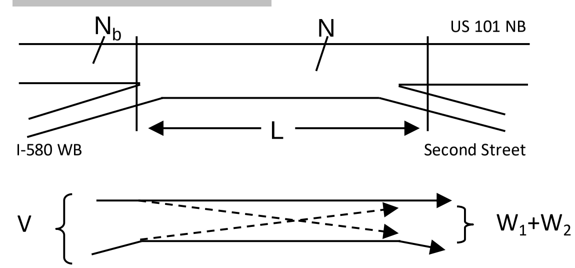
Project Information

Project	BioMarin
Scenario	Cumulative Plus Project AM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,045	Volume (vph)*	1,950	Volume (vph)*	1,004
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	4%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	6,311	Volume (pcph)	2,036	Volume (pcph)	1,045



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   40 MPH and **45 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 38.6
4. Weaving Intensity Factor (k) 2.61
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,599
6. Level of Service (LOS) D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4150	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1520
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	25.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	718	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	820
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	13.7
Speed 2 (S_3), mi/h	1.4	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6025	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.99	Flow Rate ($v_{p,GP}$), pc/h/ln	1712
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	28.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1039	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1246
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	58.3
Speed 2 (S_2), mi/h	1.7	Density (D_{ML}), pc/mi/ln	21.4
Speed 2 (S_3), mi/h	7.7	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	6281	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	2270
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.99
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	51.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	43.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	3/17/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	6281	2047
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	4.40	3.72
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.958
Flow Rate (v_i), pc/h	6809	2323
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.99	1.11

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	111124.6	Density in Ramp Influence Area (D_R), pc/mi/ln	-
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	-
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2319
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	-
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.483	Outer Lanes Freeway Speed (S_O), mi/h	60.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	4490	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1317	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1440
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	44.8
Speed 2 (S_2), mi/h	3.0	Density (D_{ML}), pc/mi/ln	32.1
Speed 2 (S_3), mi/h	12.2	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	AM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	4234	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1583
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	26.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	998	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.94	Flow Rate ($V_{p,ML}$), pc/h/ln	1104
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.0
Speed 2 (S_2), mi/h	1.0	Density (D_{ML}), pc/mi/ln	18.7
Speed 2 (S_3), mi/h	5.0	Level of Service (LOS)	C

Leisch Method for Weaving Analysis

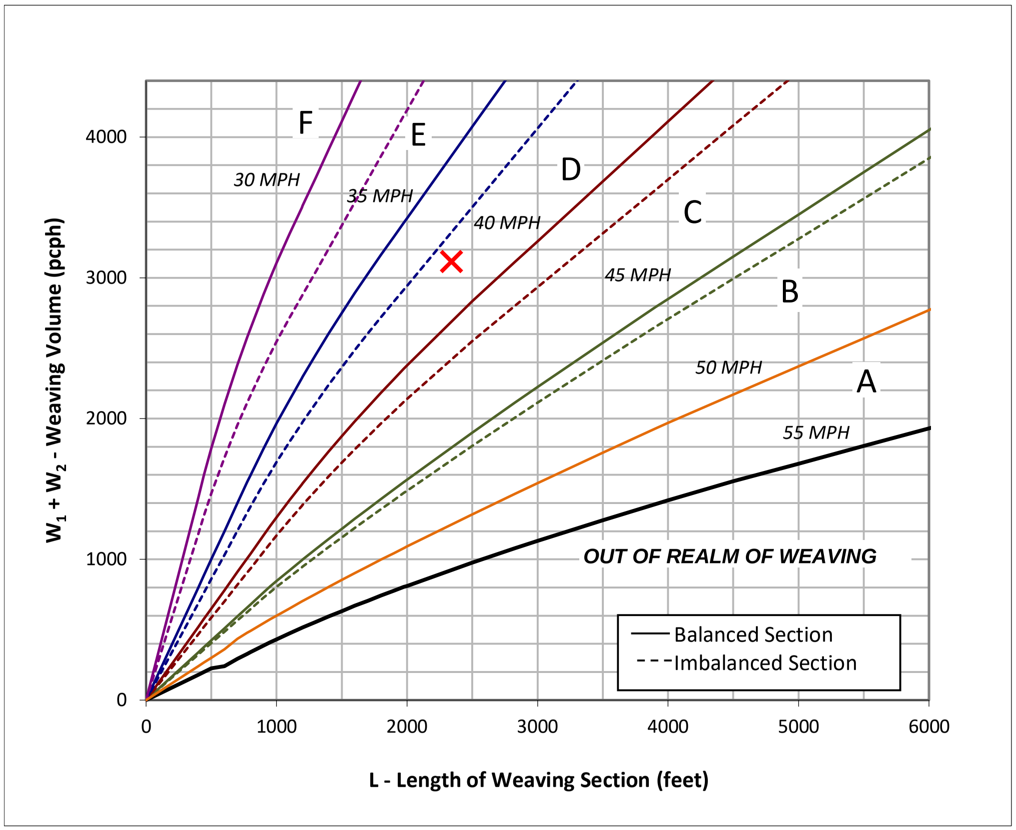
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

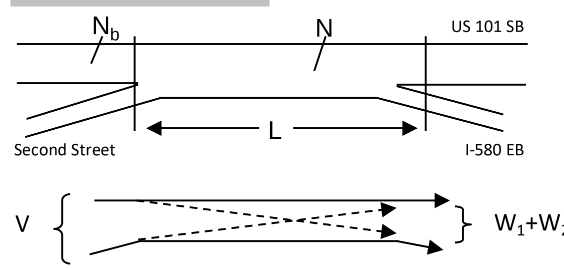
Project Information

Project	BioMarin
Scenario	Cumulative Plus Project AM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,727	Volume (vph)*	1,771	Volume (vph)*	1,226
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	2%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	7,023	Volume (pcph)	1,818	Volume (pcph)	1,299



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)?	Y
If optional exit lane, then "Y". Otherwise "N".	
2. In the chart to the left, which two speed curves is the red "x" between?	
35 MPH and 40 MPH	
If left of the 30 MPH curve, LOS is F. Select "-".	
If below the 55 MPH curve, out of the realm of weaving.	
3. Interpolated Weaving Speed (S_w, mph)	38.2
4. Weaving Intensity Factor (k)	2.63
5. Service Volume (SV, pcph)	
$SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$	2,286
6. Level of Service (LOS)	F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

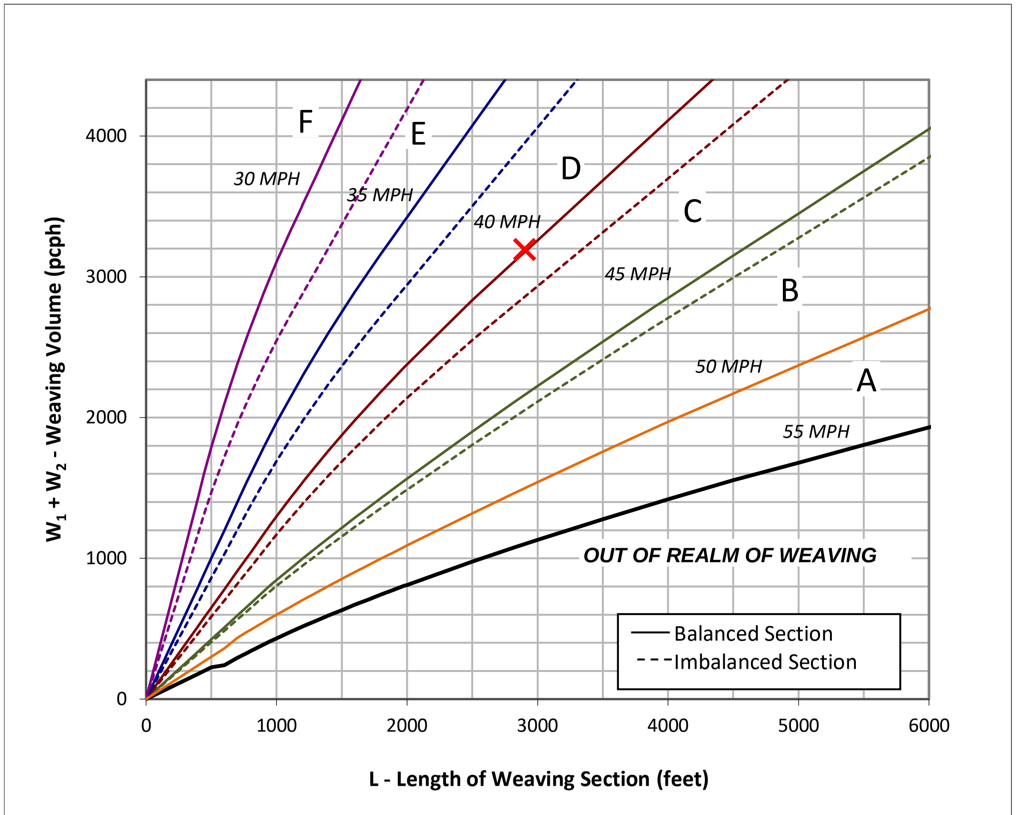
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,900

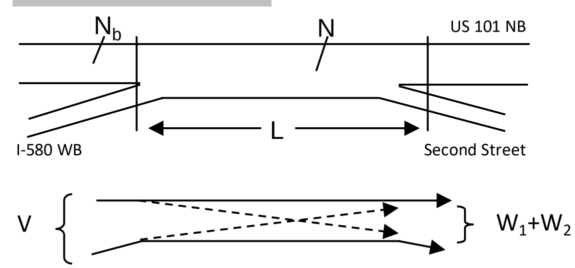
Project Information

Project	BioMarin
Scenario	Cumulative Plus Project PM Peak Hour
Freeway	US 101 NB
On-ramp	I-580 WB
Off-ramp	Second Street

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	7,267	Volume (vph)*	1,662	Volume (vph)*	1,423
Truck Percentage	4%	Truck Percentage	4%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	7,587	Volume (pcph)	1,735	Volume (pcph)	1,460



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 38.5
4. Weaving Intensity Factor (k) 2.62
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 1,989
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Fehr & Peers *9/21/2018*

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative + Project Conditions
Project Description	BioMarin - US 101 NB Second Street to Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5170	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	1913
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	58.2
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	32.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	848	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	890
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.7
Speed 2 (S_2), mi/h	0.3	Density (D_{ML}), pc/mi/ln	14.9
Speed 2 (S_3), mi/h	2.1	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	Cumulative + Project Conditions, PM Peak Hour
Project Description	BioMarin - US 101 NB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	4	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.86
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	1.02
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	7518	Heavy Vehicle Adjustment Factor (f_{HV})	0.889
Peak Hour Factor (PHF)	0.98	Flow Rate ($v_{p,GP}$), pc/h/ln	2157
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	3.840		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	54.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	39.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	2.86

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1217	Heavy Vehicle Adjustment Factor (f_{HV})	0.916
Peak Hour Factor	0.99	Flow Rate ($V_{p,ML}$), pc/h/ln	1342
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	5.597		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	47.9
Speed 2 (S_2), mi/h	2.3	Density (D_{ML}), pc/mi/ln	28.0
Speed 2 (S_3), mi/h	9.8	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 SB north of Mission Avenue		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	-2.44
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	0.77
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	5449	Heavy Vehicle Adjustment Factor (f_{HV})	0.951
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1969
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	66	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.86
Passenger Car Equivalent (E_T)	2.180		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	34.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	1377	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1555
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	56.0
Speed 2 (S_2), mi/h	4.0	Density (D_{ML}), pc/mi/ln	27.8
Speed 2 (S_3), mi/h	15.4	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/24/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 Mission Ave Slip Off-Ramp		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	60.0	50.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	170
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-2.44	-1.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Volume (V_i), veh/h	5449	2080
Peak Hour Factor (PHF)	0.97	0.96
Total Trucks, %	4.40	2.00
Single-Unit Trucks (SUT), %	66	66
Tractor-Trailers (TT), %	34	34
Heavy Vehicle Adjustment Factor (f_{HV})	0.951	0.973
Flow Rate (v_i), pc/h	5907	2227
Capacity (c), pc/h	6900	2100
Volume-to-Capacity Ratio (v/c)	0.86	1.06

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	150865.8	Density in Ramp Influence Area (D_R), pc/mi/ln	-
Distance to Upstream Ramp (L_{UP}), ft	10000	Speed Index (D_S)	-
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1803
Distance to Downstream Ramp (L_{DOWN}), ft	10000	Off-Ramp Influence Area Speed (S_R), mi/h	-
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.510	Outer Lanes Freeway Speed (S_O), mi/h	62.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	4104	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Specific Grade
Managed Lane Length, ft	5280	Percent Grade, %	-2.44
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Volume (V_{ML}), veh/h	1380	Heavy Vehicle Adjustment Factor (f_{HV})	0.973
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1559
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	66	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	34	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (E_T)	2.390		
Managed Lane Speed and Density			
Breakpoint (BP_{ML})	501	Indicator Variable	1
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	40.4
Speed 2 (S_2), mi/h	4.1	Density (D_{ML}), pc/mi/ln	38.6
Speed 2 (S_3), mi/h	15.5	Level of Service (LOS)	E

HCS7 Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	3/16/2018
Agency		Analysis Year	2018
Jurisdiction	San Rafael, Caltrans District 4	Time Period Analyzed	PM Peak Hour, Cumulative Plus Project Conditions
Project Description	BioMarin - US 101 SB Mission Avenue to Second Street		

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Volume (V), veh/h	3369	Heavy Vehicle Adjustment Factor (f_{HV})	0.919
Peak Hour Factor (PHF)	0.97	Flow Rate ($v_{p,GP}$), pc/h/ln	1260
Total Trucks, %	4.40	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2300
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	3.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	21.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

Managed Lane Geometric Data

Managed Lane Type	Continuous Access	Free-Flow Speed (FFS), mi/h	60.0
Number of Managed Lanes, ln	1	Terrain Type	Rolling
Managed Lane Length, ft	5280	Percent Grade, %	-

Managed Lane Adjustment Factors

Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000

Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Volume (V_{ML}), veh/h	918	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate ($V_{p,ML}$), pc/h/ln	1049
Total Trucks, %	2.00	Capacity (c), pc/h/ln	1650
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1650
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	3.000		

Managed Lane Speed and Density

Breakpoint (BP_{ML})	501	Indicator Variable	0
Speed 1 (S_1), mi/h	60.0	Average Speed (S_{ML}), mi/h	59.2
Speed 2 (S_2), mi/h	0.8	Density (D_{ML}), pc/mi/ln	17.7
Speed 2 (S_3), mi/h	4.2	Level of Service (LOS)	B

Leisch Method for Weaving Analysis

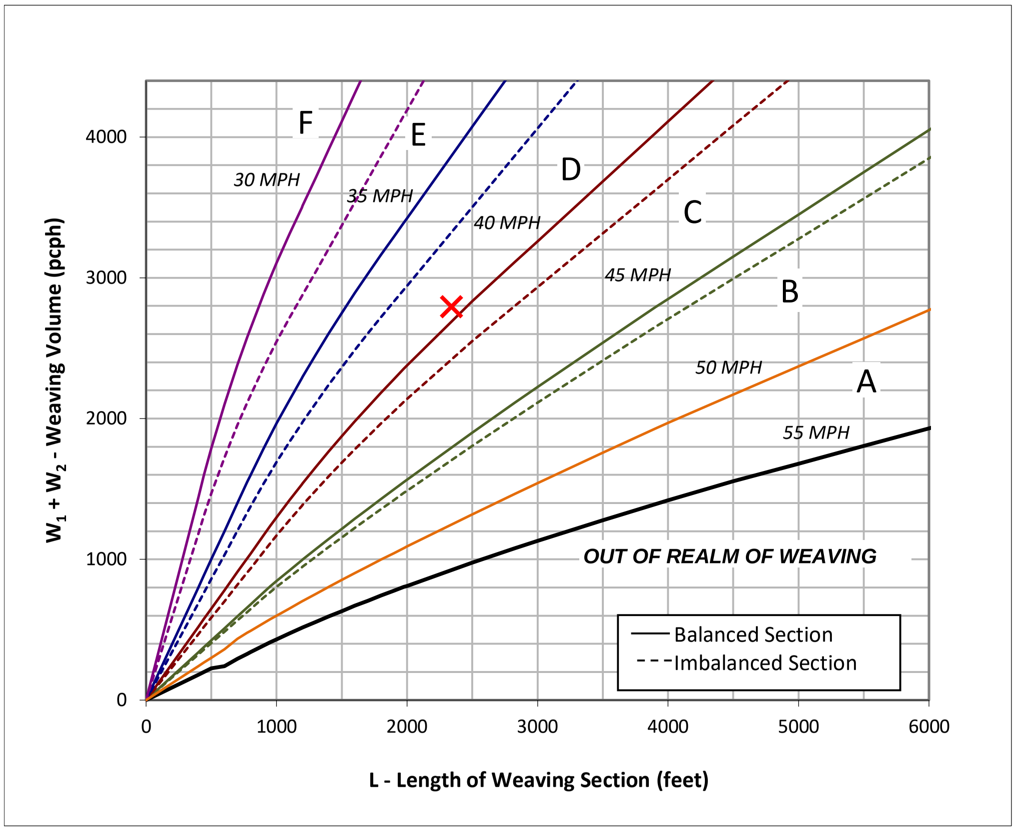
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	2,340

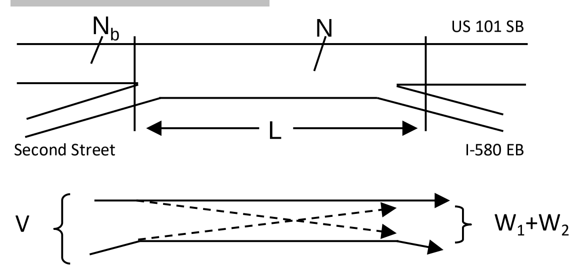
Project Information

Project	BioMarin
Scenario	Cumulative Plus Project PM Peak Hour
Freeway	US 101 SB
On-ramp	Second Street
Off-ramp	I-580 EB

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,441	Volume (vph)*	1,185	Volume (vph)*	1,442
Truck Percentage	4%	Truck Percentage	3%	Truck Percentage	3%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	4.1
Volume (pcph)	5,680	Volume (pcph)	1,215	Volume (pcph)	1,582



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 39.6
4. Weaving Intensity Factor (k): 2.55
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$: 1,890

6. Level of Service (LOS): E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014