URBAN CROSSROADS

Mango & South Highland Residential

TRAFFIC STUDY

CITY OF FONTANA

PREPARED BY:

Aric Evatt, PTP
aevatt@urbanxroads.com

Charlene So, PE
cso@urbanxroads.com

REGISTERED PROFESSIONAL ENGINEER
CHARLENE HWANG SO
Charlene So
No. TR 2414
TRAFFIC
STATE OF CALIFORNIA

JULY 12, 2021

TABLE OF CONTENTS

APPENDICES

This Page Intentionally Left Blank

LIST OF EXHIBITS

LIST OF TABLES

This Page Intentionally Left Blank

LIST OF ABBREVIATED TERMS

(1)	Reference
ADT	Average Daily Traffic
CA MUTCD	California Manual on Uniform Traffic Control Devices
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CMP	Congestion Management Program
DIF	Development Impact Fee
HCM	Highway Capacity Manual
ITE	Institute of Transportation Engineers
LOS	Level of Service
NCHRP	National Cooperative Highway Research Program
OD	Origination-Destination
OPR	Office of Planning and Research
PHF	Peak Hour Factor
Project	Mango & South Highland Residential
RCTC	Riverside County Transportation Commission
RTA	Riverside Transit Agency
SB 743	Senate Bill 743
SBTAM	San Bernardino Transportation Analysis Model
SHS	State Highway System
TA	Traffic Analysis
TAZ	Traffic Analysis Zone
TPA	Transit Priority Area
V/C	Volume to Capacity
VMT	Vehicle Miles Traveled

This Page Intentionally Left Blank

1 INTRODUCTION

This report presents the results of the Traffic Analysis (TA) for the proposed Mango & South Highland Residential development ("Project"), which is located on the southwest corner of Mango Avenue and S. Highland Avenue in the City of Fontana, as shown on Exhibit 1-1.

The purpose of this TA is to evaluate the potential deficiencies related to traffic, identify circulation system deficiencies that may result from the development of the proposed Project, and to recommend improvements to resolve identified deficiencies in order to achieve acceptable operational conditions at study area intersections and ensure consistency with the City's General Plan. This TA has been prepared in accordance with the City of Fontana's Traffic Impact Analysis (TIA) Guidelines for Vehicle Miles Traveled (VMT) and Level of Service Assessment (October 21, 2020) and through consultation with City of Fontana staff during the scoping process. (1) The Project traffic study scoping agreement is provided in Appendix 1.1 of this TA, which has been approved by the City of Fontana.

1.1 SUMMARY OF FINDINGS

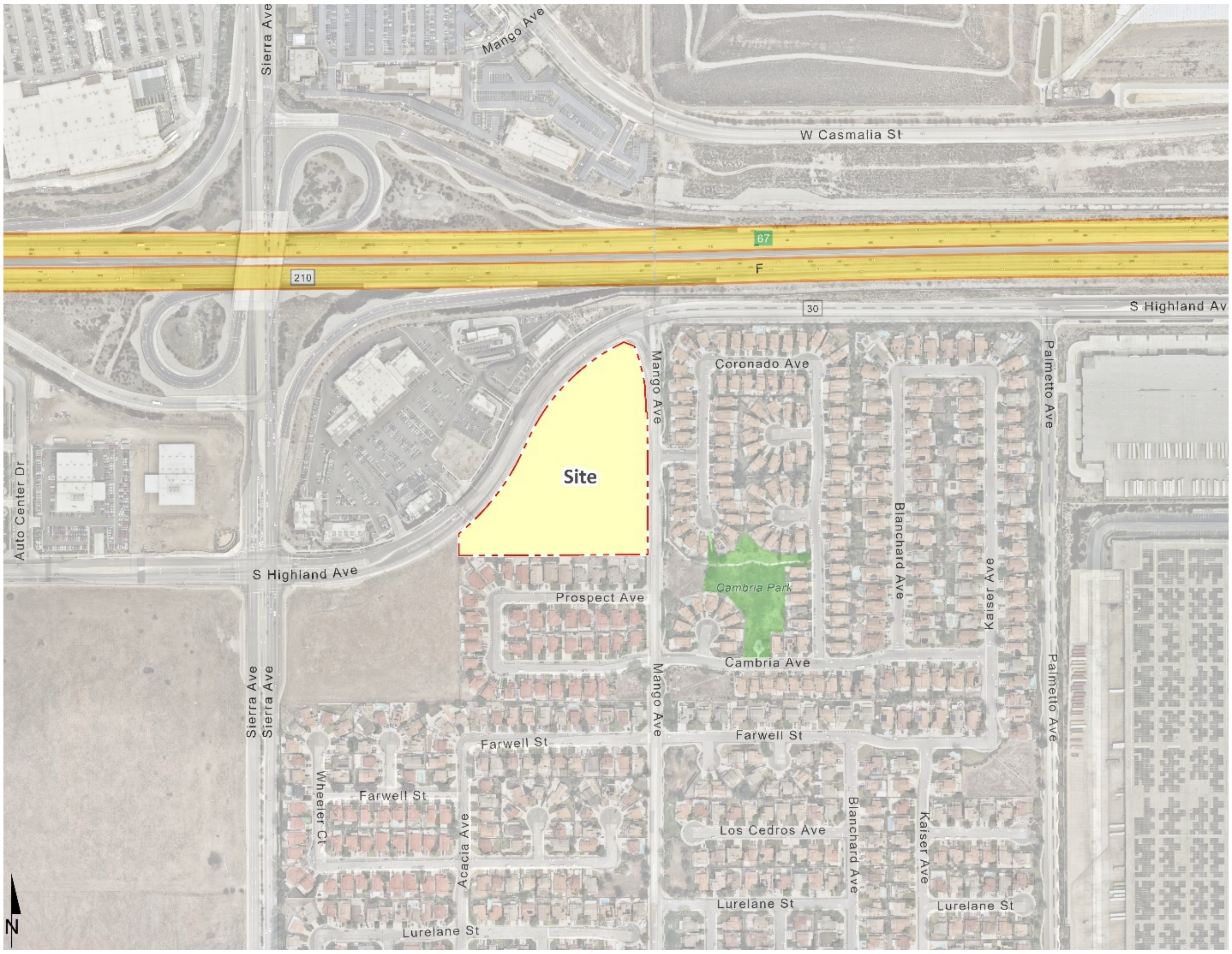
The Project is to construct the following improvements as design features in conjunction with development of the site:

- Project to construct S. Highland Avenue at its ultimate half-width as a Primary Highway (104-foot right-of-way) from the Project's western boundary to Mango Avenue consistent with the City's standards.
- Project to construct Mango Avenue at its ultimate half-width as a Collector Street (68-foot right-of-way) between S. Highland Avenue and the Project's southern boundary consistent with the City's standards.

Additional details and intersection lane geometrics are provided in Section 1.6 *Recommendations* of this report. The proposed Project is not anticipated to require the construction of any off-site improvements, however, there are improvement needs identified at off-site intersections for future cumulative traffic study scenarios. As such, the Project Applicant's responsibility for the Project's contributions towards deficient off-site intersections is fulfilled through payment of fair share and/or payment into pre-existing fee programs (if applicable) that would be assigned to the future construction of the identified recommended improvements. The Project Applicant would be required to pay requisite fees and/or fair share contributions consistent with the City's requirements (see Section 7 *Local and Regional Funding Mechanisms*).

As required by City Guidelines, a project-level vehicle miles traveled (VMT) analysis was conducted consistent with the requirements identified for residential projects. The Project was found to meet the low VMT screening criteria. In addition, the Project is consistent with the adopted General Plan and is consistent with the growth projections assumed in the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). Therefore, the Project would result in a less than significant impact for VMT; no further VMT analysis required. Detail traffic analysis can be found in Section 8 *Vehicle Miles Traveled Analysis* of this TS.

EXHIBIT 1-1: LOCATION MAP



1.2 PROJECT OVERVIEW

The proposed Project includes the development of 107 multifamily housing (low-rise) dwelling units. The Project is anticipated to have an Opening Year of 2023. A preliminary site plan of the proposed Project is shown on Exhibit 1-2. As indicated on Exhibit 1-2, access to the Project site will be provided to S. Highland Avenue and Mango Avenue. Regional access to the Project site is available from the I-210 Freeway via Sierra Avenue. Exhibit 1-1 depicts the location of the proposed Project in relation to the existing roadway network and the study area intersections.

In order to develop the traffic characteristics of the proposed project, trip-generation statistics published in the Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition, 2017) for the Multifamily Housing (Low-Rise) (ITE Land Use Code 220). (2) The Project is anticipated to generate a net total of 784 two-way trips per day with 49 AM peak hour trips and 60 PM peak hour trips. The assumptions and methods used to estimate the Project's trip generation characteristics are discussed in greater detail in Section 4.1 *Project Trip Generation* of this report.

1.3 ANALYSIS SCENARIOS

For the purposes of this traffic study, potential deficiencies to traffic and circulation have been assessed for each of the following conditions:

- Existing (2021)
- Opening Year Cumulative (2023) Without Project
- Opening Year Cumulative (2023) With Project
- Horizon Year (2040) Without Project
- Horizon Year (2040) With Project

1.3.1 EXISTING (2021) CONDITIONS

Information for Existing (2021) conditions is disclosed to represent the baseline traffic conditions as they existed at the time this report was prepared. Existing traffic counts were adjusted accordingly to reflect a non-COVID baseline for the purposes of this analysis. Additional details are provided in Section 3.5 *Existing Traffic Counts*.

1.3.3 OPENING YEAR CUMULATIVE (2023) CONDITIONS

The Opening Year Cumulative (2023) conditions analysis determines the potential near-term cumulative circulation system deficiencies. To account for background traffic growth, traffic associated with other known cumulative development projects in conjunction with an ambient growth from Existing (2021) conditions of 2.33% is included for Opening Year Cumulative (2023) traffic conditions. This list of cumulative projects was compiled from information provided by the City of Fontana and is consistent with other recent studies in the study area.

EXHIBIT 1-2: SITE MAP

1.3.3 HORIZON YEAR (2040) CONDITIONS

Traffic projections for Horizon Year (2040) with Project conditions were derived from the San Bernardino Transportation Analysis Model (SBTAM) modified to represent buildout of the City of Fontana. The Horizon Year (2040) conditions analysis will be utilized to determine if improvements funded through regional transportation fee programs, such as the County's Development Impact Fee (DIF) program, or other approved funding mechanisms can accommodate the long-range cumulative traffic at the target level of service (LOS) identified by the City of Fontana (lead agency). Other improvements needed beyond the "funded" improvements (such as localized improvements to non-DIF facilities) are identified as such.

1.4 STUDY AREA

To ensure that this TA satisfies the City of Fontana's traffic study requirements, Urban Crossroads, Inc. prepared a Project traffic study scoping package for review by City of Fontana staff prior to the preparation of this report. This agreement provides an outline of the Project study area, trip generation, trip distribution, and analysis methodology. The agreement approved by the City of Fontana is included in Appendix 1.1 of this TA.

The 3 study area intersections shown on Exhibit 1-3 and listed in Table 1-1 were selected for evaluation in this TA based on consultation with City of Fontana staff. The study area includes intersections where the Project is anticipated to contribute 50 or more peak hour trips per the City of Fontana's traffic study guidelines. (1) The "50 peak hour trip" criterion represents a minimum number of trips at which a typical intersection would have the potential to be substantively affected by a given development proposal. The 50 peak hour trip criterion is a traffic engineering rule of thumb that is accepted and widely used within San Bernardino County for estimating a potential area of influence (i.e., study area).

The intent of a Congestion Management Program (CMP) is to more directly link land use, transportation, and air quality, thereby prompting reasonable growth management programs that will effectively utilize new transportation funds, alleviate traffic congestion and related deficiencies, and improve air quality. Counties within California have developed CMPs with varying methods and strategies to meet the intent of the CMP legislation.

TABLE 1-1: INTERSECTION ANALYSIS LOCATIONS

ID	Intersection Location	Jurisdiction	CMP?
1	Highland Village Ctr./ Driveway 1 & Highland Av.	City of Fontana	No
2	Mango Av. & Highland Av.	City of Fontana	No
3	Mango Av. & Driveway 2/Walnut Grove Ct.	City of Fontana	No

EXHIBIT 1-3: STUDY AREA

1.5 DEFICIENCIES

This section provides a summary of deficiencies by analysis scenario. Section 2 *Methodologies* provides information on the methodologies used in the analysis and Section 5 *Opening Year Cumulative (2023) Traffic Conditions*, and Section 6 *Horizon Year (2040)* includes the detailed analysis. A summary of LOS results for all analysis scenarios is presented on Table 1-2.

TABLE 1-2: SUMMARY OF LOS

#	Intersection	Existing		2023 Without Project		2023 With Project		2040 Without Project		2040 With Project	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	Highland Village Ctr./Driveway 1 & Highland Av	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C
2	Mango Av. & Highland AV.	A - C	A - C	D/E	D/E	F	D/E	F	F	F	F
3	Mango Av. & Driveway 2/Walnut Grove Ct.	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C	A - C

● = A - C ● = D/E ● = F

1.5.1 EXISTING (2021) CONDITIONS

The study area intersections are currently operating at an acceptable LOS during the peak hours.

1.5.2 OPENING YEAR CUMULATIVE (2023) CONDITIONS

The following study area intersection is anticipated to operate at an unacceptable LOS during the peak hours under Opening Year Cumulative (2023) Without Project:

- Mango Avenue & Highland Avenue (#2) – LOS E AM and PM peak hours

There are no additional study area intersections anticipated to operate at an unacceptable LOS with the addition of Project traffic, in addition to the intersection previously identified under Opening Year Cumulative (2023) Without Project traffic conditions.

1.5.3 HORIZON YEAR (2040) CONDITIONS

The following study area intersection is anticipated to operate at an unacceptable LOS under Horizon Year (2040) Without Project traffic conditions:

- Mango Avenue & Highland Avenue (#2) – LOS F AM and PM peak hours

There are no additional study area intersections anticipated to operate at a deficient LOS during one or both peak hours with the addition of Project traffic, in addition to the locations identified above for Horizon Year (2040) Without Project traffic conditions.

1.6 RECOMMENDATIONS

1.6.1 SITE ADJACENT AND SITE ACCESS RECOMMENDATIONS

The following recommendations are based on the minimum improvements needed to accommodate site access and maintain acceptable peak hour operations. The site adjacent recommendations are shown on Exhibit 1-4.

Recommendation 1 – Highland Village Center/Driveway 1 & Highland Avenue (#1) – The following improvements are necessary to accommodate site access:

- Project to install additional signal equipment to accommodate site access to the south.
- Project to construct northbound shared left-through-right turn lane.
- Project to construct a westbound left turn lane with a minimum of 100-feet of storage.

Recommendation 2 – Mango Avenue & Driveway 2/Walnut Grove Court (#3) – The following improvements are necessary to accommodate site access:

- Project to install a stop control on the eastbound approach (Project driveway) and a shared left-through-right turn lane.

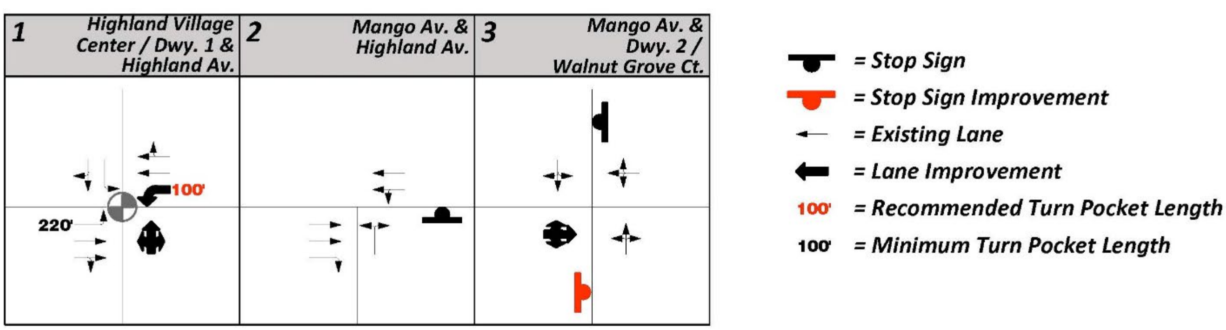
Recommendation 3 – Highland Avenue is an east-west oriented roadway located on the Project's northern boundary. Project to construct Highland Avenue at its ultimate half-width as a Primary Highway (104-foot right-of-way) from the western Project boundary to Mango Avenue consistent with the City's standards.

Recommendation 4 – Mango Avenue is a north-south oriented roadway located on the Project's eastern boundary. Project to construct Mango Avenue at its ultimate half-width as a Collector Street (68-foot right-of-way) between Highland Avenue and the Project's southern boundary consistent with the City's standards.

On-site traffic signing and striping should be implemented agreeable with the provisions of the California Manual on Uniform Traffic Control Devices (CA MUTCD) and in conjunction with detailed construction plans for the Project site.

Sight distance at each project access point should be reviewed with respect to standard Caltrans and City of Fontana sight distance standards at the time of preparation of final grading, landscape, and street improvement plans.

EXHIBIT 1-4: SITE ADJACENT ROADWAY AND SITE ACCESS RECOMMENDATIONS



1.6.2 QUEUING ANALYSIS

A queuing analysis has been performed for the Project driveways and the site adjacent intersection of Mango Avenue and Highland Avenue for Horizon Year (2040) With Project traffic conditions. The traffic modeling and signal timing optimization software package SimTraffic has been utilized to assess the queues. SimTraffic is designed to model networks of signalized and unsignalized intersections, with the primary purpose of checking and fine-tuning signal operations. SimTraffic uses the input parameters from Synchro to generate random simulations. These random simulations generated by SimTraffic have been utilized to determine the 95th percentile queue lengths observed for each applicable turn lane. These queuing results were then used to determine the appropriate turn lane storage requirements reflected on Exhibit 1-4. A SimTraffic simulation has been recorded up to 5 times, during the weekday AM and weekday PM peak hours, and has been seeded for 30-minute periods with 60-minute recording intervals. Queuing analysis worksheets for the weekday AM and PM peak hours are provided in Appendix 1.2 of this report.

1.6.3 OFF-SITE RECOMMENDATIONS

The recommended improvements needed to address the cumulative deficiencies identified under Existing (2021), Opening Year Cumulative (2023), and Horizon Year (2040) traffic conditions are shown in Table 1-3. For those improvements listed in Table 1-3 and not constructed as part of the Project, the Project Applicant's responsibility for the Project's contributions towards deficient intersections is fulfilled through payment of fair share that would be assigned to construction of the identified recommended improvements. The Project Applicant would be required to pay fair share fees consistent with the City's requirements (see Section 7 *Local and Regional Funding Mechanisms)*.

1.7 VEHICLE MILES TRAVELED (VMT) ANALYSIS

The Project was found to meet the low VMT screening criteria. In addition, the Project is consistent with the adopted General Plan and is consistent with the growth projections assumed in the regional RTP/SCS. Therefore, the Project would result in a less than significant impact for VMT; no further VMT analysis required. Detail traffic analysis can be found in Section 8 *Vehicle Miles Traveled Analysis* of this TA.

TABLE 1-3: SUMMARY OF IMPROVEMENTS BY ANALYSIS SCENARIO

#	Intersection Location	Jurisdiction	Analysis Scenarios: 2023 With Project	Analysis Scenarios: 2040 With Project	Improvements included in Fee Program?[1]	Mechanism for Mitigation[2]	Total Cost[3]	Fair Share %[4]	Estimated Fair Share Cost
1	Mango Av. & Highland Av.	Fontana	Install a Traffic Signal	Same	No	Fair Share	$400,000	10.9%	$43,523
			Add WB left turn lane	Same	No	Fair Share	$85,500		$9,303
			Restripe the NB approach with a left and right turn lane	Same	No	Fair Share	$25,000		$2,720
						Total	**$510,500**		**$55,546**
						Total Costs for Horizon Year (2040) Improvements[5]	**$510,500**		**$55,546**

[1] Improvements are included in the SBCTA Nexus Study Fee program or the SSBCTA Measure I Funding.

[2] Identifies the Project's responsibility to construct an improvement or contribute fair share or fee payment towards the implementation of the improvements shown.

[3] Costs have been estimated using the data provided in Appendix G of the San Bernardino County CMP (2016 Update) for preliminary construction costs. Appendix G costs escalated by a factor of 1.71 to reflect 2021 conditions, except for Traffic Signals.

[4] Program improvements constructed may be eligible for fee credit, at discretion of City. See Table 7-1 for Fair Share Calculations.

[5] Total project fair share contribution consists of the improvements which are not already included in the City of Fontana's DIF for those intersections wholly or partially within the City of Fontana.

This Page Intentionally Left Blank

2 METHODOLOGIES

This section of the report presents the methodologies used to perform the traffic analyses summarized in this report. The methodologies described are generally consistent with the City of Fontana's traffic study guidelines. (1)

2.1 LEVEL OF SERVICE

Traffic operations of roadway facilities are described using the term "Level of Service" (LOS). LOS is a qualitative description of traffic flow based on several factors such as speed, travel time, delay, and freedom to maneuver. Six levels are typically defined ranging from LOS A, representing completely free-flow conditions, to LOS F, representing breakdown in flow resulting in stop-and-go conditions. LOS E represents operations at or near capacity, an unstable level where vehicles are operating with the minimum spacing for maintaining uniform flow.

2.2 INTERSECTION CAPACITY ANALYSIS

The definitions of LOS for interrupted traffic flow (flow restrained by the existence of traffic signals and other traffic control devices) differ slightly depending on the type of traffic control. The LOS is typically dependent on the quality of traffic flow at the intersections along a roadway. The Highway Capacity Manual (HCM) methodology expresses the LOS at an intersection in terms of delay time for the various intersection approaches. (3) The HCM uses different procedures depending on the type of intersection control.

2.2.1 SIGNALIZED INTERSECTIONS

The City of Fontana requires signalized intersection operations analysis based on the methodology described in the HCM (6^{th} Edition). Intersection LOS operations are based on an intersection's average control delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. For signalized intersections, LOS is directly related to the average control delay per vehicle and is correlated to a LOS designation as described in Table 2-1. Study area intersections have been evaluated using the Synchro (Version 10) analysis software package.

The traffic modeling and signal timing optimization software package Synchro 11 is utilized to analyze signalized intersections within the study area. Synchro is a macroscopic traffic software program that is based on the signalized intersection capacity analysis as specified in the HCM. Macroscopic level models represent traffic in terms of aggregate measures for each movement at the study intersections. Equations are used to determine measures of effectiveness such as delay and queue length. The level of service and capacity analysis performed by Synchro takes into consideration optimization and coordination of signalized intersections within a network.

TABLE 2-1: SIGNALIZED INTERSECTION LOS THRESHOLDS

Description	Average Control Delay (Seconds), V/C ≤ 1.0	Level of Service, V/C ≤ 1.0	Level of Service, V/C > 1.0
Operations with very low delay occurring with favorable progression and/or short cycle length.	0 to 10.00	A	F
Operations with low delay occurring with good progression and/or short cycle lengths.	10.01 to 20.00	B	F
Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.01 to 35.00	C	F
Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	35.01 to 55.00	D	F
Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered to be the limit of acceptable delay.	55.01 to 80.00	E	F
Operation with delays unacceptable to most drivers occurring due to over saturation, poor progression, or very long cycle lengths	80.01 and up	F	F

Source: HCM, 6th Edition

A saturation flow rate of 1900 has been utilized for all study area intersections located within the City of Fontana. The peak hour traffic volumes are adjusted using a peak hour factor (PHF) to reflect peak 15-minute volumes. Common practice for LOS analysis is to use a peak 15-minute rate of flow. However, flow rates are typically expressed in vehicles per hour. The PHF is the relationship between the peak 15-minute flow rate and the full hourly volume (e.g., PHF = [Hourly Volume] / [4 x Peak 15-minute Flow Rate]). The use of a 15-minute PHF produces a more detailed analysis as compared to analyzing vehicles per hour. Existing PHFs have been used for all analysis scenarios. Per the HCM, PHF values over 0.95 often are indicative of high traffic volumes with capacity constraints on peak hour flows while lower PHF values are indicative of greater variability of flow during the peak hour. (3)

2.2.2 Unsignalized Intersections

The City of Fontana requires the operations of unsignalized intersections be evaluated using the methodology described the HCM. (3) The LOS rating is based on the weighted average control delay expressed in seconds per vehicle (see Table 2-2).

TABLE 2-2: UNSIGNALIZED INTERSECTION LOS THRESHOLDS

Description	Average Control Delay Per Vehicle (Seconds)	Level of Service, V/C ≤ 1.0	Level of Service, V/C > 1.0
Little or no delays.	0 to 10.00	A	F
Short traffic delays.	10.01 to 15.00	B	F
Average traffic delays.	15.01 to 25.00	C	F
Long traffic delays.	25.01 to 35.00	D	F
Very long traffic delays.	35.01 to 50.00	E	F
Extreme traffic delays with intersection capacity exceeded.	> 50.00	F	F

Source: HCM, 6th Edition

At two-way or side-street stop-controlled intersections, LOS is calculated for each controlled movement and for the left turn movement from the major street, as well as for the intersection as a whole. For approaches composed of a single lane, the delay is computed as the average of all movements in that lane. Per the HCM, the highest delay and associated LOS on the minor approach is reported for two-way stop-controlled intersections. For all-way stop controlled intersections, LOS is computed for the intersection as a whole and the average delay is reported (similar to signalized intersections).

2.3 TRAFFIC SIGNAL WARRANT ANALYSIS METHODOLOGY

The term "signal warrants" refers to the list of established criteria used by the Caltrans and other public agencies to quantitatively justify or ascertain the potential need for installation of a traffic signal at an otherwise unsignalized intersection. This TA uses the signal warrant criteria presented in the latest edition of the California Department of Transportation (Caltrans) California Manual on Uniform Traffic Control Devices *(CA MUTCD)*. (4)

The signal warrant criteria for Existing conditions are based upon several factors, including volume of vehicular and pedestrian traffic, frequency of accidents, and location of school areas. The Caltrans CA MUTCD indicates that the installation of a traffic signal should be considered if one or more of the signal warrants are met. (4) Specifically, this TA utilizes the Peak Hour Volume-based Warrant 3 as the appropriate representative traffic signal warrant analysis for existing study area intersections for all analysis scenarios. Warrant 3 is appropriate to use for this TA because it provides specialized warrant criteria for intersections with rural characteristics (e.g., located in communities with populations of less than 10,000 persons or with adjacent major streets operating above 40 miles per hour). For the purposes of this study, the speed limit was the basis for determining whether Urban or Rural warrants were used for a given intersection.

Traffic signal warrant analyses were performed for the following unsignalized study area intersections shown in Table 2-3:

TABLE 2-3: TRAFFIC SIGNAL WARRANT ANALYSIS LOCATIONS

ID	Intersection Location	Jurisdiction
2	Mango Av. & Highland Av.	Fontana
3	Mango Av. & Driveway 2/Walnut Grove Ct.	Fontana

The Existing conditions traffic signal warrant analysis is presented in the subsequent section, Section 3 *Area Conditions* of this report. The traffic signal warrant analyses for future conditions are presented in Section 5 *Opening Year Cumulative (2023) Traffic Conditions*, and Section 6 *Horizon Year (2040) Traffic Conditions* of this report.

It is important to note that a signal warrant defines the minimum condition under which the installation of a traffic signal might be warranted. Meeting this threshold condition does not require that a traffic control signal be installed at a particular location, but rather, that other traffic factors and conditions be evaluated in order to determine whether the signal is truly justified. It should also be noted that signal warrants do not necessarily correlate with LOS. An intersection may satisfy a signal warrant condition and operate at or above acceptable LOS or operate below acceptable LOS and not meet a signal warrant.

2.4 MINIMUM LEVEL OF SERVICE (LOS)

The City's General Plan recommends a LOS standard of LOS C. Intersections which are forecast to operate at unsatisfactory conditions (i.e., at LOS worse than LOS C for city intersections) shall be identified as cumulatively deficient intersections. Therefore, any intersection operating at LOS D, E, or F will be considered deficient for the purposes of this analysis. (1)

2.5 DEFICIENCY CRITERIA

For the intersections that lie within the City of Fontana, determination of direct project-related deficiencies will be based on a comparison of without and with project levels of service for each analysis year. A project-related deficiency occurs if project traffic increases the average delay at an intersection by more than the thresholds identified on Table 2-4. The thresholds for LOS A, B, and C do not apply to projects consistent with the General Plan.

TABLE 2-4: THRESHOLDS OF SIGNIFICANT IMPACT

Pre-Project LOS	Significant Impact Threshold[1]
A/B	10.0 Seconds
C	8.0 Seconds
D	5.0 Seconds
E	2.0 Seconds
F	1.0 Second

Source: Fontana Traffic Study Guidelines, October 2020

[1] Increase in delay

Cumulative traffic impacts are deficiencies that are not directly caused by the Project, but occur as a result of regional growth combined with that or other nearby cumulative development projects. Cumulative impacts utilize the same thresholds of significant impacts as shown on Table 2-4. The Project's contribution to a particular cumulative transportation deficiency is deemed cumulatively considerable if the Project adds significant traffic to the forecasted deficiency (Per Table 2-4). A Project's contribution to a cumulatively considerable impact can be reduced to less than significant if the Project is required to implement or fund its fair share of improvements designed to alleviate the potential cumulative impact. If full funding of future cumulative improvements is not reasonably assured, a temporary unmitigated cumulative impact may occur until the needed improvement is fully funded and constructed.

2.6 PROJECT FAIR SHARE CALCULATION METHODOLOGY

In cases where this TA identifies that the Project would contribute additional traffic volumes to traffic deficiencies, Project fair share costs of improvements necessary to address deficiencies have been identified. The Project's fair share cost of improvements is determined based on the following equation, which is the ratio of Project traffic to new traffic, and new traffic is total future (Horizon Year) traffic less existing baseline traffic:

Project Fair Share % = Project (2040) AM/PM Traffic / (2040 With Project AM/PM Total Traffic – Existing AM/PM Traffic)

The project fair share percentage has been calculated for both the AM peak hour and PM peak hour and the highest of the two has been selected. The Project fair share contribution calculations are presented in Section 7 *Local and Regional Funding Mechanisms* of this TA. The cost of implementing the improvements shown on Table 1-3 have been estimated based on the preliminary construction cost estimates found in Appendix G of the San Bernardino County CMP in conjunction with a total cost escalation factor of 1.568 to more closely approximate current (2020) costs. These cost estimates have been utilized in conjunction with the Project fair share percentages to determine the Project's fair share cost of the recommended improvements (see Table 8-1). These estimates are a rough order of magnitude only as they are intended only for discussion purposes and do not imply any legal responsibility or formula for contributions or physical improvements.

This Page Intentionally Left Blank

3 AREA CONDITIONS

This section provides a summary of the existing circulation network, the City of Fontana General Plan Circulation Network, and a review of existing peak hour intersection operations and traffic signal warrant analyses.

3.1 EXISTING CIRCULATION NETWORK

Pursuant to the scoping agreement with City of Fontana staff (Appendix 1.1), the study area includes a total of 3 existing and future intersections as shown previously on Exhibit 1-2. Exhibit 3-1 illustrates the study area intersections located near the proposed Project and identifies the number of through traffic lanes for existing roadways and intersection traffic controls.

3.2 GENERAL PLAN CIRCULATION ELEMENTS

As noted previously, the Project site is located within the City of Fontana. The roadway classifications and planned (ultimate) roadway cross-sections of the major roadways within the study area, as identified on City of Fontana General Plan Hierarchy of Streets, are described subsequently. Exhibit 3-2 shows the City of Fontana General Plan Circulation Element. The City of Fontana General Plan does not include roadway cross-sections in its General Plan.

Primary Highways are four-lane roadways and may include a painted median. These roadways typically direct traffic through major development areas. The following study area roadway within the City of Fontana is classified as a Primary Highway:

- Highland Avenue

Collector Streets are two-lane streets, providing one lane in each direction. The following study area roadway within the study area is classified as a Modified Local Street:

- Mango Avenue

3.3 BICYCLE & PEDESTRIAN FACILITIES

The City of Fontana bike facilities are shown on Exhibit 3-3. There are existing Class II bike facilities along Sierra Avenue to the west of the study area. Exhibit 3-4 illustrates the existing pedestrian facilities, including sidewalks and crosswalks. As shown on Exhibit 3-4, there are limited pedestrian facilities along the Project frontage on both Highland Avenue and Mango Avenue.

EXHIBIT 3-1: EXISTING NUMBER OF THROUGH LANES AND INTERSECTION CONTROLS

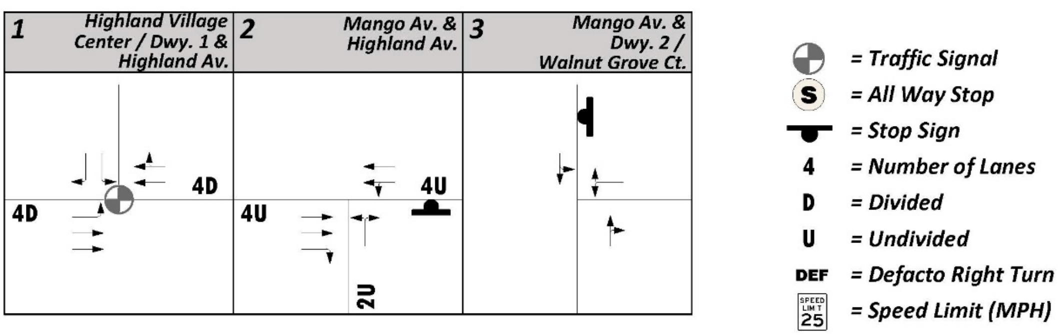
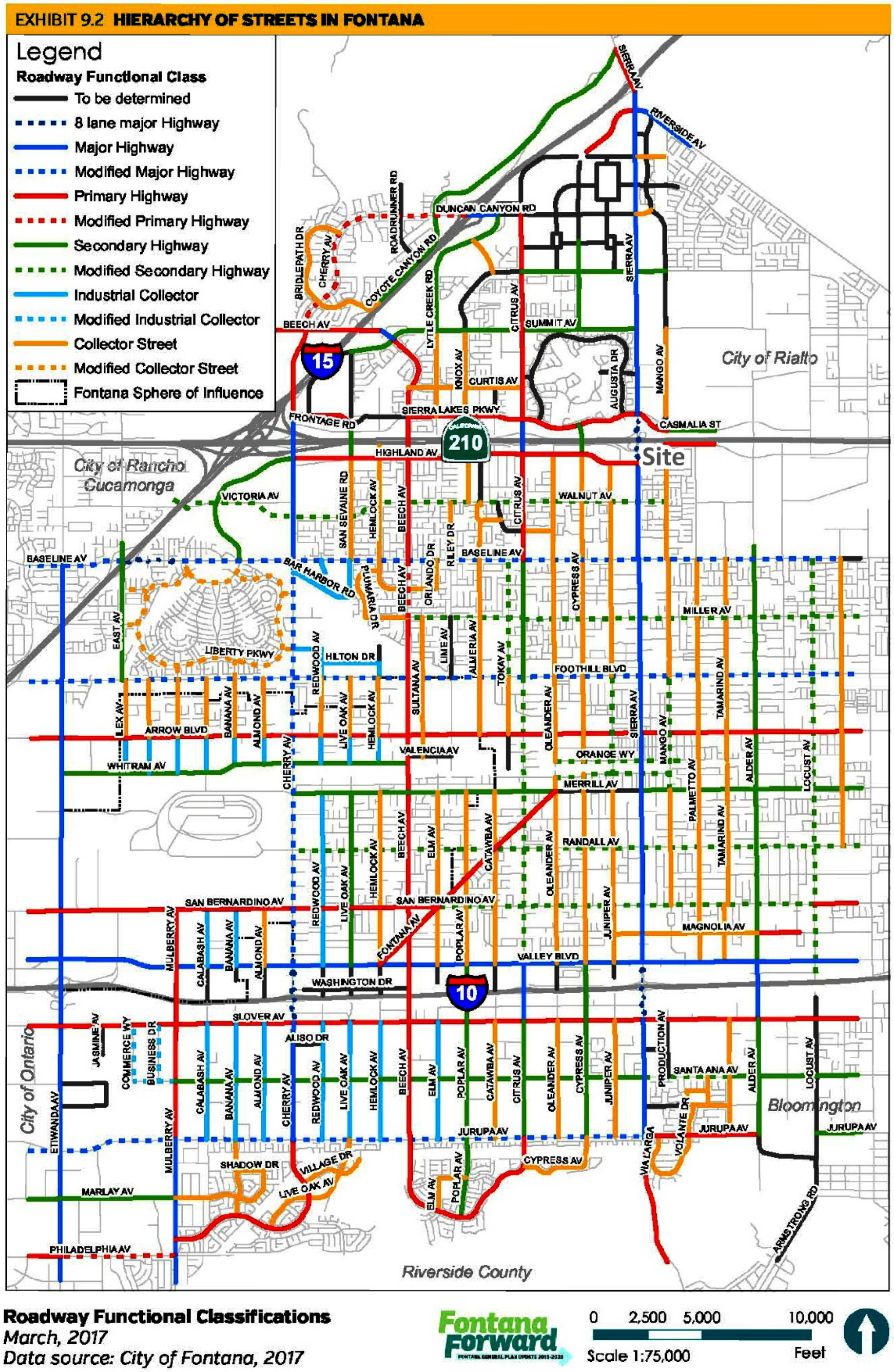


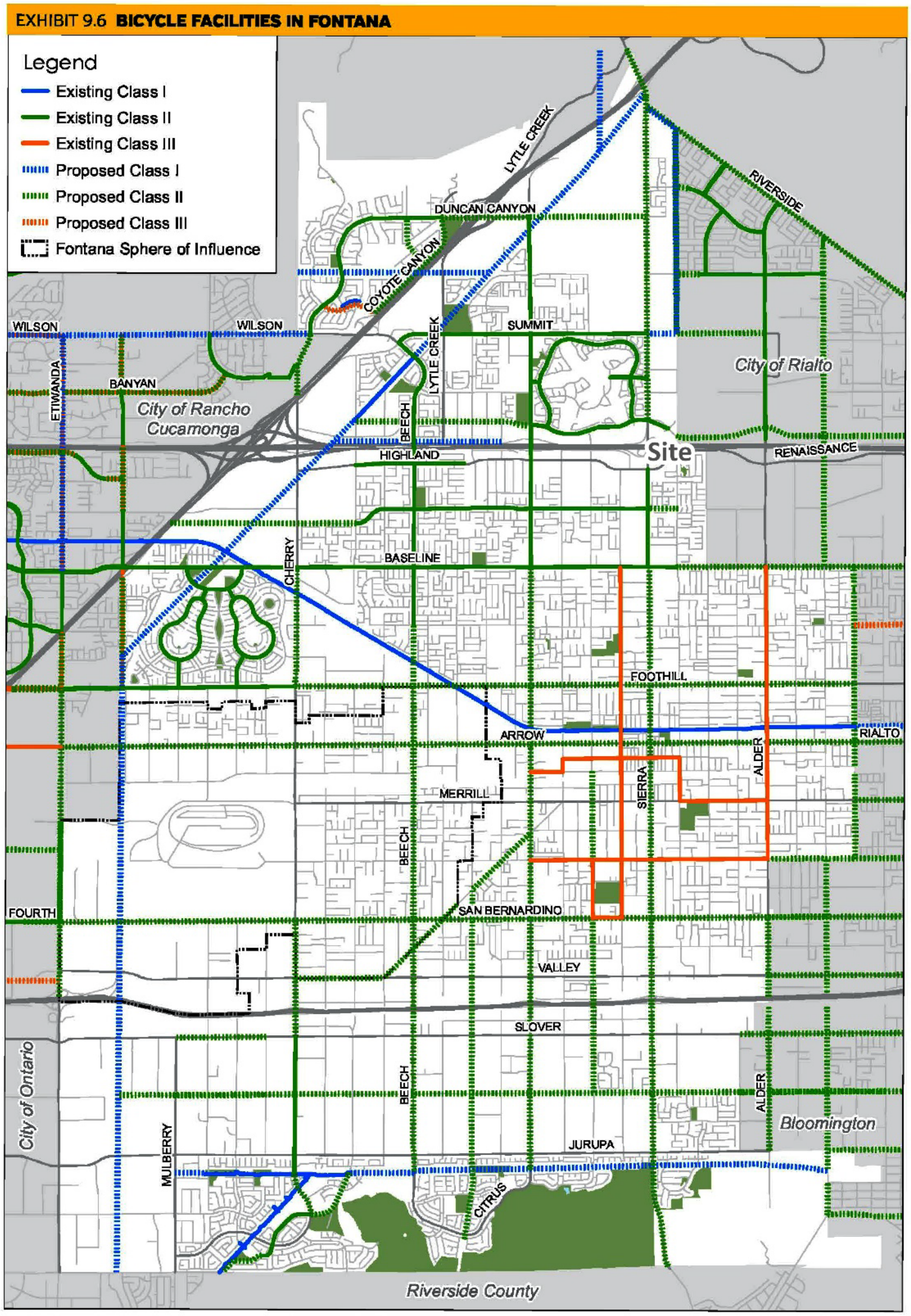
EXHIBIT 3-2: CITY OF FONTANA HIERARCHY OF STREETS



Approved and Adopted by City Council November 13, 2018

City Council Resolution 2018-096
City Council Resolution 2018-097

EXHIBIT 3-3: CITY OF FONTANA BICYCLE FACILITIES



Bicycle Facilities
March, 2017
Data sources: City of Fontana, 2015;
SANBAG NMTP, 2014

Fontana Forward

0 2,500 5,000 10,000
Scale 1:75,000 Feet

9.14 Fontana General Plan
Approved and Adopted by City Council November 13, 2018

City Council Resolution 2018-096
City Council Resolution 2018-097

EXHIBIT 3-4: EXISTING PEDESTRIAN FACILITIES

3.4 TRANSIT SERVICE

The study area is currently served by Omnitrans Transit Agency with bus services along Sierra Avenue. Route 82 runs along Sierra Avenue with a stop at the intersection of Sierra Avenue and Highland Avenue, but there are currently no transit routes along Highland Avenue in front of the Project. The transit services are illustrated on Exhibit 3-5. Transit service is reviewed and updated by Omnitrans periodically to address ridership, budget, and community demand needs. Changes in land use can affect these periodic adjustments which may lead to either enhanced or reduced service where appropriate.

3.5 EXISTING TRAFFIC COUNTS

The intersection LOS analysis is based on the traffic volumes observed during the peak hour conditions using traffic count data collected in December 2019 at the intersection of Mango Avenue and Highland Avenue. The following peak hours were selected for analysis:

- Weekday AM Peak Hour (peak hour between 7:00 AM and 9:00 AM)
- Weekday PM Peak Hour (peak hour between 4:00 PM and 6:00 PM)

Due to the currently ongoing COVID-19 pandemic, schools and businesses within the study area were closed or operating at less than full capacity at the time this study was prepared. As such, historic traffic counts from 2019 were utilized in conjunction with a 1.16% per year, compounded annually, growth rate to develop traffic volumes for 2021 conditions. The historic weekday AM and weekday PM peak hour count data is representative of typical weekday peak hour traffic conditions in the study area. There were no observations made in the field that would indicate atypical traffic conditions on the count dates, such as construction activity or detour routes and near-by schools were in session and operating on normal schedules.

Historic traffic count data was not readily available at Highland Village Center and Walnut Grove Court. As such, 2021 traffic counts have been collected at these intersections. Traffic counts have also been collected at the intersection of Mango Avenue and Highland Avenue in order to compare and develop an adjustment factor based on a comparison to historic 2019 traffic count data to the recently collected 2021 traffic count data. This adjustment factor has been applied to the 2021 traffic count data at the intersections lacking historic data to reflect non-COVID traffic conditions. Where applicable, traffic volumes have been flow conserved in order to not have any loss of vehicles. The raw manual peak hour turning movement traffic count data sheets are included in Appendix 3.1.

Existing weekday ADT volumes on arterial highways throughout the study area are shown on Exhibit 3-6. Existing ADT volumes were based upon factored intersection peak hour counts collected by Urban Crossroads, Inc. using the following formula for each intersection leg:

Weekday PM Peak Hour (Approach Volume + Exit Volume) x 12.00 = Leg Volume

EXHIBIT 3-5: EXISTING TRANSIT ROUTES

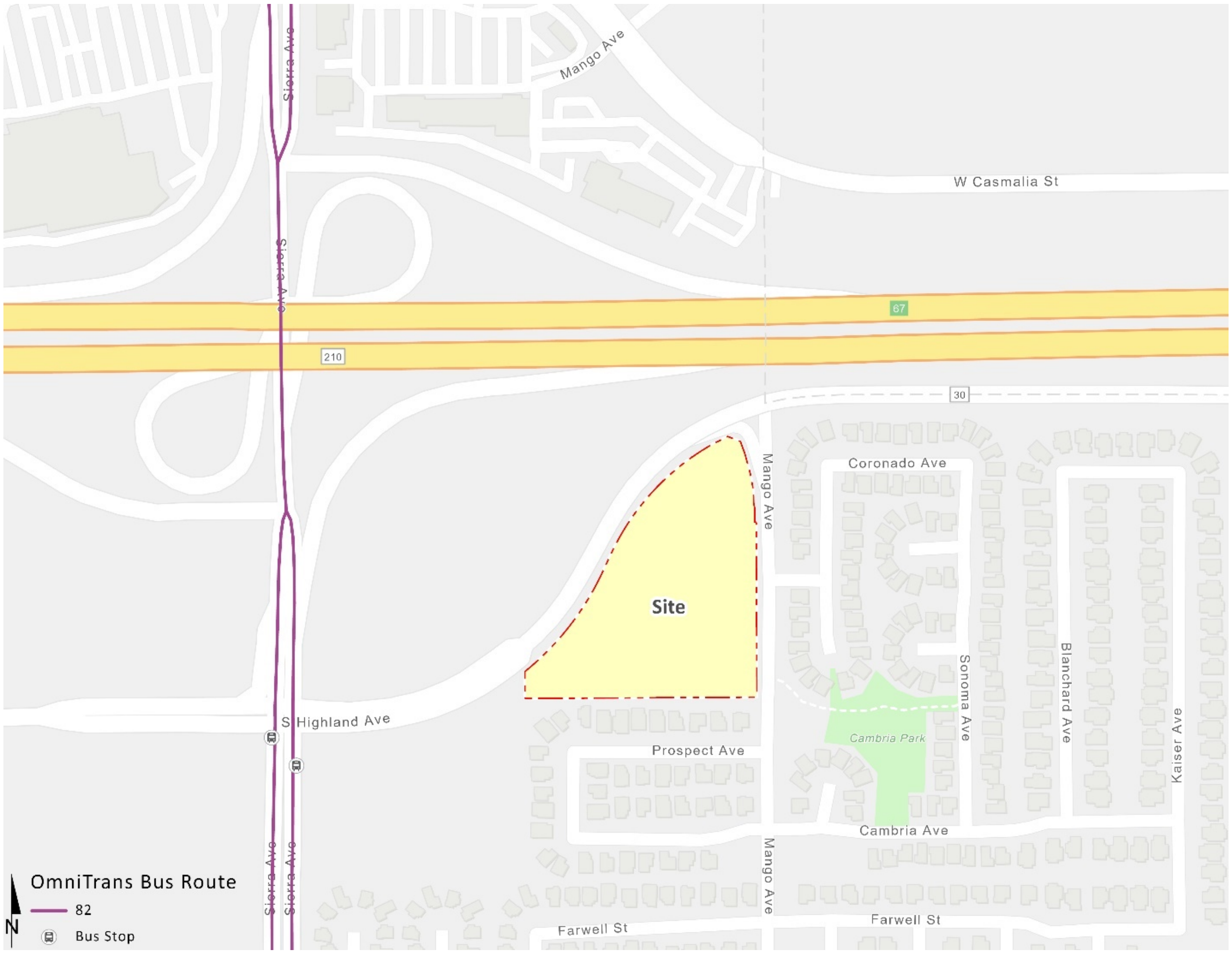
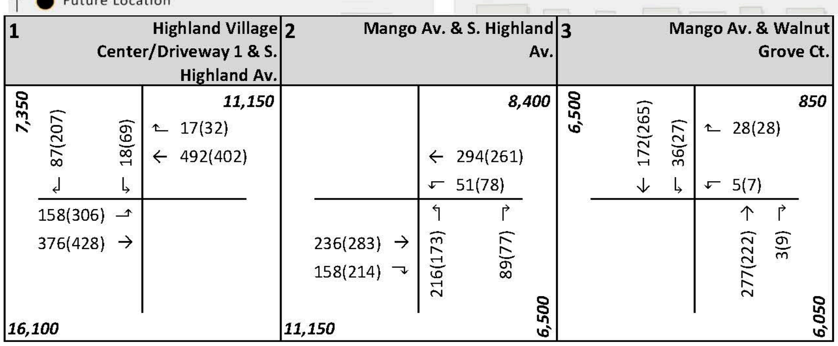


EXHIBIT 3-6: EXISTING (2021) TRAFFIC VOLUMES



##(##) AM(PM) Peak Hour Intersection Volumes

Average Daily Trips

The above equation utilizing a factor of 12.00 estimates the ADT volumes on the study area roadway segments assuming a peak-to-daily relationship of approximately 8.33 percent (i.e., 1/0.0833 = 12.00) and was assumed to sufficiently estimate ADT volumes for planning-level analyses. Existing weekday AM and weekday PM peak hour intersection volumes are shown on Exhibit 3-6.

3.6 EXISTING (2021) INTERSECTION OPERATIONS ANALYSIS

Existing peak hour traffic operations have been evaluated for the study area intersections based on the analysis methodologies presented in Section 2.2 *Intersection Capacity Analysis* of this report. The intersection operations analysis results are summarized in Table 3-1 which indicates that the study area intersections are currently operating at an acceptable LOS during the peak hours.

TABLE 3-1: INTERSECTION ANALYSIS FOR EXISTING (2021) CONDITIONS

#	Intersection	Traffic Control[2]	Delay[1] (secs.) AM	Delay[1] (secs.) PM	Level of Service AM	Level of Service PM
1	Highland Village Ctr./Driveway 1 & Highland Av.	TS	9.5	13.0	A	B
2	Mango Av. & Highland Av.	CSS	22.5	24.4	C	C
3	Mango Av. & Driveway 2/Walnut Grove Ct.	CSS	10.7	10.5	B	B

[1] Per the Highway Capacity Manual (6th Edition), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown. HCM delay reported in seconds.

[2] TS = Traffic Signal; CSS = Cross-Street Stop

The intersection operations analysis worksheets are included in Appendix 3.2 of this TA.

3.7 EXISTING (2021) TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic signal warrants for Existing traffic conditions are based on existing peak hour intersection turning volumes. The following unsignalized study area intersection currently meets a traffic signal for Existing (2021) traffic conditions (see Appendix 3.3):

- Mango Avenue & Highland Avenue (#2)

This Page Intentionally Left Blank

4 PROJECTED FUTURE TRAFFIC

The proposed Project includes the development of 107 multifamily housing (low-rise) dwelling units. The Project is anticipated to have an Opening Year of 2023. As indicated previously on Exhibit 1-2, access to the Project site will be provided to Highland Avenue via a future driveway aligning with Highland Village Center and Mango Avenue via a future driveway aligning with Walnut Grove Court. Regional access to the Project site is available from the I-210 Freeway via Sierra Avenue.

4.1 PROJECT TRIP GENERATION

In order to develop the traffic characteristics of the proposed project, trip-generation statistics published in the ITE Trip Generation Manual (10th Edition, 2017) for the Multifamily Housing (Low-Rise) land use (ITE Land Use Code 220) has been utilized. The Project trip generation summary is shown in Table 4-1. As shown in Table 4-1, the Project is anticipated to generate a total of 784 two-way trips per day with 49 AM peak hour trips and 60 PM peak hour trips. The assumptions and methods used to estimate the Project's trip generation characteristics are discussed in greater detail in Section 4.1 *Project Trip Generation* of this report.

TABLE 4-1: PROJECT TRIP GENERATION SUMMARY

Land Use[1]	ITE LU Code	Units[2]	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	Daily
Project Trip Generation Rates:									
Multifamily Housing (Low-Rise)	220	DU	0.11	0.35	0.46	0.35	0.21	0.56	7.32

1 Trip Generation Source: Institute of Transportation Engineers (ITE), Trip Generation Manual, Tenth Edition (2017).

2 DU = Dwelling Units

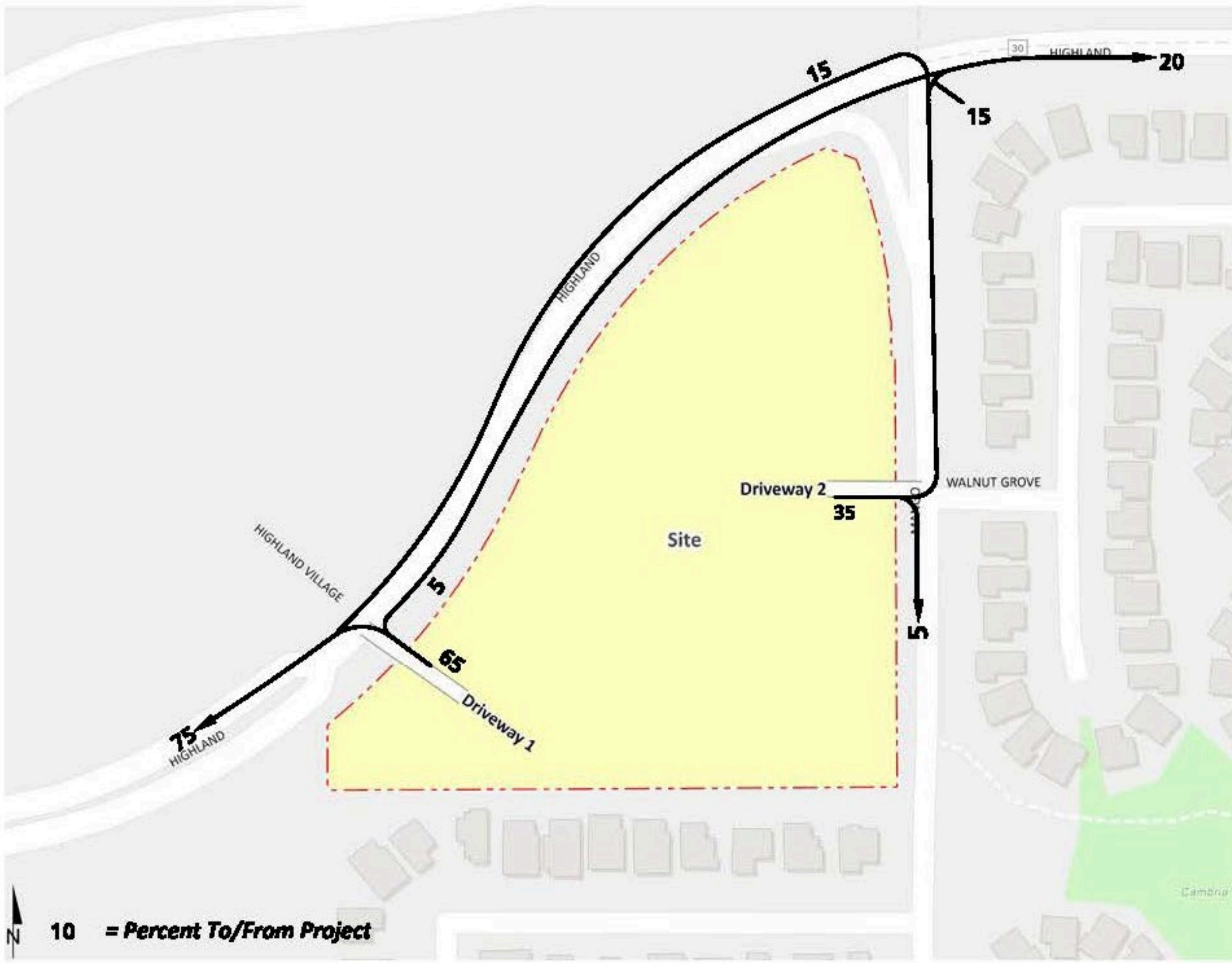
Land Use	Quantity	Units[1]	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	Daily
Project Trip Generation Summary:									
Multifamily Housing	107	DU	11	38	49	38	22	60	784

1 DU = Dwelling Units

4.2 PROJECT TRIP DISTRIBUTION

The Project trip distribution and assignment process represents the directional orientation of traffic to and from the Project site. Trip distribution is the process of identifying the probable destinations, directions or traffic routes that will be utilized by Project traffic. The potential interaction between the planned land use and surrounding regional access routes are considered, to identify the route where the Project traffic would distribute. The Project trip distribution patterns are graphically depicted on Exhibit 4-1.

EXHIBIT 4-1: PROJECT TRIP DISTRIBUTION



4.3 MODAL SPLIT

The traffic reducing potential of public transit, walking, or bicycling have not been considered in this TA. Essentially, the traffic projections are "conservative" in that these alternative travel modes might be able to reduce the forecasted traffic volumes.

4.4 PROJECT TRIP ASSIGNMENT

The assignment of traffic from the Project area to the adjoining roadway system is based upon the Project trip generation, trip distribution, and the arterial highway and local street system improvements that would be in place by the time of initial occupancy of the Project. Based on the identified Project traffic generation and trip distribution patterns, the Project only ADT and peak hour intersection turning movement volumes are shown on Exhibit 4-2.

4.5 BACKGROUND TRAFFIC

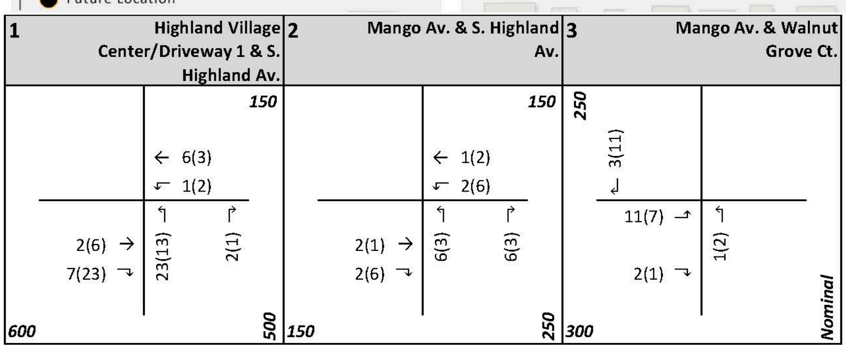
Future year traffic forecasts have been based upon background (ambient) growth at 1.16% per year for 2023 traffic conditions, consistent with other recent studies performed in the area. The total ambient growth is 2.33% for 2023 traffic conditions (compounded growth of 1.16 percent per year over 2 years or $1.0116^{2\ \text{years}}$). The ambient growth factor is intended to approximate regional traffic growth. This ambient growth rate is added to existing traffic volumes to account for area-wide growth not reflected by cumulative development projects. Ambient growth has been added to daily and peak hour traffic volumes on surrounding roadways, in addition to traffic generated by the development of future projects that have been approved but not yet built and/or for which development applications have been filed and are under consideration by governing agencies. Opening Year Cumulative (2023) traffic volumes are provided in Section 6 of this TA. The traffic generated by the proposed Project was then manually added to the base volume to determine Opening Year Cumulative “With Project” forecasts.

4.6 CUMULATIVE DEVELOPMENT TRAFFIC

A cumulative project list was developed for the purposes of this analysis through consultation with planning and engineering staff from the City of Fontana. The cumulative project list includes known and foreseeable projects that are anticipated to contribute traffic to the study area intersections.

Where applicable, cumulative projects anticipated to contribute measurable traffic (i.e., 50 or more peak hour trips) to study area intersections have been manually added to the study area network to generate Opening Year Cumulative (2023) forecasts. In other words, this list of cumulative development projects has been reviewed to determine which projects would likely contribute measurable traffic through the study area intersections (e.g., those cumulative projects in close proximity to the proposed Project). For the purposes of this analysis, the cumulative projects that were determined to affect one or more of the study area intersections are shown on Exhibit 4-3, listed in Table 4-2, and have been considered for inclusion.

EXHIBIT 4-2: PROJECT ONLY TRAFFIC VOLUMES



##(##) AM(PM) Peak Hour Intersection Volumes

Average Daily Trips

EXHIBIT 4-3: CUMULATIVE DEVELOPMENT LOCATION MAP

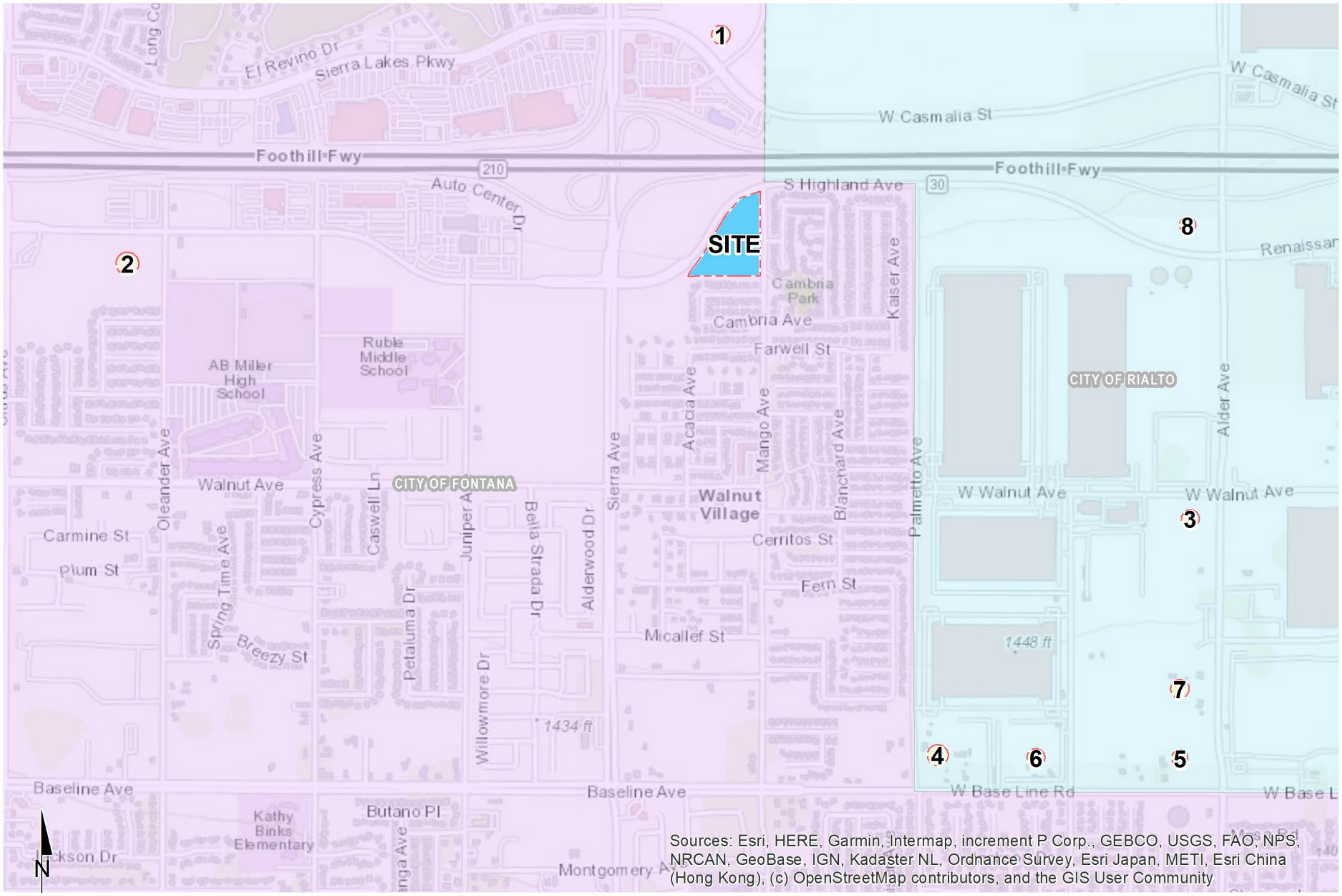


TABLE 4-2: CUMULATIVE DEVELOPMENT LAND USE SUMMARY

#	Project	Land Use	Quantity [2]
1	N of Mango Av. & Sierra Lakes Pkwy.	Fast Food w/ Drive-Thru	47.000 TSF
2	16850 S. Highland Av.	Car Dealership	46.073 TSF
		Automated Car Wash	4.160 TSF
3	SWC of Alder Av. & Casmalia St.	Gas Station	16 VFP
		Truck Fueling Positions	9 VFP
		Fast-Food w/ Drive-Thru	2.400 TSF
4	Baseline/Palmetto Warehouse II	Warehouse	90.726 TSF
5	NWC of Baseline / Alder Warehouse	Warehouse	255.655 TSF
6	NWC of Baseline / Tamarind Warehouse	Warehouse	156.500 TSF
7	W of Alder Av. & S of Miro Wy.	Warehouse	78.680 TSF
8	W of Alder Av. & N of Renaissance Pkwy.	Gas Station	16 VFP
		High-Turnover Sit-Down Restaurant	4.500 TSF
		Fast-Food w/ Drive-Thru	4.550 TSF
		Fast-Food w/o Drive-Thru	1.000 TSF
		Hotel	100 Rooms

[1] TSF = Thousand Square Feet; VFP = Vehicle Fueling Positions

Any additional traffic generated by other projects not on the cumulative projects list is likely accounted for through background ambient growth factors that have been applied to the peak hour volumes at study area intersections as discussed in Section 4.5 *Background Traffic*. Cumulative Only ADT and peak hour intersection turning movement volumes are shown on Exhibit 4-4.

4.7 NEAR-TERM TRAFFIC CONDITIONS

The "buildup" approach combines existing traffic counts with a background ambient growth factor to forecast the near-term 2023 traffic conditions. An ambient growth factor of 1.16% per year, compounded annually, accounts for background (area-wide) traffic increases that occur over time up to the years 2023 from the year 2021. Traffic volumes generated by cumulative development projects are then added to assess the Opening Year Cumulative (2023) traffic conditions. Lastly, Project traffic is added to assess "With Project" traffic conditions. The 2023 roadway network are similar to the existing conditions roadway network with the exception of intersections proposed to be developed by the Project.

EXHIBIT 4-4: CUMULATIVE ONLY TRAFFIC VOLUMES

1 Highland Village Center/Driveway 1 & S. Highland Av.	2 Mango Av. & S. Highland Av.	3 Mango Av. & Walnut Grove Ct.
1,600	1,850	550
← 64(54)	← 61(51) ↰ 18(15)	↓ 20(17)
68(60) →	66(57) → 3(3) ↴ ↰ 3(3) ↱ 20(17)	↑ 23(19)
1,600	1,600 550	550

##(##) AM(PM) Peak Hour Intersection Volumes

Average Daily Trips

The near-term traffic analysis includes the following traffic conditions, with the various traffic components:

- Opening Year Cumulative (2023) Without Project
  - Adjusted Existing 2021 counts
  - Ambient growth traffic (2.33%)
  - Cumulative Development Project traffic
- Opening Year Cumulative (2023) With Project
  - Adjusted Existing 2021 counts
  - Ambient growth traffic (2.33%)
  - Cumulative Development Project traffic
  - Project traffic

4.8 HORIZON YEAR (2040) VOLUME DEVELOPMENT

Traffic projections for Horizon Year (2040) without Project conditions were derived from the San Bernardino Transportation Analysis Model (SBTAM) using accepted procedures for model forecast refinement and smoothing for study area intersections located within the County of San Bernardino. The current version of the SBTAM (Version 2.20, March 2019) reflects the local input in the adopted 2016 SCAG RTP within the County of San Bernardino. The post processing volume worksheets are provided in Appendix 4.1 of this TA.

The traffic forecasts reflect the area-wide growth anticipated between the adjusted Existing (2021) conditions and Horizon Year (2040) traffic conditions. In most instances the traffic model zone structure is not designed to provide accurate turning movements along arterial roadways unless refinement and reasonableness checking is performed. Therefore, the Horizon Year (2040) peak hour forecasts were refined using the model derived long range forecasts, base (validation) year model forecasts, along with existing peak hour traffic count data collected at each analysis location. The SBTAM has a base (validation) year of 2012 and a horizon (future forecast) year of 2040. The difference in model volumes (2040-2012) defines the growth in traffic over the 28-year period.

The refined future peak hour approach and departure volumes obtained from the model output data are then entered into a spreadsheet program consistent with the National Cooperative Highway Research Program (NCHRP Report 765), along with initial estimates of turning movement proportions. A linear programming algorithm is used to calculate individual turning movements which match the known directional roadway segment forecast volumes computed in the previous step. This program computes a likely set of intersection turning movements from intersection approach counts and the initial turning proportions from each approach leg.

The SBTAM uses an AM peak period-to-peak hour factor of 0.35 and a PM peak period-to-peak hour factor of 0.27. These factors represent the relationship of the highest single AM peak hour to the modeled 3-hour AM peak period (an even distribution would result in a factor of 0.33) and the highest single PM peak hour to the modeled 4-hour PM peak period (an even distribution would result in a factor of 0.25).

Typically, the model growth is prorated and is subsequently added to the existing (base validation) traffic volumes to represent Horizon Year traffic conditions. In an effort to conduct a conservative analysis, reductions to traffic forecasts from either Existing or Opening Year Cumulative traffic conditions were not assumed as part of this analysis. As such, in conjunction with the addition of cumulative projects that are not consistent with the General Plan, additional growth has also been applied on a movement-by-movement basis, where applicable, to estimate reasonable Horizon Year (2040) forecasts. Horizon Year (2040) turning volumes were compared to Opening Year Cumulative (2030) volumes in order to ensure a minimum growth as a part of the refinement process. The minimum growth includes any additional growth between Opening Year Cumulative (2030) and Horizon Year (2040) traffic conditions that is not accounted for by the traffic generated by cumulative development projects and ambient growth rates assumed between Existing (2021) and Opening Year Cumulative (2030) conditions. Future estimated peak hour traffic data was used for new intersections and intersections with an anticipated change in travel patterns to further refine the Horizon Year (2040) peak hour forecasts.

The future Horizon Year (2040) Without Project peak hour turning movements were then reviewed by Urban Crossroads, Inc. for reasonableness, and in some cases, were adjusted to achieve flow conservation, reasonable growth, and reasonable diversion between parallel routes. Flow conservation checks ensure that traffic flow between two closely spaced intersections, such as two adjacent driveway locations, is verified in order to make certain that vehicles leaving one intersection are entering the adjacent intersection and that there is no unexplained loss of vehicles. The result of this traffic forecasting procedure is a series of traffic volumes which are suitable for traffic operations analysis.

This Page Intentionally Left Blank

5 OPENING YEAR CUMULATIVE (2023) TRAFFIC CONDITIONS

This section discusses the methods used to develop Opening Year Cumulative (2023) Without and With Project traffic forecasts, and the resulting intersection operations and traffic signal warrant analyses.

5.1 ROADWAY IMPROVEMENTS

The lane configurations and traffic controls assumed to be in place for Opening Year Cumulative (2023) conditions are consistent with those shown previously on Exhibit 3-1, with the exception of the following:

- Project driveways and those facilities assumed to be constructed by the Project to provide site access are also assumed to be in place for Opening Year Cumulative conditions only (e.g., intersection and roadway improvements along the Project's frontage and driveways, including Mango Avenue and S. Highland Avenue).
- Driveways and those facilities assumed to be constructed by cumulative developments to provide site access are also assumed to be in place for Opening Year Cumulative conditions only (e.g., intersection and roadway improvements along the cumulative development's frontages and driveways).

5.2 OPENING YEAR CUMULATIVE (2023) WITHOUT PROJECT TRAFFIC VOLUME FORECASTS

This scenario includes Existing traffic volumes plus an ambient growth factor of 2.33% plus traffic from pending and approved but not yet constructed known development projects in the area. The ADT and peak hour intersection turning movement volumes which can be expected for Opening Year Cumulative (2023) Without Project conditions are shown on Exhibit 5-1.

5.3 OPENING YEAR CUMULATIVE (2023) WITH PROJECT TRAFFIC VOLUME FORECASTS

This scenario includes Existing traffic volumes, an ambient growth factor of 2.33%, traffic from pending and approved but not yet constructed known development projects in the area and the addition of Project traffic. The ADT and peak hour intersection turning movement volumes which can be expected for Opening Year Cumulative (2023) With Project conditions are shown on Exhibit 5-2.

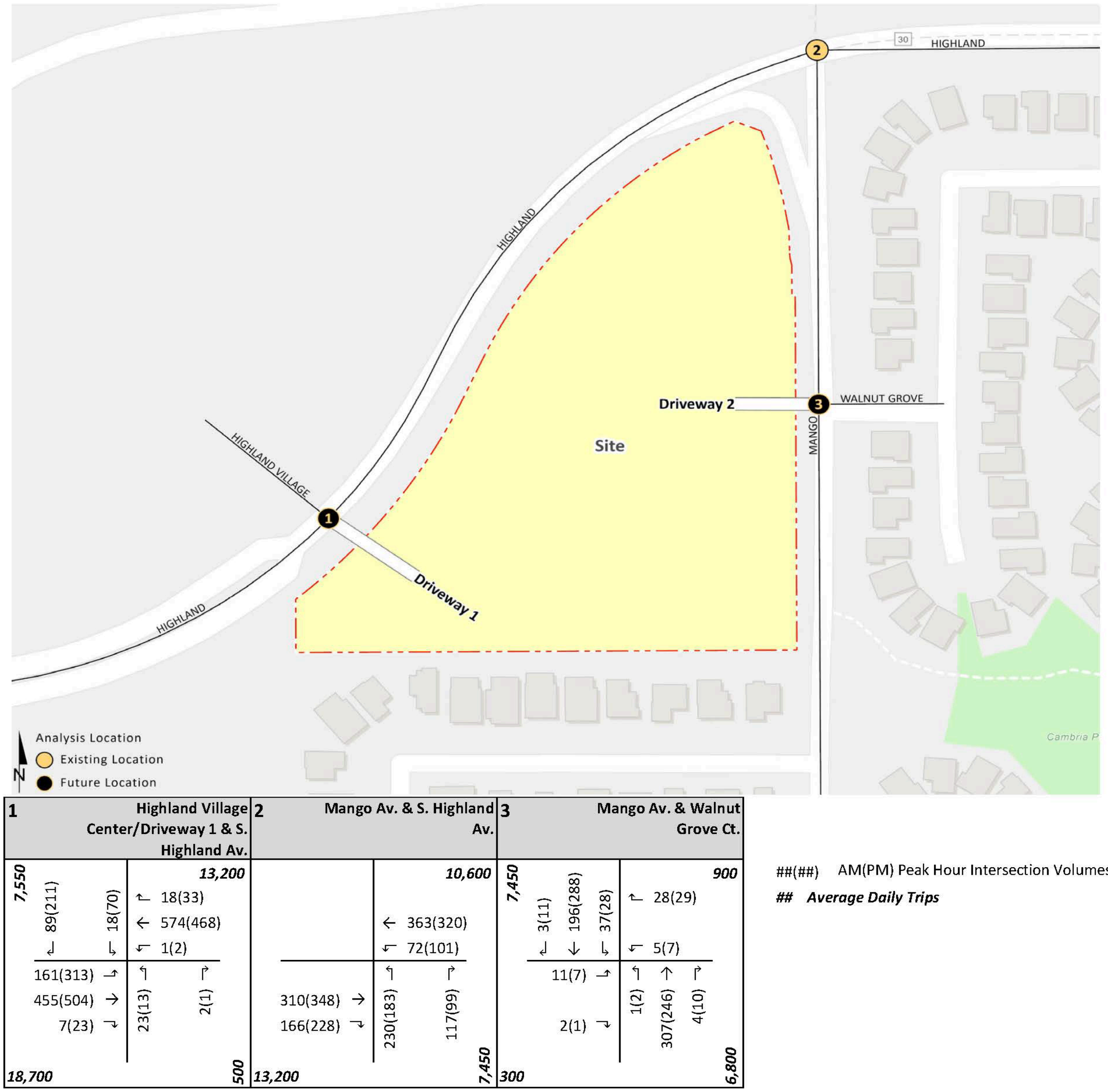
EXHIBIT 5-1: OPENING YEAR CUMULATIVE (2023) WITHOUT PROJECT TRAFFIC VOLUMES

1 Highland Village Center/Driveway 1 & S. Highland Av.	2 Mango Av. & S. Highland Av.	3 Mango Av. & Walnut Grove Ct.
7,550 13,050 89(211) 18(70) 18(33) 568(465) 161(313) 453(498) 18,100	10,450 362(318) 70(95) 308(347) 164(222) 224(180) 111(96) 13,050 7,200	7,200 900 196(288) 37(28) 28(29) 5(7) 307(246) 4(10) 6,750

##(##) AM(PM) Peak Hour Intersection Volumes

Average Daily Trips

EXHIBIT 5-2: OPENING YEAR CUMULATIVE (2023) WITH PROJECT TRAFFIC VOLUMES



##(##) AM(PM) Peak Hour Intersection Volumes

Average Daily Trips

5.4 INTERSECTION OPERATIONS ANALYSIS

5.4.1 OPENING YEAR CUMULATIVE (2023) WITHOUT PROJECT TRAFFIC CONDITIONS

Opening Year Cumulative (2023) peak hour traffic operations have been evaluated for the study area intersections based on the analysis methodologies presented in Section 2.2 *Intersection Capacity Analysis* of this report. The intersection analysis results are summarized in Table 5-1, which indicate that the following study area intersection is anticipated to operate at an unacceptable LOS during the peak hours under Opening Year Cumulative (2023) Without Project:

- Mango Avenue & Highland Avenue (#2) – LOS E AM and PM peak hours

The intersection operations analysis worksheets for Opening Year Cumulative (2023) Without Project traffic conditions are included in Appendix 5.1 of this TA.

TABLE 5-1: INTERSECTION ANALYSIS FOR OPENING YEAR CUMULATIVE (2023) CONDITIONS

#	Intersection	Traffic Control[2]	2023 Without Project Delay[1] (secs.) AM	PM	Level of Service AM	PM	2023 With Project Delay[1] (secs.) AM	PM	Level of Service AM	PM
1	Highland Village Ctr./Driveway 1 & Highland Av.	TS	9.5	14.5	A	B	13.0	16.1	B	B
2	Mango Av. & Highland Av.	CSS	**45.1**	**41.1**	**E**	**E**	**50.3**	**46.5**	**F**	**E**
3	Mango Av. & Driveway 2/Walnut Grove Ct.	CSS	11.0	10.9	B	B	14.6	15.0	B	C

BOLD = LOS does not meet the applicable jurisdictional requirements (i.e., unacceptable LOS).

1 Per the Highway Capacity Manual (6th Edition), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown. HCM delay reported in seconds.

2 TS = Traffic Signal; CSS = Cross-Street Stop

5.4.2 OPENING YEAR CUMULATIVE (2023) WITH PROJECT TRAFFIC CONDITIONS

As shown in Table 5-1, there are no additional study area intersections anticipated to operate at an unacceptable LOS with the addition of Project traffic, in addition to the intersection previously identified under Opening Year Cumulative (2023) Without Project traffic conditions. The intersection operations analysis worksheets for Opening Year Cumulative (2023) With Project traffic conditions are included in Appendix 5.2 of this TA.

5.5 TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic signal warrants have been performed (based on CA MUTCD) for Opening Year Cumulative (2023) traffic conditions based on peak hour intersection turning movements volumes or planning level (ADT) volumes. There is no additional unsignalized study area intersections anticipated to meet a traffic signal warrant under Opening Year Cumulative (2023) Without Project traffic conditions, in addition to the intersections identified previously under Existing (2021) traffic conditions (see Appendix 5.3). Similarly, the intersection of Mango Avenue at Driveway 2/Walnut Grove Court is not anticipated to meet a traffic signal warrant for Opening Year Cumulative (2023) With Project traffic conditions (see Appendix 5.4).

5.6 Deficiencies and Improvements

This section provides a summary of deficiencies, based on the City of Fontana's deficiency criteria discussed in Section 2.5 *Deficiency Criteria*, and improvements needed to improve operations back to acceptable levels. The effectiveness of the recommended improvement strategies to address Opening Year Cumulative (2023) traffic deficiencies are presented in Table 5-2. Worksheets for Opening Year Cumulative (2023) With Project conditions, with improvements, HCM calculation worksheets are provided in Appendix 5.5.

TABLE 5-2: INTERSECTION ANALYSIS FOR OPENING YEAR CUMULATIVE (2023) CONDITIONS WITH IMPROVEMENTS

#	Intersection	Traffic Control[3]	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Delay[2] (secs.) AM	Delay[2] (secs.) PM	Level of Service AM	Level of Service PM
2	Mango Av. & Highland Av.																	
	Without Improvements:	CSS	0	1	0	0	0	0	0	2	1	0	2	0	**50.3**	**46.5**	**F**	**E**
	With Improvements:	**<u>TS</u>**	**<u>1</u>**	**<u>0</u>**	**<u>1</u>**	0	0	0	0	2	1	**<u>1</u>**	2	0	6.4	12.1	A	B

Intersection Approach Lanes[1]

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; **<u>1</u>** = Improvement

[2] Per the Highway Capacity Manual (6th Edition), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross-street Stop; TS = Traffic Signal; **<u>TS</u>** = Improvement

This Page Intentionally Left Blank

6 HORIZON YEAR (2040) TRAFFIC CONDITIONS

This section discusses the methods used to develop Horizon Year (2040) Without and With Project traffic forecasts, and the resulting intersection operations and traffic signal warrant analyses.

6.1 ROADWAY IMPROVEMENTS

The lane configurations and traffic controls assumed to be in place for Horizon Year (2040) conditions are consistent with those shown previously on Exhibit 3-1, with the exception of the following:

- Project driveways and those facilities assumed to be constructed by the Project to provide site access are also assumed to be in place for Horizon Year conditions only (e.g., intersection and roadway improvements along the Project's frontage and driveways).
- Driveways and those facilities assumed to be constructed by cumulative developments to provide site access are also assumed to be in place for Horizon Year conditions only (e.g., intersection and roadway improvements along the cumulative development's frontages and driveways).
- Other parallel facilities, that although not evaluated for the purposes of this analysis, are anticipated to be in place for Horizon Year traffic conditions and would affect the travel patterns within the study area.

6.2 HORIZON YEAR (2040) WITHOUT PROJECT TRAFFIC VOLUME FORECASTS

This scenario includes the refined post-process volumes obtained from the SBTAM (see Section 4.8 *Horizon Year (2040) Volume Development* of this TA for a detailed discussion on the post-processing methodology). The weekday ADT and weekday AM and PM peak hour volumes which can be expected for Horizon Year (2040) Without Project traffic conditions are shown on Exhibit 6-1.

6.3 HORIZON YEAR (2040) WITH PROJECT TRAFFIC VOLUME FORECASTS

This scenario includes the refined post-process volumes obtained from the SBTAM, plus the traffic generated by the proposed Project. The weekday ADT and weekday AM and PM peak hour volumes which can be expected for Horizon Year (2040) With Project traffic conditions are shown on Exhibit 6-2.

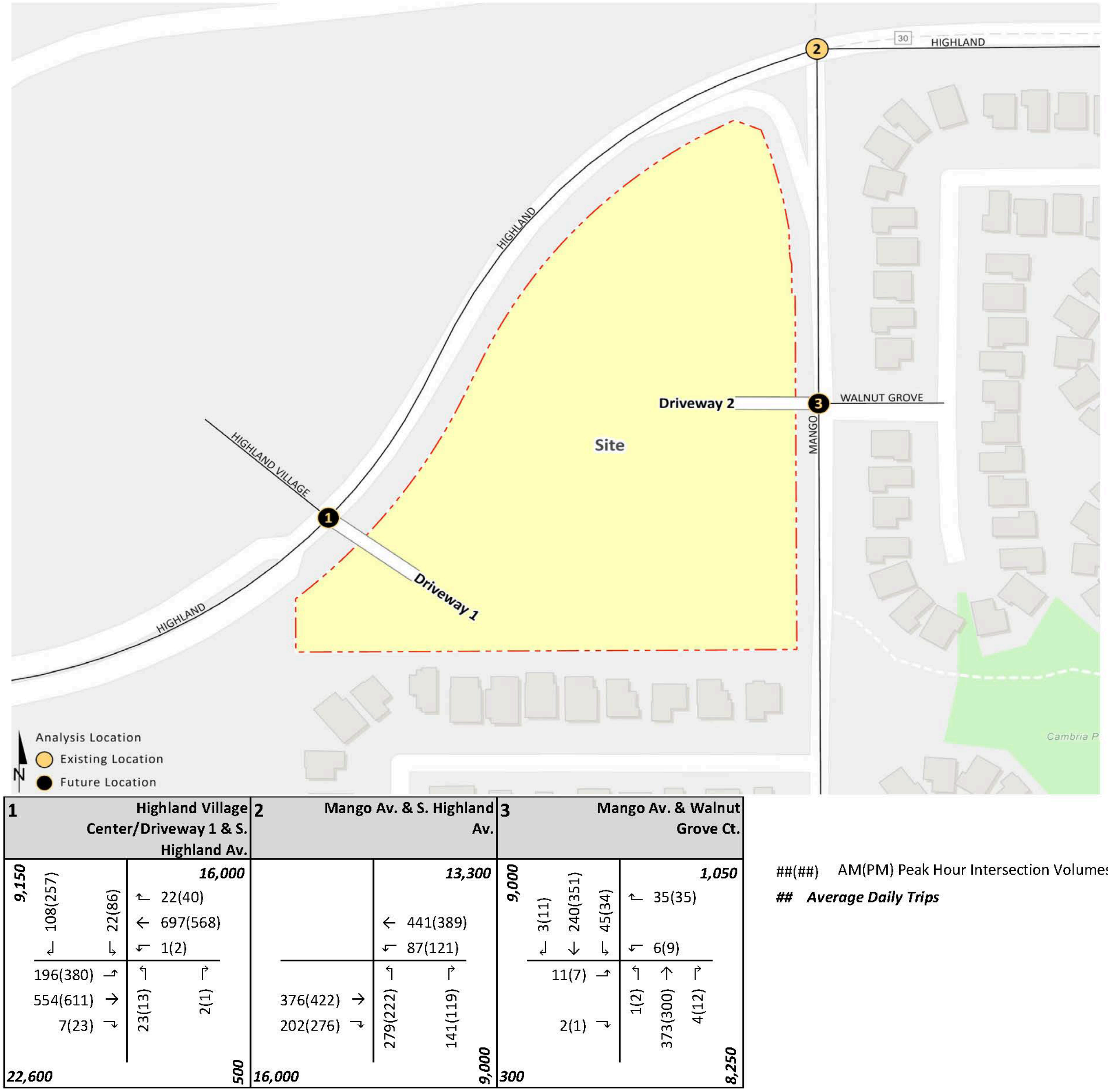
EXHIBIT 6-1: HORIZON YEAR (2040) WITHOUT PROJECT TRAFFIC VOLUMES

1 Highland Village Center/Driveway 1 & S. Highland Av.	2 Mango Av. & S. Highland Av.	3 Mango Av. & Walnut Grove Ct.
9,150; 15,850; 22,000	13,100; 15,850; 8,750	8,750; 1,050; 8,200
108(257); 22(86)		240(351); 45(34)
22(40); 691(565)	440(387); 85(115)	35(35); 6(9)
196(380); 552(605)	374(421); 200(270)	
	273(219); 135(116)	373(300); 4(12)

##(##) AM(PM) Peak Hour Intersection Volumes

Average Daily Trips

EXHIBIT 6-2: HORIZON YEAR (2040) WITH PROJECT TRAFFIC VOLUMES



6.4 INTERSECTION OPERATIONS ANALYSIS

6.4.1 HORIZON YEAR (2040) WITHOUT PROJECT TRAFFIC CONDITIONS

LOS calculations were conducted for the study intersections to evaluate their operations under Horizon Year (2040) Without Project conditions with roadway and intersection geometrics consistent with Section 6.1 *Roadway Improvements*. As shown on Table 6-1, the following study area intersection is anticipated to operate at an unacceptable LOS under Horizon Year (2040) Without Project traffic conditions:

- Mango Avenue & Highland Avenue (#2) – LOS F AM and PM peak hours

The intersection operations analysis worksheets for Horizon Year (2040) Without Project traffic conditions are included in Appendix 6.1 of this TA.

6.4.2 HORIZON YEAR (2040) WITH PROJECT TRAFFIC CONDITIONS

As shown on Table 6-1, there are no additional study area intersections anticipated to operate at a deficient LOS during one or both peak hours for Horizon Year (2040) With Project traffic conditions, in addition to the locations identified above for Horizon Year (2040) Without Project traffic conditions. The intersection operations analysis worksheets for Horizon Year (2040) With Project traffic conditions are included in Appendix 6.2 of this TA.

TABLE 6-1: INTERSECTION ANALYSIS FOR HORIZON YEAR (2040) CONDITIONS

			2040 Without Project				2040 With Project			
		Traffic	Delay[1] (secs.)		Level of Service		Delay[1] (secs.)		Level of Service	
#	Intersection	Control[2]	AM	PM	AM	PM	AM	PM	AM	PM
1	Highland Village Ctr./Driveway 1 & Highland Av.	TS	10.7	20.9	B	c	14.6	23.5	B	C
2	Mango Av. & Highland Av.	CSS	**182.0**	**176.5**	**F**	**F**	**205.5**	**202.5**	**F**	**F**
3	Mango Av. & Driveway 2/Walnut Grove Ct.	CSS	11.9	11.8	B	B	17.3	17.7	C	C

BOLD = LOS does not meet the applicable jurisdictional requirements (i.e., unacceptable LOS).

1 Per the Highway Capacity Manual (6th Edition), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown. HCM delay reported in seconds.

2 TS = Traffic Signal; CSS = Cross-Street Stop

6.5 TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic signal warrants have been performed (based on CA MUTCD) for Horizon Year (2040) traffic conditions based on peak hour intersection turning movements volumes or planning level (ADT) volumes. There is no additional unsignalized study area intersection anticipated to meet a traffic signal warrant under Horizon Year (2040) Without Project or With Project traffic conditions, in addition to the intersection identified previously under Existing (2021) traffic conditions (see Appendices 6.3 and 6.4).

6.6 DEFICIENCIES AND IMPROVEMENTS

This section provides a summary of deficiencies, based on the City of Fontana's deficiency criteria discussed in Section 2.5 *Deficiency Criteria*, and improvements needed to improve operations back to acceptable levels. The effectiveness of the recommended improvement strategies to address Horizon Year (2040) traffic deficiencies are presented in Table 6-2. Worksheets for Horizon Year (2040) With Project conditions, with improvements, HCM calculation worksheets are provided in Appendix 6.5.

TABLE 6-2: INTERSECTION ANALYSIS FOR HORIZON YEAR (2040) CONDITIONS WITH IMPROVEMENTS

			Intersection Approach Lanes[1]												Delay[2] (secs.)		Level of Service	
		Traffic	Northbound			Southbound			Eastbound			Westbound						
#	Intersection	Control[3]	L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM
2	Mango Av. & Highland Av.																	
	Without Improvements:	CSS	0	1	0	0	0	0	0	2	1	0	2	0	**205.5**	**202.5**	**F**	**F**
	With Improvements:	TS	1	0	1	0	0	0	0	2	1	1	2	0	11.9	12.6	B	B

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; 1 = Improvement

[2] Per the Highway Capacity Manual (6th Edition), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross-street Stop; TS = Traffic Signal; TS = Improvement

This Page Intentionally Left Blank

7 LOCAL AND REGIONAL FUNDING MECHANISMS

Transportation improvements within the City of Fontana are funded through a combination of direct project mitigation, development impact fee programs or fair share contributions, such as the City of Fontana DIF program. Identification and timing of needed improvements is generally determined through local jurisdictions based upon a variety of factors.

7.1 MEASURE "I" FUNDS

In 2004, the voters of San Bernardino County approved the 30-year extension of Measure "I", a one-half of one percent sales tax on retail transactions, through the year 2040, for transportation projects including, but not limited to, infrastructure improvements, commuter rail, public transit, and other identified improvements. The Measure "I" extension requires that a regional traffic impact fee be created to ensure development is paying its fair share. A regional Nexus study was prepared by SBCTA and concluded that each jurisdiction should include a regional fee component in their local programs in order to meet the Measure "I" requirement. The regional component assigns specific facilities and cost sharing formulas to each jurisdiction and was most recently updated in May 2018. Revenues collected through these programs are used in tandem with Measure "I" funds to deliver projects identified in the Nexus Study.

While Measure "I" is a self-executing sales tax administered by SBCTA, it bears discussion here because the funds raised through Measure "I" have funded in the past and will continue to fund new transportation facilities in San Bernardino County, including within the City of Fontana.

7.2 CITY OF FONTANA DEVELOPMENT IMPACT FEE (DIF)

The City of Fontana adopted the latest update to their DIF program in September 2019. Fees from new residential, commercial and industrial development are collected to fund Measure "I" compliant regional facilities as well as local facilities. Under the City's DIF program, the City may grant to developers a credit against specific components of fees when those developers construct certain facilities and landscaped medians identified in the list of improvements funded by the DIF program.

After the City's DIF fees are collected, they are placed in a separate restricted use account pursuant to the requirements of Government Code sections 66000 *et seq*. The timing to use the DIF fees is established through periodic capital improvement programs which are overseen by the City's Engineering Department. Periodic traffic counts, review of traffic accidents, and a review of traffic trends throughout the City are also periodically performed by City staff and consultants. The City uses this data to determine the timing of the improvements listed in its facilities list. The City also uses this data to ensure that the improvements listed on the facilities list are constructed before the LOS falls below the LOS performance standards adopted by the City. In this way, the improvements are constructed before the LOS falls below the City's LOS performance thresholds. The City's DIF program establishes a timeline to fund, design, and build the improvements.

7.3 FAIR SHARE CONTRIBUTION

Project improvements may include a combination of fee payments to established programs, construction of specific improvements, payment of a fair share contribution toward future improvements or a combination of these approaches. Improvements constructed by development may be eligible for a fee credit or reimbursement through the program where appropriate (to be determined at the City's discretion). When off-site improvements are identified with a minor share of responsibility assigned to proposed development, the approving jurisdiction may elect to collect a fair share contribution or require the development to construct improvements. Detailed fair share calculations, for each peak hour, have been provided in Table 7-1 for the applicable deficient study area intersection for both Opening Year Cumulative and Horizon Year (2040) traffic conditions. These fees are collected with the proceeds solely used as part of a funding mechanism aimed at ensuring that regional highways and arterial expansions keep pace with the projected population increases.

TABLE 7-1: PROJECT FAIR SHARE CALCULATIONS

#	Intersection	Existing	Project	2023 With Project	Total New Traffic	Project % of New Traffic
2	Mango Av. & Highland Av.					
	AM:	1,044	19	1,258	214	8.9%
	PM:	1,085	21	1,278	193	**10.9%**

#	Intersection	Existing	Project	2040 With Project	Total New Traffic	Project % of New Traffic
2	Mango Av. & Highland Av.					
	AM:	1,044	19	1,526	482	3.9%
	PM:	1,085	21	1,549	464	**4.5%**

BOLD = Highest fair share percentage is highlighted.

8 VEHICLE MILES TRAVELED

Changes to California Environmental Quality Act (CEQA) Guidelines were adopted in December 2018, which require all lead agencies to adopt VMT as a replacement for automobile delay-based level of service (LOS) as the measure for identifying transportation impacts for land use projects. This statewide mandate went into effect July 1, 2020. To aid in this transition, the Governor's Office of Planning and Research (OPR) released a Technical Advisory on Evaluating Transportation Impacts in CEQA (December of 2018) (**Technical Advisory**). (5) Based on OPR's Technical Advisory, the San Bernardino County Transportation Authority (SBCTA) released to each of its member agencies Recommended Traffic Impact Analysis Guidelines for Vehicle Miles Traveled and Level of Service Assessment (**SBCTA Guidelines**) (6), which provided a template of specific procedures for complying with the new CEQA requirements for VMT analysis. (6) Based on the SBCTA Guidelines, the City of Fontana adopted Traffic Impact Analysis Guidelines for Vehicle Miles Traveled and Level of Service Assessment (**City Guidelines**) (7), which documents the City's VMT analysis methodology and approved impact thresholds. The VMT screening evaluation presented in this report has been developed based on the adopted City Guidelines.

8.1 PROJECT SCREENING

The City Guidelines describe specific "screening thresholds" that can be used to identify when a proposed land use project is anticipated to result in a less than significant impact without conducting a more detailed project level VMT analysis. Screening thresholds are described in the following four steps:

- Step 1: Transit Priority Area (TPA) Screening
- Step 2: Low VMT Area Screening
- Step 3: Low Project Type Screening
- Step 4: Project net daily trips less than 500 ADT

Consistent with City Guidelines a land use project needs only to satisfy one of the above screening thresholds to result in a less than significant impact.

For the purposes of this analysis, the initial VMT screening process has been conducted with the SBCTA VMT Screening Tool (**Screening Tool**), which uses screening criteria consistent with the screening thresholds recommended in the Technical Advisory and City Guidelines.

8.1.1 STEP 1: TPA SCREENING

Consistent with guidance identified in the City Guidelines, projects located within a Transit Priority Area (TPA) (i.e., within ½ mile of an existing "major transit stop"[1] or an existing stop along

[1] Pub. Resources Code, § 21064.3 ("'Major transit stop' means a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods.").

a "high-quality transit corridor"[2]) may be presumed to have a less than significant impact absent substantial evidence to the contrary. However, the presumption may not be appropriate if a project:

- Has a Floor Area Ratio (FAR) of less than 0.75;
- Includes more parking for use by residents, customers, or employees of the project than required by the jurisdiction (if the jurisdiction requires the project to supply parking);
- Is inconsistent with the applicable Sustainable Communities Strategy (as determined by the lead agency, with input from the Metropolitan Planning Organization); or
- Replaces affordable residential units with a smaller number of moderate- or high-income residential units.

Based on the Screening Tool results presented in Attachment A, the Project site is not located within ½ mile of an existing major transit stop, or along a high-quality transit corridor.

TPA screening criteria is not met.

8.1.2 STEP 2: LOW VMT AREA SCREENING

As noted in the City Guidelines, "Residential and office projects located within a low VMT-generating area may be presumed to have a less than significant impact absent substantial evidence to the contrary. In addition, other employment-related and mixed-use land use projects may qualify for the use of screening if the project can reasonably be expected to generate VMT per resident, per worker, or per service population that is similar to the existing land uses in the low VMT area." [3] The Screening Tool uses the sub-regional San Bernardino County Transportation Analysis Model (SBTAM) to measure VMT performance within San Bernardino County for individual traffic analysis zones (TAZ's) within each city. The Project's physical location based on APN is input into the Screening Tool to determine the VMT generated within the respective TAZ as compared to the jurisdictional average inclusive of a particular threshold (e.g., 15% below baseline County of San Bernardino VMT per service population). The results are displayed in Attachment A, which indicates that the Project TAZ generates 25.7 VMT per service population for baseline conditions. SBCTA maintains baseline and horizon year VMT per service population values for each of its member agencies as calculated from the SBTAM model. Urban Crossroads has obtained these values from SBCTA to use in this assessment. The baseline County of San Bernardino VMT per service population is 32.7. The Project's TAZ is found to generate VMT per service population at a level of 21.4% below the baseline County of San Bernardino.

Low VMT Area screening criteria is met.

8.1.3 STEP 3: LOW PROJECT TYPE SCREENING

The City Guidelines identify that local serving retail with buildings less than 50,000 square feet or other local serving essential services (e.g., day care centers, public schools, medical/dental office

[2] Pub. Resources Code, § 21155 ("For purposes of this section, a high-quality transit corridor means a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours.").
[3] City Guidelines; Page 12.

buildings, etc.) are presumed to have a less than significant impact absent substantial evidence to the contrary. The proposed Project is not considered a local serving use based on the examples provided in the City Guidelines.[4]

Low Project Type screening criteria is not met.

8.1.4 Step 4: Project Net Daily Trips Less Than 500 ADT Screening

Projects that generate fewer than 500 average daily trips (ADT) (stated in actual vehicles) are deemed to not cause a substantial increase in the total citywide or regional VMT and are therefore presumed to have a less than significant impact on VMT. Substantial evidence in support this daily trip threshold is documented in the City Guidelines.[5] Trip generation rates and a summary of daily vehicle trips for the Project are presented in Attachment B of this memorandum. The trip generation rates used for this analysis are based on the trip generation statistics published in the Institute of Transportation Engineer (ITE) Trip Generation Manual (10th Edition, 2017). (8) The Project anticipated to generate 784 vehicle trip-ends per day which would exceed the City's screening threshold of 500 ADT.

Project net daily trips less than 500 ADT screening criteria is not met.

8.2 Conclusion

The Project was found to meet the low VMT screening criteria. In addition, the Project is consistent with the adopted General Plan and is consistent with the growth projections assumed in the regional RTP/SCS. Therefore, the Project would result in a less than significant impact for VMT; no further VMT analysis required.

[4] City Guidelines; Page 13.
[5] City Guidelines; Appendix B.

This Page Intentionally Left Blank

9 REFERENCES

1. **City of Fontana Public Works Department.** *Traffic Impact Analysis (TIA) Guidelines for Vehicle Miles Traveled (VMT) and Level of Service Assessment.* Fontana : s.n., October 21, 2020.
2. **Institute of Transportation Engineers.** *Trip Generation Manual.* 10th Edition. 2017.
3. **Transportation Research Board.** *Highway Capacity Manual (HCM).* 6th Edition. s.l. : National Academy of Sciences, 2016.
4. **California Department of Transportation.** California Manual on Uniform Traffic Control Devices (MUTCD). [book auth.] California Department of Transportation. *California Manual on Uniform Traffic Control Devices (CAMUTCD).* 2017.
5. **Office of Planning and Research.** *Technical Advisory on Evaluating Transportation Impacts in CEQA.* State of California : s.n., December 2018.
6. **San Bernardino County Transportation Authority (SBCTA).** *Recommended Traffic Impact Analysis Guidelines for Vehicle Miles Traveled and Level of Service Assessment.* February 2020.
7. **City of Fontana Traffic Engineering Division.** *Traffic Impact Analysis Guidelines for Vehicle Miles Traveled and Level of Service Assessment.* City of Fontana : s.n., October 2020.
8. **Institute of Transportation Engineers.** *Trip Generation Manual.* 10th Edition. 2017.

This Page Intentionally Left Blank

APPENDIX 1.1:

APPROVED TRAFFIC STUDY SCOPING AGREEMENT

This Page Intentionally Left Blank

Exhibit B

SCOPING AGREEMENT FOR TRAFFIC IMPACT STUDY

This letter acknowledges the City of Fontana Engineering Department requirements for traffic impact analysis of the following project. The analysis must follow the SBCTA Congestion Management Plan (CMP) Guidelines Updated 2016.

Case No. (i.e. TR, PM, CUP, PP) PAM21-054
Related Cases -
SP No. ______
EIR No. ______
GPA No. ______
CZ No. ______
Project Name: Mango & South Highland Residential
Project Address: Southwest corner of Mango Avenue and S. Highland Avenue
Project Description: 107 multifamily (low-rise) housing dwelling units

	Consultant	Developer
Name:	URBAN CROSSROADS, INC. - Charlene So	FRONTIER ENTERPRISES
Address:	1133 Camelback Street, #8329	2151 E. Convention Center Dr. Suite 114
	Newport Beach, CA 92658	Ontario, CA 91764
Telephone:	(949) 861-0177	
Fax:		

A. Trip Generation Source: (ITE 10th Edition)

Current GP Land Use	C-C Community Com.	Proposed Land Use	MDR
Current Zoning	Walnut Village SP	Proposed Zoning	Walnut Village SP

	Current Trip Generation In	Out	Total	Proposed Trip Generation In	Out	Total
AM Trips				11	38	49
PM Trips				38	22	60

Internal Trip Allowance ☐ Yes ☑ No (______ % Trip Discount)
Pass-By Trip Allowance ☐ Yes ☑ No (______ % Trip Discount)

A pass-by trip discount is allowed for appropriate land uses per ITE trip generation handbook 3rd edition. The pass-by trips at adjacent study area intersections and project driveways shall be indicated on a report figure. (Attach table for detailed trip generation)

B. Trip Geographic Distribution: N 0 % S 5 % E 20 % W 75 %
(attach exhibit for detailed assignment)

C. Background Traffic

Project Opening & Future Build-Out Year: 2023 Annual Ambient Growth Rate: 1.16 %

Phase Year(s) 2023
Other area projects to be analyzed: Requested City to provide updated list. Also requested from Rialto.

Model/Forecast methodology SBTAM

Exhibit B – Scoping Agreement – Page 2

D. Study intersections: *(NOTE: Subject to revision after other projects, trip generation and distribution are determined, or comments from other agencies.)*

1. Driveway 1/Highland Village Ctr. & S. Highland Av.
2. Mango Av. & S. Highland Av.
3. Mango Av. & Driveway 2/Walnut Grove Ct.
4. ______
5. ______
6. ______
7. ______
8. ______
9. ______
10. ______

E. Study Roadway Segments: *(NOTE: Subject to revision after other projects, trip generation and distribution are determined, or comments from other agencies.)*

1. Not Applicable
2. ______
3. ______
4. ______
5. ______
6. ______
7. ______
8. ______
9. ______
10. ______

E. Other Jurisdictional Impacts

Is this project within a City's Sphere of Influence or one-mile radius of City boundaries? ☑ Yes ☐ No

If so, name of City Jurisdiction: City of Rialto & I-210 Ramps at Sierra (Caltrans)

F. Site Plan (please attach reduced copy)

G. Specific issues to be addressed in the Study (in addition to the standard analysis described in the Guideline) (To be filled out by Engineering Department)
(NOTE: If the traffic study states that "a traffic signal is warranted" (or "a traffic signal appears to be warranted," or similar statement) at an existing unsignalized intersection under existing conditions, 8-hour approach traffic volume information must be submitted in addition to the peak hourly turning movement counts for that intersection.)

See Attached Memo

H. Existing Conditions

Traffic count data must be new or recent. Provide traffic count dates if using other than new counts.
Date of counts Historic counts plus new counts (adjusted to pre-COVID conditions)

I. VMT Assessment

Provide VMT screening/assessment per the latest TIA & VMT Guidelines.

NOTE* Traffic Study Submittal Form and appropriate fee must be submitted with, or prior to submittal of this form. Transportation Department staff will not process the Scoping Agreement prior to receipt of the fee.

Recommended by:

Charlene So — 5/28/21
Consultant's Representative — Date

Scoping Agreement Submitted on 5/19/21

Revised on 5/28/21

Approved Scoping Agreement:

Mahmoud Khodr — 6/1/2021
City of Fontana Traffic Engineer — Date

May 28, 2021

Mr. Mahmoud Khodr
City of Fontana
8353 Sierra Avenue
Fontana, CA 92335

SUBJECT: SCOPING AGREEMENT FOR THE MANGO & SOUTH HIGHLAND RESIDENTIAL TRAFFIC ANALYSIS

Dear Mr. Mahmoud Khodr:

The firm of Urban Crossroads, Inc. is pleased to submit this letter documenting the recommended Scope of Work for the traffic analysis in support of the proposed Mango & South Highland Residential development (**Project**), which is located on the southwest corner of Mango Avenue and South Highland Avenue in the City of Fontana. Exhibit 1 depicts the location of the proposed Project in relation to the existing roadway network. Our goal is to obtain comments from City of Fontana staff, to ensure that the traffic assessment fully addresses the potential impacts of the proposed Project. The remainder of this letter describes the draft proposed analysis methodology, project trip generation, trip distribution, and project traffic assignment/project trips on the surrounding roadway network, which have been used to establish the draft proposed project study area and analysis locations.

PROJECT DESCRIPTION

The proposed Project includes the development of 107 multifamily housing (low-rise) dwelling units. The proposed Project is anticipated to have an Opening Year of 2023. The preliminary site plan for the proposed Project is shown on Exhibit 2. As indicated on Exhibit 2, access to the Project site will be provided to S. Highland Avenue via Driveway 1 (opposite the existing signalized entry into the Highland Village Center) and Mango Avenue via Driveway 2 (to align with the existing Walnut Grove Court). Both driveways will allow for full turning movements.

STUDY AREA

The purpose of this traffic analysis is to evaluate the peak hour operations of study area intersections based on the proposed distribution of Project traffic. Exhibit 3 presents the proposed study area intersection analysis locations (and listed on Table 1). The study area intersections will be evaluated using the HCM 6th Edition methodology.

TABLE 1: STUDY AREA INTERSECTIONS

#	Intersection
1	Highland Village Center/Driveway 1 & S. Highland Av.
2	Mango Av. & S. Highland Av.
3	Mango Av. & Walnut Grove Ct.

ANALYSIS SCENARIOS

The analysis of peak hour operations at study area intersections will be provided for the following analysis scenarios (analysis based on HCM 6th Edition):

- Existing (2021) Conditions
- Opening Year Cumulative (2023) Without and With Project
- Horizon Year (2040) Without and With Project

EXISTING COUNT DATA

Due to the currently ongoing COVID-19 pandemic, historic traffic count data for the study area intersections that we collected during the **weekday AM** (7-9AM) and **weekday PM** (4-6PM) under pre-pandemic traffic conditions will be utilized. Counts utilized will have been conducted when local schools were in session and operating on normal bell schedules. An ambient growth rate of 1.16 percent per year is proposed to adjust the historic count data to the current baseline year (2021). The growth rate is based on the average growth for population (1.06% per year), households (1.43% per year), and employment (0.97% per year) between 2016 and 2045 in the 2020 SCAG RTP/SCS for the City of Fontana (Connect SoCal, adopted September 3, 2020).

For study area intersections where historic traffic count data is unavailable, new traffic counts will be conducted at those locations in addition to key locations where historic count data is available. An adjustment factor will be calculated based on a comparison of the adjusted 2021 (using historic counts) and current 2021 traffic counts. This adjustment factor will then be applied to the 2021 counts for all study area intersections where historic count data is not available in order to establish a non-COVID baseline.

TRIP GENERATION

Trip generation represents the amount of traffic that is attracted and produced by a development and is based upon the specific land uses planned for a given project. In order to develop the traffic characteristics of the proposed project, trip-generation statistics published in the Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition, 2017) was used to estimate the trip generation. Trip generation rates for the Project are shown in Table 2. The trip generation summary for the Project is also shown on Table 2. As shown on Table 2, the Project is anticipated to generate a total of 784 two-way trips per day with 49 AM peak hour trips and 60 PM peak hour trips.

TABLE 2: PROJECT TRIP GENERATION SUMMARY

Land Use[1]	ITE LU Code	Units[2]	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	Daily
Project Trip Generation Rates:									
Multifamily Housing (Low-Rise)	220	DU	0.11	0.35	0.46	0.35	0.21	0.56	7.32

Land Use	Quantity	Units[2]	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	Daily
Project Trip Generation Summary:									
Multifamily Housing	107	DU	11	38	49	38	22	60	784

[1] Trip Generation Source: Institute of Transportation Engineers (ITE), Trip Generation Manual, Tenth Edition (2017).
[2] DU = Dwelling Units

TRIP DISTRIBUTION

Trip distribution is the process of identifying the probable destinations, directions, or traffic routes that will be utilized by Project traffic. The potential interaction between the planned land uses and surrounding regional access routes are considered, to identify the route where the Project traffic would distribute. Exhibit 4 illustrates the Project trip distribution patterns.

LEVEL OF SERVICE (LOS) CRITERIA

The City of Fontana has set the goal for acceptable LOS as LOS C or better, wherever feasible (see Goal #1, Policy #12 of the City of Fontana General Plan Circulation Element). However, in some instances maintaining the LOS C threshold within a built environment may require extensive roadway widening that could affect existing uses, property rights and substantial costs associated with implementing these improvements. In the event that the improvements required to maintain LOS C is determined to be infeasible, the City of Fontana recognizes that LOS D may be considered the worst acceptable level of service in urbanized areas of the City.

DEFICIENCY CRITERIA – INTERSECTIONS

For the intersections that lie within the City of Fontana, determination of whether the Project has an adverse effect on intersection operations will be based on a comparison of without and with project levels of service. A deficiency occurs if project traffic increases the average delay at an intersection by more than the thresholds identified on Table 3. The thresholds for LOS A, B, and C do not apply to projects consistent with the General Plan. The deficiency criteria will be applied to Opening Year Cumulative traffic conditions to determine off-site construct obligations and will recommend improvements needed to reduce delays to pre-project conditions (as applicable).

TABLE 3: INTERSECTION DEFICIENCY CRITERIA

Pre-Project LOS	Deficiency Criteria[1]
LOS A/B	10.0 Seconds
LOS C	8.0 Seconds
LOS D	5.0 Seconds
LOS E	2.0 Seconds
LOS F	1.0 Second

[1] Increase in delay.

AMBIENT GROWTH

Consistent with other studies performed in the area, an ambient growth rate of 1.16% per year is proposed for the study area intersections to approximate background traffic growth not identified by nearby cumulative development projects. The rate will be compounded over a two-year period for Phase 1 (i.e., 1.0116^{2years} = 1.0233 or 2.33% for 2023). Horizon Year (2040) traffic forecasts will be based on post-processed and refined forecasts from the San Bernardino County Transportation Analysis Model (SBTAM).

SPECIAL ISSUES

The following special issues will also be addressed as part of the focused traffic assessment:

- Conduct traffic signal warrant analysis for all existing and future unsignalized study area intersections (Mango Avenue at S. Highland Avenue and Mango Avenue at Driveway 2).
- Provide a queuing analysis for applicable Project driveways and site adjacent intersections of Mango Avenue and S. Highland Avenue.
- A VMT assessment has been prepared under separate cover.

OPEN ITEMS – CUMULATIVE DEVELOPMENT PROJECTS

We request that City staff provide a list/map of cumulative projects for inclusion in the traffic study. We have already reached out to the City of Rialto for any relative cumulative projects within their jurisdiction.

SIGNAL TIMING

It is requested that the City provide any signal timing that should be considered for signalized study area intersections within the City.

The analysis findings and recommendations (if applicable) will be presented in a draft report for the City's review. If you have any questions, please contact me directly at (949) 861-0177.

Respectfully submitted,

Charlene So

Charlene So, PE
Associate Principal

EXHIBIT 1: LOCATION MAP

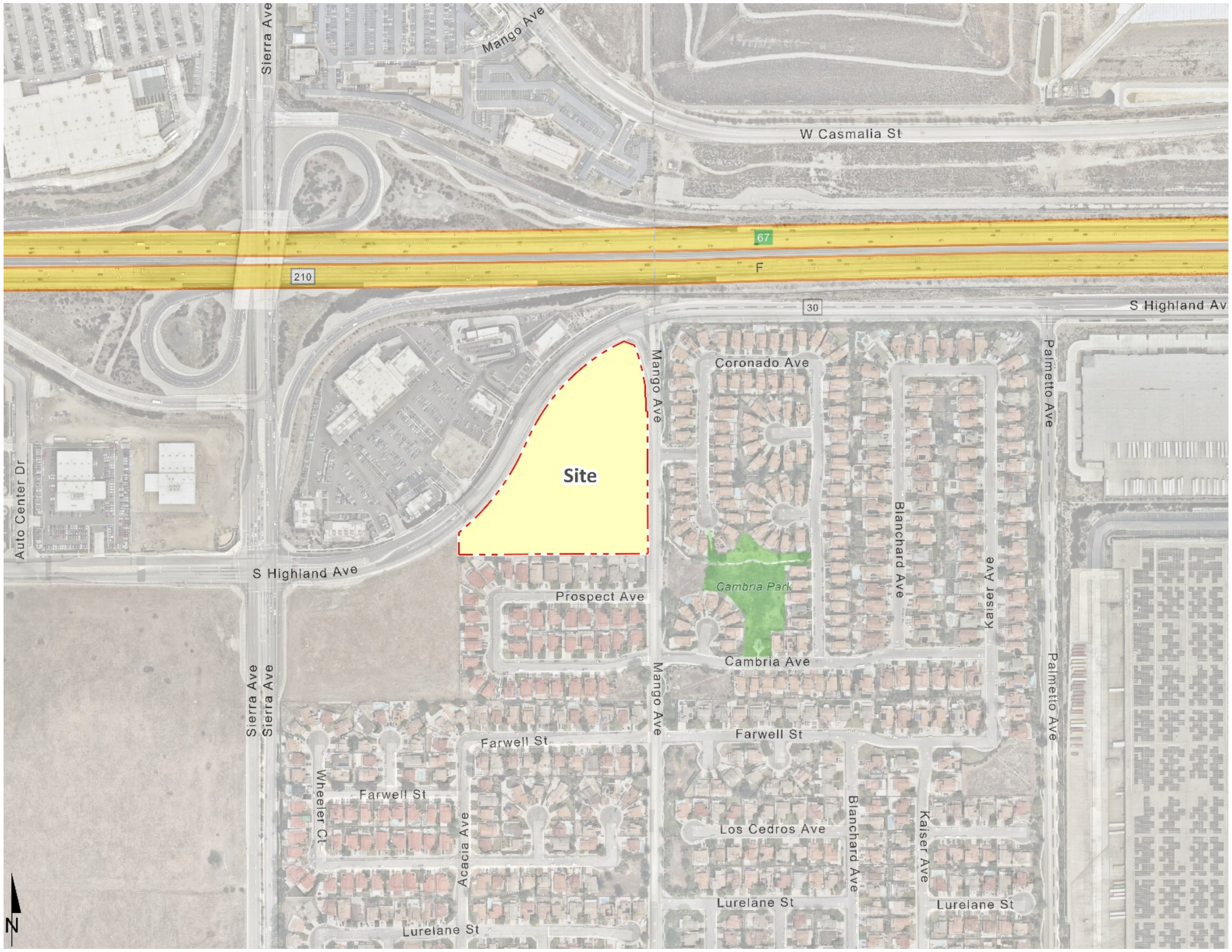
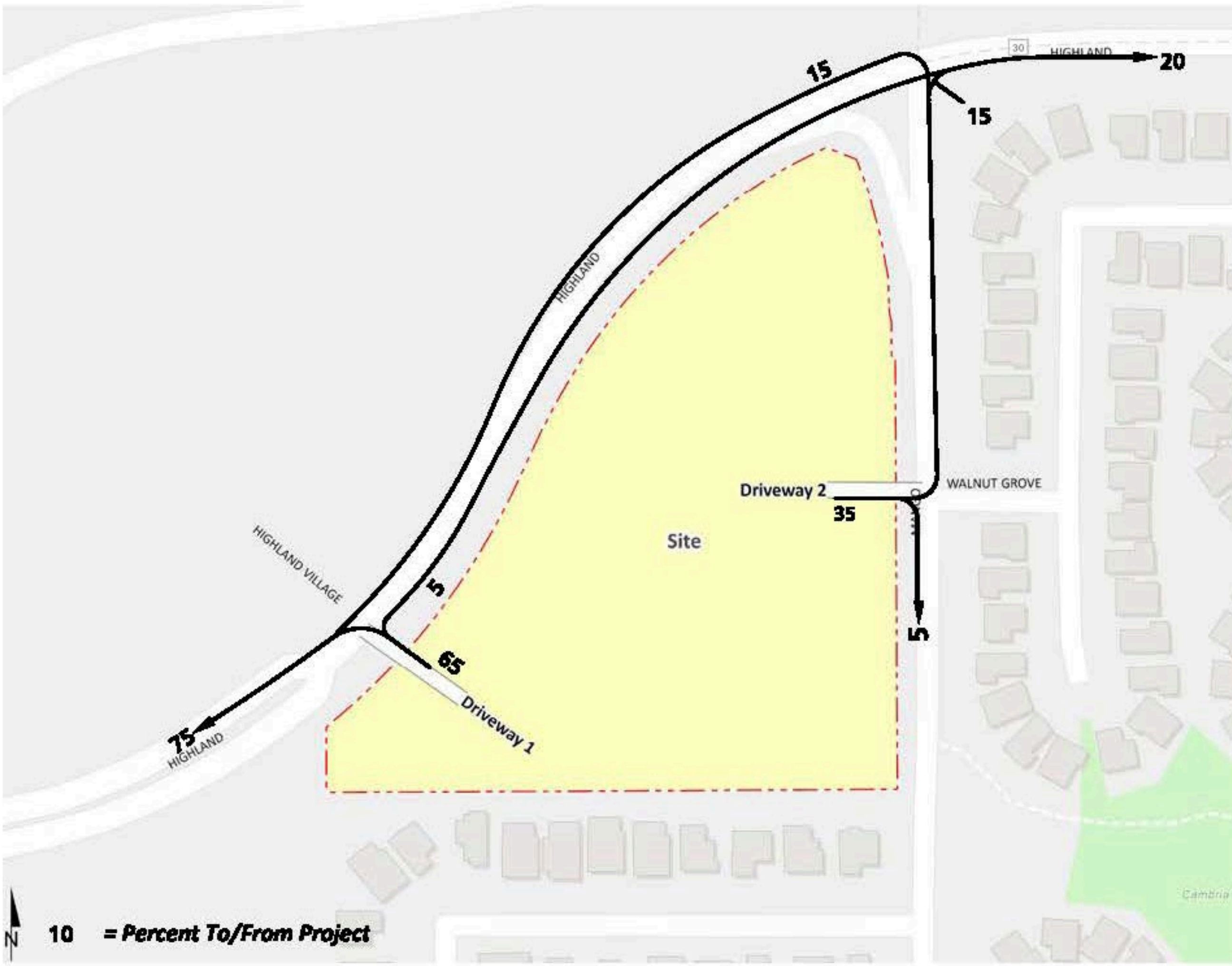


EXHIBIT 2: PRELIMINARY SITE PLAN

EXHIBIT 3: STUDY AREA

EXHIBIT 4: PROJECT TRIP DISTRIBUTION



This Page Intentionally Left Blank

APPENDIX 1.2:

SITE ADJACENT QUEUING WORKSHEETS

This Page Intentionally Left Blank

Intersection: 1: Driveway 1/Highland Village Ctr. & Highland Av.

Movement	EB	EB	EB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	LTR	L	TR
Maximum Queue (ft)	179	103	138	6	182	191	36	51	79
Average Queue (ft)	80	37	44	0	96	101	14	17	40
95th Queue (ft)	143	80	95	4	152	158	40	44	72
Link Distance (ft)		746	746		812	812	115	155	155
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	220			100					
Storage Blk Time (%)	0				6				
Queuing Penalty (veh)	0				0				

Intersection: 2: Mango Av. & Highland Av.

Movement	EB	EB	EB	WB	WB	WB	NB
Directions Served	T	T	R	L	T	T	LR
Maximum Queue (ft)	143	120	97	117	133	111	214
Average Queue (ft)	78	59	46	46	66	43	116
95th Queue (ft)	126	107	79	86	111	87	193
Link Distance (ft)	812	812			1313	1313	383
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			225	200			
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 3: Mango Av. & Driveway 2/Walnut Grove Ct.

Movement	EB	WB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	30	46	63
Average Queue (ft)	9	21	15
95th Queue (ft)	30	45	47
Link Distance (ft)	77	135	383
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 1: Driveway 1/Highland Village Ctr. & Highland Av.

Movement	EB	EB	EB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	LTR	L	TR
Maximum Queue (ft)	291	263	149	15	154	155	46	94	131
Average Queue (ft)	158	46	54	1	100	100	8	43	66
95th Queue (ft)	252	152	108	7	145	146	31	88	112
Link Distance (ft)		746	746		812	812	115	155	155
Upstream Blk Time (%)									0
Queuing Penalty (veh)									0
Storage Bay Dist (ft)	220			100					
Storage Blk Time (%)	3	0			9				
Queuing Penalty (veh)	8	0			0				

Intersection: 2: Mango Av. & Highland Av.

Movement	EB	EB	EB	WB	WB	WB	NB
Directions Served	T	T	R	L	T	T	LR
Maximum Queue (ft)	117	133	100	147	100	78	192
Average Queue (ft)	64	63	52	61	48	30	100
95th Queue (ft)	100	111	84	111	84	66	170
Link Distance (ft)	812	812			1313	1313	383
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			225	200			
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 3: Mango Av. & Driveway 2/Walnut Grove Ct.

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	29	59	14	75
Average Queue (ft)	5	26	1	12
95th Queue (ft)	23	53	8	49
Link Distance (ft)	77	135	457	383
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 8

APPENDIX 3.1:

EXISTING & HISTORICAL TRAFFIC COUNTS

This Page Intentionally Left Blank

T816

INTERSECTION TURNING MOVEMENT COUNTS

PREPARED BY: AimTD LLC. tel: 714 253 7888 cs@aimtd.com

DATE:	LOCATION:	Fontana	PROJECT #:	SC2935
Thu, Jun 3, 21	NORTH & SOUTH:	Driveway	LOCATION #:	1
	EAST & WEST:	Highland	CONTROL:	SIGNAL

NOTES:

AM
PM
MD
OTHER
OTHER

▲ N
◄ W
E ►
S ▼

Add U-Turns to Left Turns

	NORTHBOUND Driveway			SOUTHBOUND Driveway			EASTBOUND Highland			WESTBOUND Highland				U-TURNS					RTOR			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	NB	SB	EB	WB	TTL	NRR	SRR	ERR	WRR
LANES:	X	X	X	1	X	1	1	2	X	X	2	0		0	0	0	0		X	0	X	0
AM																						
7:00 AM	0	0	0	2	0	9	12	37	0	0	49	1	110	0	0	0	0	0	0	5	0	0
7:15 AM	0	0	0	3	0	9	11	41	0	0	68	0	132	0	0	0	0	0	0	6	0	0
7:30 AM	0	0	0	1	0	8	20	36	0	0	72	1	138	0	0	0	0	0	0	6	0	0
7:45 AM	0	0	0	4	0	13	26	45	0	0	76	2	166	0	0	2	0	2	0	9	0	0
8:00 AM	0	0	0	1	0	17	19	60	0	0	69	2	168	0	0	0	0	0	0	13	0	1
8:15 AM	0	0	0	4	0	8	16	28	0	0	64	2	122	0	0	0	0	0	0	4	0	0
8:30 AM	0	0	0	3	0	9	23	38	0	0	81	3	157	0	0	0	0	0	0	4	0	1
8:45 AM	0	0	0	1	0	16	33	68	0	0	70	3	191	0	0	0	0	0	0	9	0	1
VOLUMES	0	0	0	19	0	89	160	353	0	0	549	14	1,184	0	0	2	0	2	0	56	0	3
APPROACH %	0%	0%	0%	18%	0%	82%	31%	69%	0%	0%	98%	2%										
APP/DEPART	0	/	172	108	/	0	513	/	372	563	/	640	0									
BEGIN PEAK HR		8:00 AM																				
VOLUMES	0	0	0	9	0	50	91	194	0	0	284	10	638						0	30	0	3
APPROACH %	0%	0%	0%	15%	0%	85%	32%	68%	0%	0%	97%	3%										
PEAK HR FACTOR		0.000			0.819			0.705			0.875		0.835									
APP/DEPART	0	/	101	59	/	0	285	/	203	294	/	334	0									
PM																						
04:00 PM	0	0	0	11	0	49	67	99	0	0	77	8	311	0	0	1	0	1	0	31	0	3
4:15 PM	0	0	0	19	0	35	86	98	0	0	81	11	330	0	0	1	0	1	0	19	0	1
4:30 PM	0	0	0	14	0	49	75	97	0	0	82	10	327	0	0	0	0	0	0	24	0	5
4:45 PM	0	0	0	17	0	46	78	95	0	0	72	11	319	0	0	0	0	0	0	30	0	4
5:00 PM	0	0	0	18	0	47	71	96	0	0	80	3	315	0	0	0	0	0	0	28	0	0
5:15 PM	0	0	0	15	0	53	87	106	0	0	105	9	375	0	0	0	0	0	0	34	0	1
5:30 PM	0	0	0	17	0	47	76	109	0	0	112	9	370	0	0	1	0	1	0	32	0	4
5:45 PM	0	0	0	16	0	51	59	97	0	0	87	10	320	0	0	2	0	2	0	30	0	4
VOLUMES	0	0	0	127	0	377	599	797	0	0	696	71	2,667	0	0	5	0	5	0	228	0	22
APPROACH %	0%	0%	0%	25%	0%	75%	43%	57%	0%	0%	91%	9%										
APP/DEPART	0	/	665	504	/	0	1,396	/	924	767	/	1,078	0									
BEGIN PEAK HR		5:00 PM																				
VOLUMES	0	0	0	66	0	198	293	408	0	0	384	31	1,380						0	124	0	9
APPROACH %	0%	0%	0%	25%	0%	75%	42%	58%	0%	0%	93%	7%										
PEAK HR FACTOR		0.000			0.971			0.908			0.857		0.920									
APP/DEPART	0	/	321	264	/	0	701	/	474	415	/	585	0									

Driveway

NORTH SIDE

Highland WEST SIDE

EAST SIDE **Highland**

SOUTH SIDE

Driveway

	ALL PED AND BIKE					PEDESTRIAN CROSSINGS					BICYCLE CROSSINGS				
	E SIDE	W SIDE	S SIDE	N SIDE	TOTAL	E SIDE	W SIDE	S SIDE	N SIDE	TOTAL	ES	WS	SS	NS	TOTAL
AM															
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	1	0	2	3	0	1	0	2	3	0	0	0	0	0
8:00 AM	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	0	3	4	0	1	0	2	3	0	0	0	1	1
PM															
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1
TOTAL	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1

AimTD LLC

TURNING MOVEMENT COUNTS

Fontana

SC2935

ALL HOURS

Driveway (north)

					Exit
TOTAL	**612**	**466**	**0**	**146**	**837**
PM	**504**	377	0	127	665
AM	**108**	89	0	19	172

Highland (west)

					Exit
TOTAL	**759**	**1,150**	**0**	**1,909**	**1,718**
PM	599	797	0	**1,396**	1,078
AM	160	353	0	**513**	640

Highland (east)

					Exit
TOTAL	**1,330**	**85**	**1,245**	**0**	**1,296**
PM	**767**	71	696	0	924
AM	**563**	14	549	0	372

Driveway (south)

	Exit				
AM	0	0	0	0	**0**
PM	0	0	0	0	**0**
TOTAL	**0**	**0**	**0**	**0**	**0**

PEAK HOUR

AM 8:00 AM

PM 5:00 PM

Driveway (north)

					Exit
TOTAL	**323**	**248**	**0**	**75**	**422**
PM	**264**	198	0	66	321
AM	**59**	50	0	9	101

Highland (west)

					Exit
TOTAL	**384**	**602**	**0**	**986**	**919**
PM	293	408	0	**701**	585
AM	91	194	0	**285**	334

Highland (east)

					Exit
TOTAL	**709**	**41**	**668**	**0**	**677**
PM	**415**	31	384	0	474
AM	**294**	10	284	0	203

Driveway (south)

	Exit				
AM	0	0	0	0	**0**
PM	0	0	0	0	**0**
Total	**0**	**0**	**0**	**0**	**0**

INTERSECTION TURNING MOVEMENT COUNTS

PREPARED BY: AimTD LLC. tel: 714 253 7888 cs@aimtd.com

T816

DATE:	LOCATION:	Fontana	PROJECT #:	SC2935
Thu, Jun 3, 21	NORTH & SOUTH:	Mango	LOCATION #:	2
	EAST & WEST:	Highland	CONTROL:	STOP N

NOTES:

AM PM MD OTHER OTHER

▲ N ◄ W E ► S ▼

Add U-Turns to Left Turns

		NORTHBOUND Mango			SOUTHBOUND Mango			EASTBOUND Highland			WESTBOUND Highland			
		NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
	LANES:	0.5	X	0.5	X	X	X	X	2	1	0	2	X	
AM	7:00 AM	28	0	5	0	0	0	0	31	13	7	29	0	113
	7:15 AM	42	0	16	0	0	0	0	26	16	5	30	0	135
	7:30 AM	41	0	21	0	0	0	0	20	18	8	36	0	144
	7:45 AM	24	0	11	0	0	0	0	33	8	3	50	0	129
	8:00 AM	29	0	11	0	0	0	0	35	23	5	41	0	144
	8:15 AM	32	0	10	0	0	0	0	19	20	6	36	0	123
	8:30 AM	47	0	10	0	0	0	0	22	20	8	46	0	153
	8:45 AM	29	0	8	0	0	0	0	34	23	14	48	0	156
	VOLUMES	272	0	92	0	0	0	0	220	141	56	316	0	1,097
	APPROACH %	75%	0%	25%	0%	0%	0%	0%	61%	39%	15%	85%	0%	
	APP/DEPART	364	/	0	0	/	199	361	/	312	372	/	586	0
	BEGIN PEAK HR		8:00 AM											
	VOLUMES	137	0	39	0	0	0	0	110	86	33	171	0	576
	APPROACH %	78%	0%	22%	0%	0%	0%	0%	56%	44%	16%	84%	0%	
	PEAK HR FACTOR		0.772			0.000			0.845			0.823		0.923
	APP/DEPART	176	/	0	0	/	120	196	/	149	204	/	307	0
PM	04:00 PM	42	0	11	0	0	0	0	70	47	19	58	0	247
	4:15 PM	37	0	17	0	0	0	0	62	55	12	57	0	240
	4:30 PM	36	0	14	0	0	0	0	73	43	26	64	0	256
	4:45 PM	29	0	14	0	0	0	0	60	52	24	57	0	236
	5:00 PM	35	0	14	0	0	0	0	66	50	20	62	0	247
	5:15 PM	36	0	17	0	0	0	0	71	45	16	64	0	249
	5:30 PM	52	0	15	0	0	0	0	76	45	23	70	0	281
	5:45 PM	30	0	20	0	0	0	0	70	46	18	65	0	249
	VOLUMES	297	0	122	0	0	0	0	548	383	158	497	0	2,005
	APPROACH %	71%	0%	29%	0%	0%	0%	0%	59%	41%	24%	76%	0%	
	APP/DEPART	419	/	0	0	/	542	931	/	670	655	/	793	0
	BEGIN PEAK HR		5:00 PM											
	VOLUMES	153	0	66	0	0	0	0	283	186	77	261	0	1,026
	APPROACH %	70%	0%	30%	0%	0%	0%	0%	60%	40%	23%	77%	0%	
	PEAK HR FACTOR		0.817			0.000			0.969			0.909		0.913
	APP/DEPART	219	/	0	0	/	263	469	/	349	338	/	414	0

U-TURNS					
	NB	SB	EB	WB	TTL
	0	0	0	0	
7:00 AM	0	0	0	0	0
7:15 AM	1	0	0	0	1
7:30 AM	0	0	0	0	0
7:45 AM	0	0	0	0	0
8:00 AM	0	0	0	0	0
8:15 AM	0	0	0	0	0
8:30 AM	0	0	0	0	0
8:45 AM	1	0	0	0	1
VOLUMES	2	0	0	0	2
04:00 PM	0	0	0	0	0
4:15 PM	1	0	0	0	1
4:30 PM	0	0	0	0	0
4:45 PM	0	0	0	0	0
5:00 PM	0	0	0	0	0
5:15 PM	0	0	0	0	0
5:30 PM	0	0	0	0	0
5:45 PM	0	0	0	0	0
VOLUMES	1	0	0	0	1

RTOR				
	NRR	SRR	ERR	WRR
	X	X	X	X
7:00 AM	0	0	0	0
7:15 AM	0	0	0	0
7:30 AM	0	0	0	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	0	0	0
8:30 AM	0	0	0	0
8:45 AM	0	0	0	0
VOLUMES	0	0	0	0
PEAK HR VOLUMES	0	0	0	0
04:00 PM	0	0	0	0
4:15 PM	0	0	0	0
4:30 PM	0	0	0	0
4:45 PM	0	0	0	0
5:00 PM	0	0	0	0
5:15 PM	0	0	0	0
5:30 PM	0	0	0	0
5:45 PM	0	0	0	0
VOLUMES	0	0	0	0
PEAK HR VOLUMES	0	0	0	0

Mango

NORTH SIDE

Highland WEST SIDE EAST SIDE **Highland**

SOUTH SIDE

Mango

		ALL PED AND BIKE					PEDESTRIAN CROSSINGS					BICYCLE CROSSINGS				
		E SIDE	W SIDE	S SIDE	N SIDE	TOTAL	E SIDE	W SIDE	S SIDE	N SIDE	TOTAL	ES	WS	SS	NS	TOTAL
AM	7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7:45 AM	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0
	8:00 AM	1	0	1	1	3	1	0	0	0	1	0	0	1	1	2
	8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	2	0	1	1	4	2	0	0	0	2	0	0	1	1	2
PM	4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:45 PM	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1
	TOTAL	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1

AimTD LLC

TURNING MOVEMENT COUNTS

Fontana

SC2935

ALL HOURS

Mango

TOTAL	**0**	**0**	**0**	**0**	**0**
PM	**0**	0	0	0	0
AM	**0**	0	0	0	0

Highland

TOTAL	**1,379**	**0**	**768**	**524**	**1,292**
PM	793	0	548	383	**931**
AM	586	0	220	141	**361**

Highland

AM	**372**	0	316	56	312
PM	**655**	0	497	158	670
TOTAL	**1,027**	**0**	**813**	**214**	**982**

Mango

AM	199	272	0	92	**364**
PM	542	297	0	122	**419**
TOTAL	**741**	**569**	**0**	**214**	**783**

Mango

PEAK HOUR

AM 8:00 AM

PM 5:00 PM

Mango

TOTAL	**0**	**0**	**0**	**0**	**0**
PM	**0**	0	0	0	0
AM	**0**	0	0	0	0

Highland

TOTAL	**721**	**0**	**393**	**272**	**665**
PM	414	0	283	186	**469**
AM	307	0	110	86	**196**

Highland

AM	**204**	0	171	33	149
PM	**338**	0	261	77	349
TOTAL	**542**	**0**	**432**	**110**	**498**

Mango

AM	120	137	0	39	**176**
PM	263	153	0	66	**219**
Total	**383**	**290**	**0**	**105**	**395**

Mango

Counts Unlimited
PO Box 1178
Corona, CA 92878
(951) 268-6268

City of Fontana
N/S: Mango Avenue
E/W: South Highland Avenue
Weather: Clear

File Name : FON_Mango_S Highland AM
Site Code : 04319776
Start Date : 12/3/2019
Page No : 1

Groups Printed- Total Volume

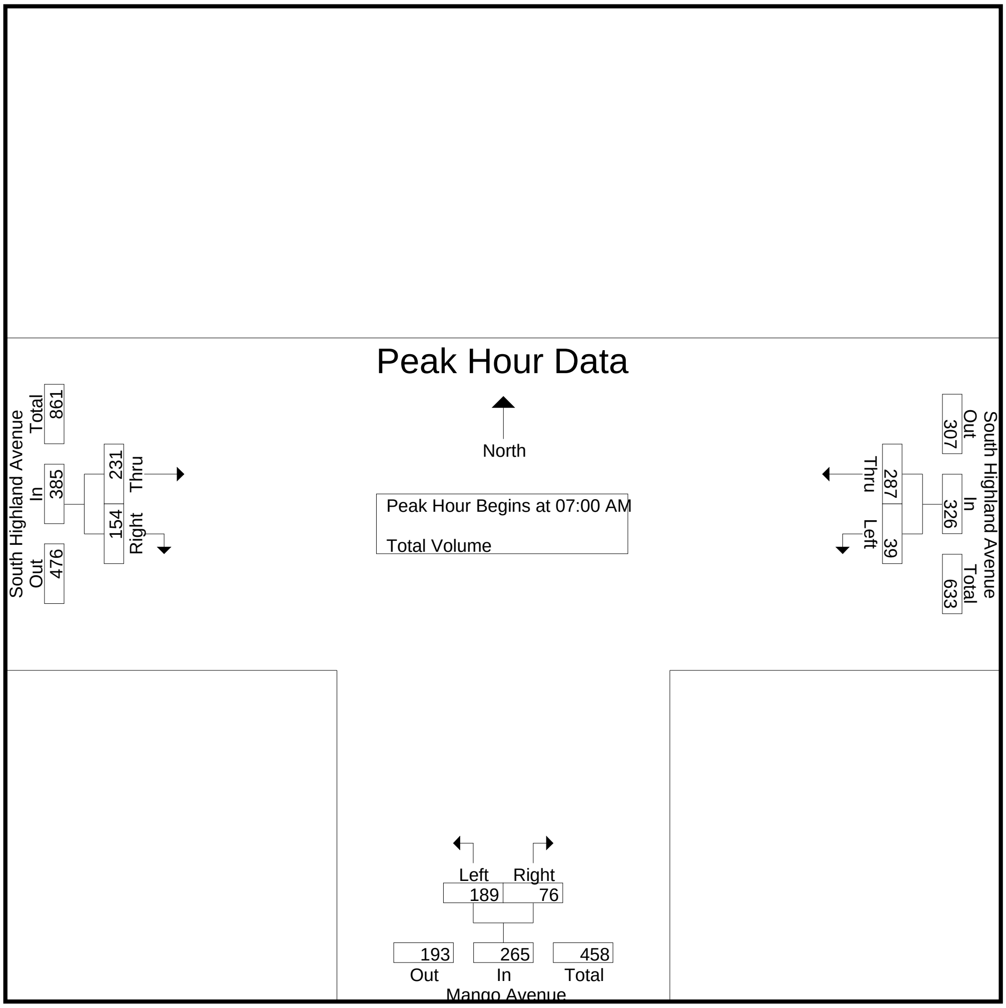
	South Highland Avenue Westbound			Mango Avenue Northbound			South Highland Avenue Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
07:00 AM	11	111	122	54	18	72	55	29	84	278
07:15 AM	11	99	110	53	15	68	94	51	145	323
07:30 AM	10	47	57	50	26	76	51	44	95	228
07:45 AM	7	30	37	32	17	49	31	30	61	147
Total	39	287	326	189	76	265	231	154	385	976
08:00 AM	9	19	28	32	13	45	26	15	41	114
08:15 AM	10	24	34	16	10	26	18	25	43	103
08:30 AM	7	24	31	26	13	39	15	18	33	103
08:45 AM	6	26	32	31	11	42	18	19	37	111
Total	32	93	125	105	47	152	77	77	154	431
Grand Total	71	380	451	294	123	417	308	231	539	1407
Apprch %	15.7	84.3		70.5	29.5		57.1	42.9		
Total %	5	27	32.1	20.9	8.7	29.6	21.9	16.4	38.3	

	South Highland Avenue Westbound			Mango Avenue Northbound			South Highland Avenue Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	**11**	**111**	**122**	**54**	18	72	55	29	84	278
07:15 AM	11	99	110	53	15	68	**94**	**51**	**145**	**323**
07:30 AM	10	47	57	50	**26**	**76**	51	44	95	228
07:45 AM	7	30	37	32	17	49	31	30	61	147
Total Volume	39	287	326	189	76	265	231	154	385	976
% App. Total	12	88		71.3	28.7		60	40		
PHF	.886	.646	.668	.875	.731	.872	.614	.755	.664	.755

Counts Unlimited
PO Box 1178
Corona, CA 92878
(951) 268-6268

City of Fontana
N/S: Mango Avenue
E/W: South Highland Avenue
Weather: Clear

File Name : FON_Mango_S Highland AM
Site Code : 04319776
Start Date : 12/3/2019
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM			07:00 AM			07:00 AM		
+0 mins.	**11**	**111**	**122**	**54**	18	72	55	29	84
+15 mins.	11	99	110	53	15	68	**94**	**51**	**145**
+30 mins.	10	47	57	50	**26**	**76**	51	44	95
+45 mins.	7	30	37	32	17	49	31	30	61
Total Volume	39	287	326	189	76	265	231	154	385
% App. Total	12	88		71.3	28.7		60	40	
PHF	.886	.646	.668	.875	.731	.872	.614	.755	.664

Counts Unlimited
PO Box 1178
Corona, CA 92878
(951) 268-6268

City of Fontana
N/S: Mango Avenue
E/W: South Highland Avenue
Weather: Clear

File Name : FON_Mango_S Highland PM
Site Code : 04319776
Start Date : 12/3/2019
Page No : 1

Groups Printed- Total Volume

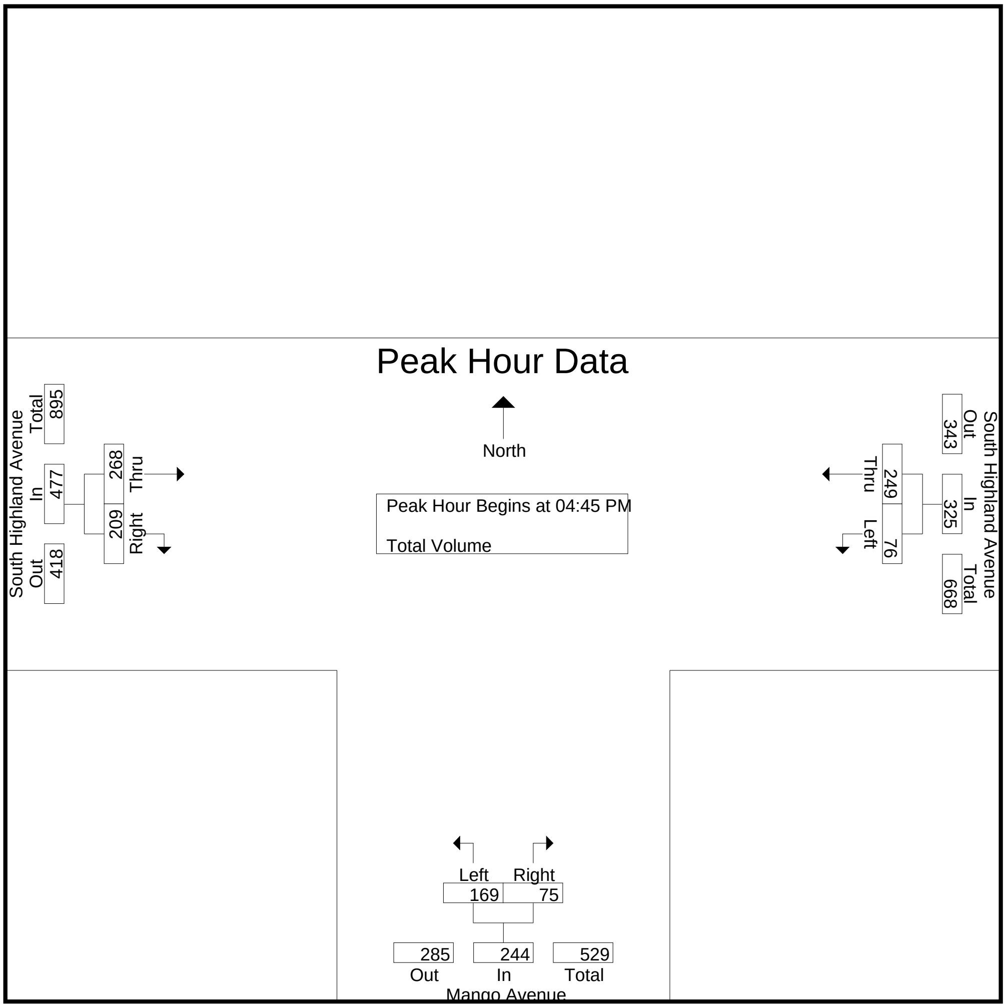
	South Highland Avenue Westbound			Mango Avenue Northbound			South Highland Avenue Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
04:00 PM	11	54	65	39	10	49	75	57	132	246
04:15 PM	17	53	70	21	19	40	62	57	119	229
04:30 PM	20	49	69	33	19	52	54	35	89	210
04:45 PM	13	70	83	34	24	58	58	50	108	249
Total	61	226	287	127	72	199	249	199	448	934
05:00 PM	24	70	94	46	17	63	88	54	142	299
05:15 PM	20	49	69	48	11	59	45	58	103	231
05:30 PM	19	60	79	41	23	64	77	47	124	267
05:45 PM	15	39	54	30	13	43	61	42	103	200
Total	78	218	296	165	64	229	271	201	472	997
Grand Total	139	444	583	292	136	428	520	400	920	1931
Apprch %	23.8	76.2		68.2	31.8		56.5	43.5		
Total %	7.2	23	30.2	15.1	7	22.2	26.9	20.7	47.6	

	South Highland Avenue Westbound			Mango Avenue Northbound			South Highland Avenue Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	13	**70**	83	34	**24**	58	58	50	108	249
05:00 PM	**24**	70	**94**	46	17	63	**88**	54	**142**	**299**
05:15 PM	20	49	69	**48**	11	59	45	**58**	103	231
05:30 PM	19	60	79	41	23	**64**	77	47	124	267
Total Volume	76	249	325	169	75	244	268	209	477	1046
% App. Total	23.4	76.6		69.3	30.7		56.2	43.8		
PHF	.792	.889	.864	.880	.781	.953	.761	.901	.840	.875

Counts Unlimited
PO Box 1178
Corona, CA 92878
(951) 268-6268

City of Fontana
N/S: Mango Avenue
E/W: South Highland Avenue
Weather: Clear

File Name : FON_Mango_S Highland PM
Site Code : 04319776
Start Date : 12/3/2019
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:45 PM			04:45 PM			04:45 PM		
+0 mins.	13	**70**	83	34	**24**	58	58	50	108
+15 mins.	**24**	70	**94**	46	17	63	**88**	54	**142**
+30 mins.	20	49	69	**48**	11	59	45	**58**	103
+45 mins.	19	60	79	41	23	**64**	77	47	124
Total Volume	76	249	325	169	75	244	268	209	477
% App. Total	23.4	76.6		69.3	30.7		56.2	43.8	
PHF	.792	.889	.864	.880	.781	.953	.761	.901	.840

INTERSECTION TURNING MOVEMENT COUNTS

T816

PREPARED BY: AimTD LLC. tel: 714 253 7888 cs@aimtd.com

DATE:			
Thu, Jun 3, 21			
LOCATION:	Fontana	PROJECT #:	SC2935
NORTH & SOUTH:	Mango	LOCATION #:	3
EAST & WEST:	Walnut Grove	CONTROL:	STOP W

NOTES:

AM
PM
MD
OTHER
OTHER

▲ N
◄ W
E ►
S ▼

Add U-Turns to Left Turns

		NORTHBOUND Mango			SOUTHBOUND Mango			EASTBOUND Walnut Grove			WESTBOUND Walnut Grove			
		NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
	LANES:	X	1	0	0	1	X	X	X	X	0	X	0	
AM	7:00 AM	0	31	0	2	17	0	0	0	0	0	0	1	51
AM	7:15 AM	0	56	1	6	21	0	0	0	0	1	0	7	92
AM	7:30 AM	0	50	0	2	19	0	0	0	0	2	0	6	79
AM	7:45 AM	0	34	0	0	13	0	0	0	0	3	0	3	53
AM	8:00 AM	0	41	0	5	23	0	0	0	0	1	0	0	70
AM	8:15 AM	0	37	1	5	23	0	0	0	0	0	0	4	70
AM	8:30 AM	0	46	0	5	21	0	0	0	0	1	0	9	82
AM	8:45 AM	0	36	1	6	32	0	0	0	0	1	0	3	79
AM	VOLUMES	0	331	3	31	169	0	0	0	0	9	0	33	576
AM	APPROACH %	0%	99%	1%	16%	85%	0%	0%	0%	0%	21%	0%	79%	
AM	APP/DEPART	334	/	364	200	/	178	0	/	34	42	/	0	0
AM	BEGIN PEAK HR		8:00 AM											
AM	VOLUMES	0	160	2	21	99	0	0	0	0	3	0	16	301
AM	APPROACH %	0%	99%	1%	18%	83%	0%	0%	0%	0%	16%	0%	84%	
AM	PEAK HR FACTOR		0.880			0.789			0.000			0.475		0.918
AM	APP/DEPART	162	/	176	120	/	102	0	/	23	19	/	0	0
PM	04:00 PM	0	50	3	7	58	0	0	0	0	3	0	3	124
PM	4:15 PM	0	51	0	3	66	0	0	0	0	2	0	3	125
PM	4:30 PM	0	48	2	10	57	0	0	0	0	0	0	2	119
PM	4:45 PM	0	35	2	11	66	0	0	0	0	0	0	7	121
PM	5:00 PM	0	44	3	5	61	0	0	0	0	3	0	6	122
PM	5:15 PM	0	49	2	0	62	0	0	0	0	4	0	4	121
PM	5:30 PM	0	58	2	8	61	0	0	0	0	0	0	6	135
PM	5:45 PM	0	49	0	4	62	0	0	0	0	0	0	4	119
PM	VOLUMES	0	384	14	48	493	0	0	0	0	12	0	35	986
PM	APPROACH %	0%	96%	4%	9%	91%	0%	0%	0%	0%	26%	0%	74%	
PM	APP/DEPART	398	/	419	541	/	505	0	/	62	47	/	0	0
PM	BEGIN PEAK HR		4:45 PM											
PM	VOLUMES	0	186	9	24	250	0	0	0	0	7	0	23	499
PM	APPROACH %	0%	95%	5%	9%	91%	0%	0%	0%	0%	23%	0%	77%	
PM	PEAK HR FACTOR		0.813			0.890			0.000			0.833		0.924
PM	APP/DEPART	195	/	209	274	/	257	0	/	33	30	/	0	0

	U-TURNS					RTOR			
	NB	SB	EB	WB	TTL	NRR	SRR	ERR	WRR
LANES:	0	0	0	0		X	X	X	X
7:00 AM	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0
VOLUMES	0	0	0	0	0	0	0	0	0
PEAK HR VOLUMES						0	0	0	0
04:00 PM	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0
VOLUMES	0	0	0	0	0	0	0	0	0
PEAK HR VOLUMES						0	0	0	0

Mango

NORTH SIDE

Walnut Grove WEST SIDE

EAST SIDE **Walnut Grove**

SOUTH SIDE

Mango

		ALL PED AND BIKE					PEDESTRIAN CROSSINGS					BICYCLE CROSSINGS				
		E SIDE	W SIDE	S SIDE	N SIDE	TOTAL	E SIDE	W SIDE	S SIDE	N SIDE	TOTAL	ES	WS	SS	NS	TOTAL
AM	7:00 AM	2	0	0	0	2	2	0	0	0	2	0	0	0	0	0
AM	7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AM	7:30 AM	2	0	0	0	2	2	0	0	0	2	0	0	0	0	0
AM	7:45 AM	3	0	0	0	3	3	0	0	0	3	0	0	0	0	0
AM	8:00 AM	2	0	0	0	2	1	0	0	0	1	1	0	0	0	1
AM	8:15 AM	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0
AM	8:30 AM	3	0	0	0	3	3	0	0	0	3	0	0	0	0	0
AM	8:45 AM	2	0	0	0	2	1	0	0	0	1	1	0	0	0	1
AM	TOTAL	15	0	0	0	15	6	0	0	0	13	2	0	0	0	2
PM	4:00 PM	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0
PM	4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM	4:30 PM	2	0	0	0	2	2	0	0	0	2	0	0	0	0	0
PM	4:45 PM	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1
PM	5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM	5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM	5:30 PM	2	0	0	0	2	0	0	0	0	0	2	0	0	0	2
PM	5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	6	0	0	0	6	0	0	0	0	3	3	0	0	0	3

AimTD LLC

TURNING MOVEMENT COUNTS

Fontana

SC2935

ALL HOURS

Mango (north leg)

TOTAL	**741**	**0**	**662**	**79**	**783**
PM	**541**	0	493	48	419
AM	**200**	0	169	31	364

Walnut Grove (west leg)

TOTAL	**0**	**0**	**0**	**0**	**0**	**0**
PM	0	0	0	0	**0**	0
AM	0	0	0	0	**0**	0

Walnut Grove (east leg)

AM	**42**	33	0	9	34
PM	**47**	35	0	12	62
TOTAL	**89**	**68**	**0**	**21**	**96**

Mango (south leg)

178	**AM**	0	331	3	**334**
505	**PM**	0	384	14	**398**
683	**TOTAL**	**0**	**715**	**17**	**732**

PEAK HOUR

AM 8:00 AM

PM

Mango (north leg)

TOTAL	**394**	**0**	**349**	**45**	**385**
PM	**274**	0	250	24	209
AM	**120**	0	99	21	176

Walnut Grove (west leg)

TOTAL	**0**	**0**	**0**	**0**	**0**	**0**
PM	0	0	0	0	**0**	0
AM	0	0	0	0	**0**	0

Walnut Grove (east leg)

AM	**19**	16	0	3	23
PM	**30**	23	0	7	33
TOTAL	**49**	**39**	**0**	**10**	**56**

Mango (south leg)

102	**AM**	0	160	2	**162**
257	**PM**	0	186	9	**195**
359	**Total**	**0**	**346**	**11**	**357**

APPENDIX 3.2:

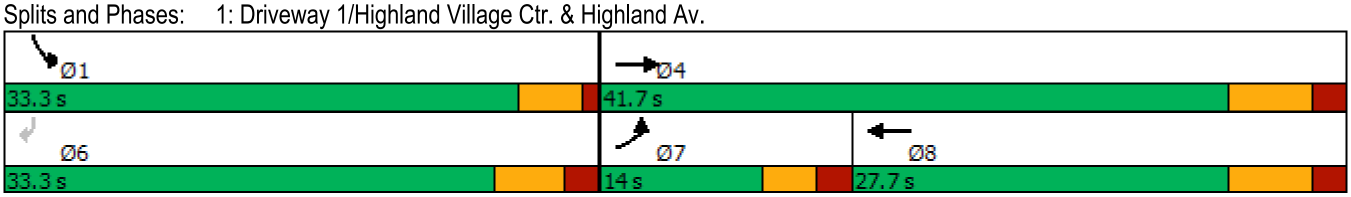
EXISTING (2021) CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	158	376	492	18	87
Future Volume (vph)	158	376	492	18	87
Turn Type	Prot	NA	NA	Prot	Perm
Protected Phases	7	4	8	1	
Permitted Phases					6
Detector Phase	7	4	8	1	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	5.0	7.0
Minimum Split (s)	12.0	13.7	27.7	9.6	33.0
Total Split (s)	14.0	41.7	27.7	33.3	33.3
Total Split (%)	18.7%	55.6%	36.9%	44.4%	44.4%
Yellow Time (s)	3.0	4.7	4.7	3.6	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	6.7	4.6	6.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	None	None	None	None

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 47.5
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	158	376	0	0	492	17	0	0	0	18	0	87
Future Volume (veh/h)	158	376	0	0	492	17	0	0	0	18	0	87
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		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	188	448	0	0	586	16				21	0	68
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84				0.84	0.84	0.84
Percent Heavy Veh, %	2	2	0	0	2	2				2	0	2
Cap, veh/h	306	2063	0	0	918	25				149	0	133
Arrive On Green	0.17	0.58	0.00	0.00	0.26	0.26				0.08	0.00	0.08
Sat Flow, veh/h	1781	3647	0	0	3624	96				1781	0	1585
Grp Volume(v), veh/h	188	448	0	0	295	307				21	0	68
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1850				1781	0	1585
Q Serve(g_s), s	3.3	2.0	0.0	0.0	5.0	5.0				0.4	0.0	1.4
Cycle Q Clear(g_c), s	3.3	2.0	0.0	0.0	5.0	5.0				0.4	0.0	1.4
Prop In Lane	1.00		0.00	0.00		0.05				1.00		1.00
Lane Grp Cap(c), veh/h	306	2063	0	0	462	481				149	0	133
V/C Ratio(X)	0.61	0.22	0.00	0.00	0.64	0.64				0.14	0.00	0.51
Avail Cap(c_a), veh/h	476	3694	0	0	1108	1154				1518	0	1351
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	12.9	3.4	0.0	0.0	11.1	11.1				14.3	0.0	14.8
Incr Delay (d2), s/veh	0.7	0.0	0.0	0.0	0.5	0.5				0.4	0.0	3.0
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	0.9	0.0	0.0	0.0	1.2	1.2				0.1	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.6	3.4	0.0	0.0	11.6	11.6				14.7	0.0	17.8
LnGrp LOS	B	A	A	A	B	B				B	A	B
Approach Vol, veh/h		636			602						89	
Approach Delay, s/veh		6.4			11.6						17.1	
Approach LOS		A			B						B	

Timer - Assigned Phs				4		6	7	8				
Phs Duration (G+Y+Rc), s				26.2		7.4	10.8	15.5				
Change Period (Y+Rc), s				6.7		4.6	5.0	6.7				
Max Green Setting (Gmax), s				35.0		28.7	9.0	21.0				
Max Q Clear Time (g_c+I1), s				4.0		3.4	5.3	7.0				
Green Ext Time (p_c), s				1.7		0.2	0.1	1.7				

Intersection Summary			
HCM 6th Ctrl Delay			9.5
HCM 6th LOS			A

Intersection	
Int Delay, s/veh	7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	236	158	51	294	216	89
Future Vol, veh/h	236	158	51	294	216	89
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	257	172	55	320	235	97

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	429	0	527	130
Stage 1	-	-	-	-	257	-
Stage 2	-	-	-	-	270	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1127	-	481	896
Stage 1	-	-	-	-	762	-
Stage 2	-	-	-	-	751	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1127	-	453	895
Mov Cap-2 Maneuver	-	-	-	-	453	-
Stage 1	-	-	-	-	762	-
Stage 2	-	-	-	-	707	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.4	22.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	529	-	-	1127	-
HCM Lane V/C Ratio	0.627	-	-	0.049	-
HCM Control Delay (s)	22.5	-	-	8.4	0.2
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	4.3	-	-	0.2	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	5	0	28	0	277	3	36	172	0
Future Vol, veh/h	0	0	0	5	0	28	0	277	3	36	172	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	5	0	30	0	301	3	39	187	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	574	574	309	-	0	0	310	0	0
Stage 1	309	309	-	-	-	-	-	-	-
Stage 2	265	265	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	480	429	731	0	-	-	1250	-	0
Stage 1	745	660	-	0	-	-	-	-	0
Stage 2	779	689	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	460	0	727	-	-	-	1243	-	-
Mov Cap-2 Maneuver	460	0	-	-	-	-	-	-	-
Stage 1	741	0	-	-	-	-	-	-	-
Stage 2	752	0	-	-	-	-	-	-	-

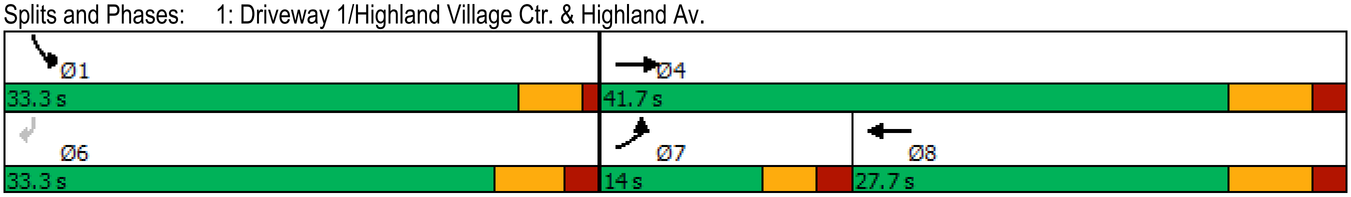
Approach	WB	NB	SB
HCM Control Delay, s	10.7	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	668	1243	-
HCM Lane V/C Ratio	-	-	0.054	0.031	-
HCM Control Delay (s)	-	-	10.7	8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	306	428	402	69	207
Future Volume (vph)	306	428	402	69	207
Turn Type	Prot	NA	NA	Prot	Perm
Protected Phases	7	4	8	1	
Permitted Phases					6
Detector Phase	7	4	8	1	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	5.0	7.0
Minimum Split (s)	12.0	13.7	27.7	9.6	33.0
Total Split (s)	14.0	41.7	27.7	33.3	33.3
Total Split (%)	18.7%	55.6%	36.9%	44.4%	44.4%
Yellow Time (s)	3.0	4.7	4.7	3.6	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	6.7	4.6	6.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	None	None	None	None

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 49.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	306	428	0	0	402	32	0	0	0	69	0	207
Future Volume (veh/h)	306	428	0	0	402	32	0	0	0	69	0	207
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	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
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	333	465	0	0	437	25				75	0	90
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	2	2	0	0	2	2				2	0	2
Cap, veh/h	402	2035	0	0	708	40				200	0	178
Arrive On Green	0.23	0.57	0.00	0.00	0.21	0.21				0.11	0.00	0.11
Sat Flow, veh/h	1781	3647	0	0	3511	195				1781	0	1585
Grp Volume(v), veh/h	333	465	0	0	227	235				75	0	90
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1835				1781	0	1585
Q Serve(g_s), s	6.4	2.3	0.0	0.0	4.2	4.2				1.4	0.0	1.9
Cycle Q Clear(g_c), s	6.4	2.3	0.0	0.0	4.2	4.2				1.4	0.0	1.9
Prop In Lane	1.00		0.00	0.00		0.11				1.00		1.00
Lane Grp Cap(c), veh/h	402	2035	0	0	368	380				200	0	178
V/C Ratio(X)	0.83	0.23	0.00	0.00	0.62	0.62				0.37	0.00	0.50
Avail Cap(c_a), veh/h	447	3467	0	0	1040	1074				1425	0	1268
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	13.2	3.8	0.0	0.0	12.9	12.9				14.8	0.0	15.0
Incr Delay (d2), s/veh	10.1	0.0	0.0	0.0	0.6	0.6				1.2	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	2.7	0.1	0.0	0.0	1.1	1.2				0.5	0.0	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.3	3.8	0.0	0.0	13.5	13.5				15.9	0.0	17.2
LnGrp LOS	C	A	A	A	B	B				B	A	B
Approach Vol, veh/h		798			462						165	
Approach Delay, s/veh		11.9			13.5						16.6	
Approach LOS		B			B						B	

Timer - Assigned Phs				4		6	7	8				
Phs Duration (G+Y+Rc), s				27.2		8.6	13.1	14.1				
Change Period (Y+Rc), s				6.7		4.6	5.0	6.7				
Max Green Setting (Gmax), s				35.0		28.7	9.0	21.0				
Max Q Clear Time (g_c+I1), s				4.3		3.9	8.4	6.2				
Green Ext Time (p_c), s				1.7		0.5	0.0	1.3				

Intersection Summary		
HCM 6th Ctrl Delay		13.0
HCM 6th LOS		B

Intersection						
Int Delay, s/veh	6.3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	283	214	78	261	173	77
Future Vol, veh/h	283	214	78	261	173	77
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	311	235	86	287	190	85

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	546	0	627	156
Stage 1	-	-	-	-	311	-
Stage 2	-	-	-	-	316	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1019	-	416	862
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	712	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1019	-	374	862
Mov Cap-2 Maneuver	-	-	-	-	374	-
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	641	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.3	24.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	453	-	-	1019	-
HCM Lane V/C Ratio	0.606	-	-	0.084	-
HCM Control Delay (s)	24.4	-	-	8.9	0.3
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	3.9	-	-	0.3	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	7	0	28	0	222	9	27	265	0
Future Vol, veh/h	0	0	0	7	0	28	0	222	9	27	265	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	8	0	30	0	241	10	29	288	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	592	592	246	-	0	0	251	0	0
Stage 1	246	246	-	-	-	-	-	-	-
Stage 2	346	346	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	469	419	793	0	-	-	1314	-	0
Stage 1	795	703	-	0	-	-	-	-	0
Stage 2	716	635	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	457	0	793	-	-	-	1314	-	-
Mov Cap-2 Maneuver	457	0	-	-	-	-	-	-	-
Stage 1	795	0	-	-	-	-	-	-	-
Stage 2	697	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.5	0	0.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	691	1314	-
HCM Lane V/C Ratio	-	-	0.055	0.022	-
HCM Control Delay (s)	-	-	10.5	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

APPENDIX 3.3:

EXISTING (2021) CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

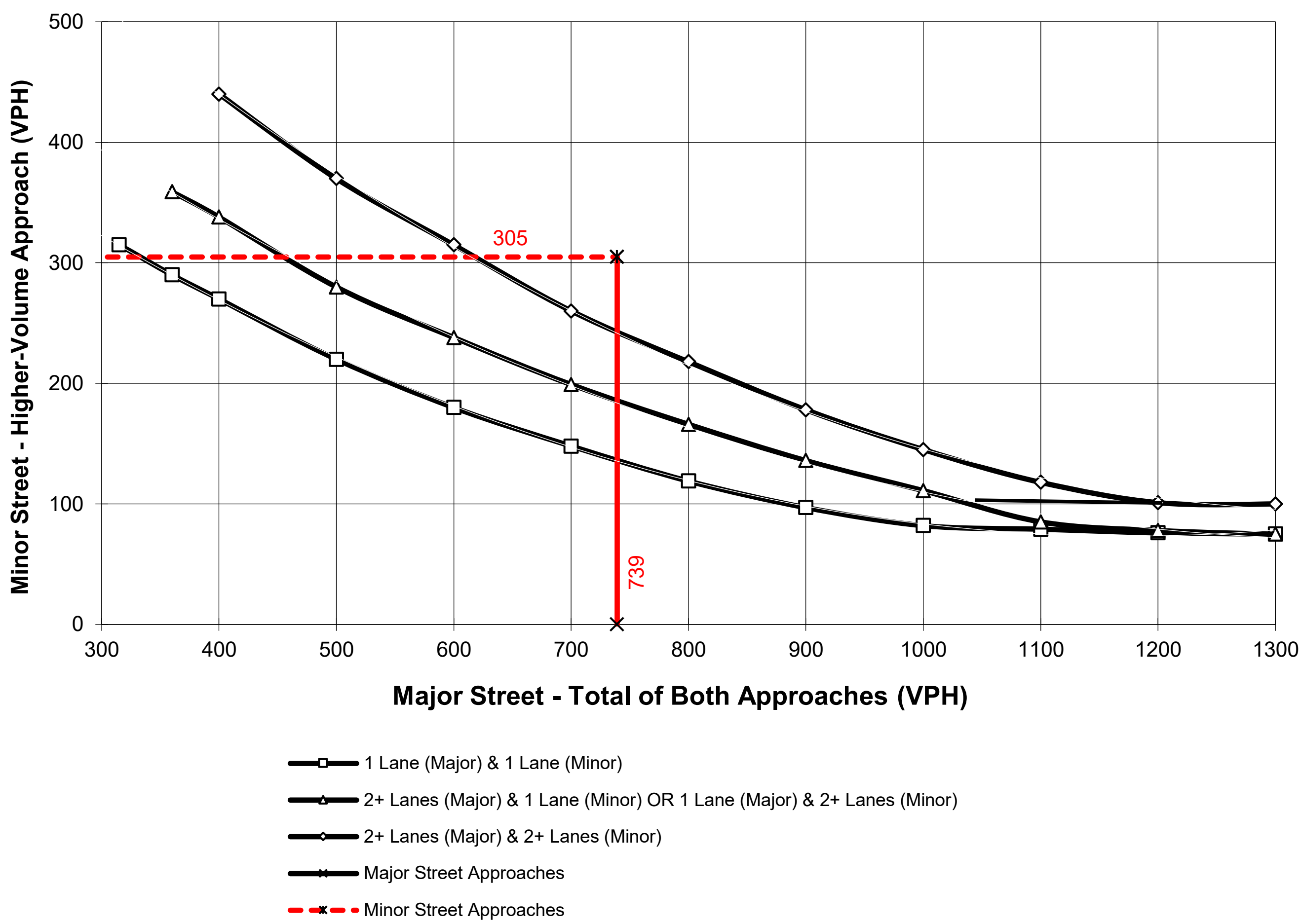
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Traffic Conditions = **Existing (2021) Conditions - Weekday AM Peak Hour**

Major Street Name = **Highland Av.**
Total of Both Approaches (VPH) = **739**
Number of Approach Lanes Major Street = **2**

Minor Street Name = **Mango Av.**
High Volume Approach (VPH) = **305**
Number of Approach Lanes Minor Street = **1**

WARRANTED FOR A SIGNAL



*Note: 100 vph applies as the lower threshold for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold for a minor-street approach with one lane

Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **Existing (2021) Conditions - Weekday PM Peak Hour**

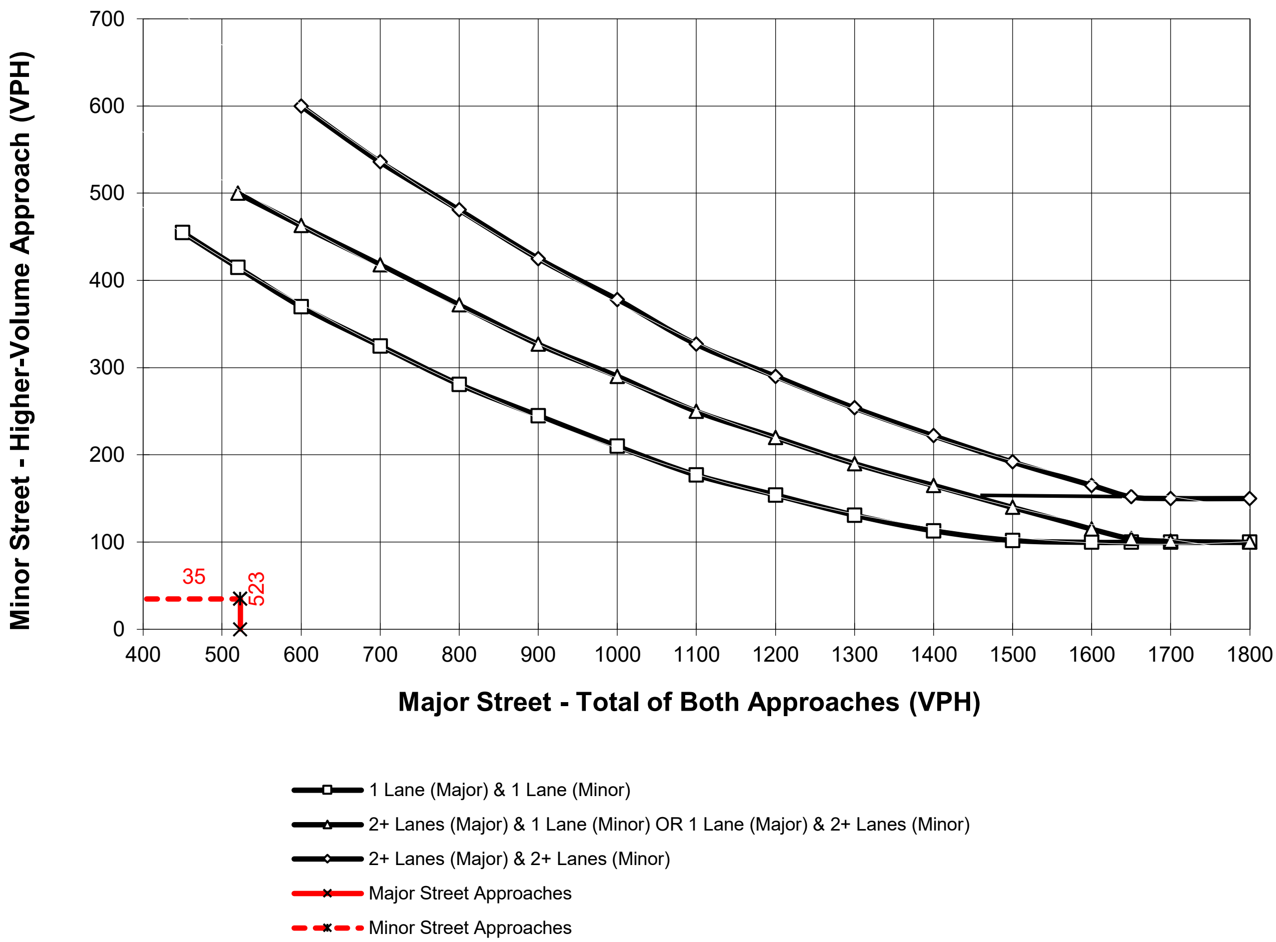
Major Street Name = **Mango Av.**

Total of Both Approaches (VPH) = **523**
Number of Approach Lanes on Major Street = **1**

Minor Street Name = **Walnut Grove Ct.**

High Volume Approach (VPH) = **35**
Number of Approach Lanes On Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold for a minor-street approach with one lane

APPENDIX 4.1:

POST PROCESSING WORKSHEETS

This Page Intentionally Left Blank

INPUT DATA

Project: ======================>		Mango & Highland Residential	<===	Job #: 14153
Scenario: ======================>		Horizon Year (2040)	<===	Analyst: CS
Existing Conditions Model Run ID:	==>	SBTAM 2016	<===	Date: 6/18/21
Future Conditions Model Run ID:	==>	SBTAM 2040	<===	

LOCATION: **Mango Av. & Highland Av.**

AM PEAK HOUR

EXISTING TURNING MOVEMENT VOLUMES:

2021		**0**	**0**	**0**		
		<	v	>		
0 ^					^	**0**
236 >					<	**294**
158 v					v	**51**
		<	^	>		
		216	**0**	**89**		

EXISTING MODEL YEAR:

2016			**0**	**0**		
			v	^		
197	<	IN =		390 <		**82**
123	>	OUT =		390 >		**140**
			v	^		
			52	**185**		

FUTURE MODEL YEAR:

2040			**0**	**0**		
			v	^		
172	<	IN =		417 <		**93**
145	>	OUT =		417 >		**166**
			v	^		
			80	**179**		

EXISTING (COUNTED) ADTs BY LEG:

2016			**0**		
			N		
	3,941	W	**LEG**	E	**2,612**
			S		
			3,089		

REFINED FUTURE ADT'S BY LEG:

2040			**0**		
			N		
	13,780	W	**LEG**	E	**13,122**
			S		
			7,745		

PM PEAK HOUR

EXISTING TURNING MOVEMENT VOLUMES:

2021		**0**	**0**	**0**		
		<	v	>		
0 ^					^	**0**
283 >					<	**261**
214 v					v	**78**
		<	^	>		
		173	**0**	**77**		

EXISTING MODEL YEAR:

2016			**0**	**0**		
			v	^		
144	<	IN =		451 <		**132**
232	>	OUT =		451 >		**140**
			v	^		
			167	**87**		

FUTURE MODEL YEAR:

2040			**0**	**0**		
			v	^		
161	<	IN =		586 <		**162**
300	>	OUT =		586 >		**246**
			v	^		
			180	**124**		

EXISTING (COUNTED) ADTs BY LEG:

2016			0		
			N		
	3,941	W	+	E	2,612
			S		
			3,089		

REFINED FUTURE ADT'S BY LEG:

2040			0		
			N		
	13,780	W	+	E	13,122
			S		
			7,745		

Z:\Shared\UcJobs_14100-14500_14100\14153\02_LOS\Post Processing\[02 Mango_Highland.xls]Input (1)

Project:	Mango & Highland Residential	Job #:	14153
Scenario:	Horizon Year (2040)	Analyst:	CS
		Date:	6/18/21

LOCATION:	Mango Av. & Highland Av.
FORECAST YEAR:	2040

INDIVIDUAL TURN VOLUME GROWTH REVIEW

		AM PEAK HOUR INPUT DATA				PM PEAK HOUR INPUT DATA			
APPROACH	TURNING MOVEMENT	EXISTING COUNT	FUTURE VOLUME	DIFF-ERENCE	% CHANGE	EXISTING COUNT	FUTURE VOLUME	DIFF-ERENCE	% CHANGE
NORTH BOUND	Left	216	214	-2	-1%	173	177	4	2%
	Through	0	0	0	#DIV/0!	0	0	0	#DIV/0!
	Right	89	101	12	14%	77	103	26	34%
	NB Total	305	315	10	3%	250	280	30	12%
SOUTH BOUND	Left	0	0	0	#DIV/0!	0	0	0	#DIV/0!
	Through	0	0	0	#DIV/0!	0	0	0	#DIV/0!
	Right	0	0	0	#DIV/0!	0	0	0	#DIV/0!
	SB Total	0	0	0	#DIV/0!	0	0	0	#DIV/0!
EAST BOUND	Left	0	0	0	#DIV/0!	0	0	0	#DIV/0!
	Through	236	249	13	5%	283	347	64	23%
	Right	158	170	12	8%	214	213	-1	0%
	EB Total	394	419	25	6%	497	560	63	13%
WEST BOUND	Left	51	60	9	18%	78	87	9	12%
	Through	294	296	2	1%	261	273	12	5%
	Right	0	0	0	#DIV/0!	0	0	0	#DIV/0!
	WB Total	345	356	11	3%	339	360	21	6%
TOTAL ENTERING VOLUME		1,044	1,090	46.2254694	4%	1,085	1,200	115	11%

FORECAST PEAK HOUR TO ADT COMPARISON

		VOLUMES		PERCENT OF ADT		
		AM	PM	AM	PM	ADT
North Leg	Inbound	0	0			
North Leg	Outbound	0	0			
North Leg	**TOTAL**	**0**	**0**	**#DIV/0!**	**#DIV/0!**	**-**
South Leg	Inbound	315	280			
South Leg	Outbound	230	300			
South Leg	**TOTAL**	**545**	**580**	**7%**	**7%**	**7,745**
East Leg	Inbound	356	360			
East Leg	Outbound	350	450			
East Leg	**TOTAL**	**706**	**810**	**5%**	**6%**	**13,122**
West Leg	Inbound	419	560			
West Leg	Outbound	510	450			
West Leg	**TOTAL**	**929**	**1,010**	**7%**	**7%**	**13,780**
OVERALL TOTAL		***2,180***	***2,400***	**6%**	***7%***	***34,648***

Z:\Shared\UcJobs_14100-14500_14100\14153\02_LOS\Post Processing\[02 Mango_Highland.xls]Output (3)

APPENDIX 5.1:

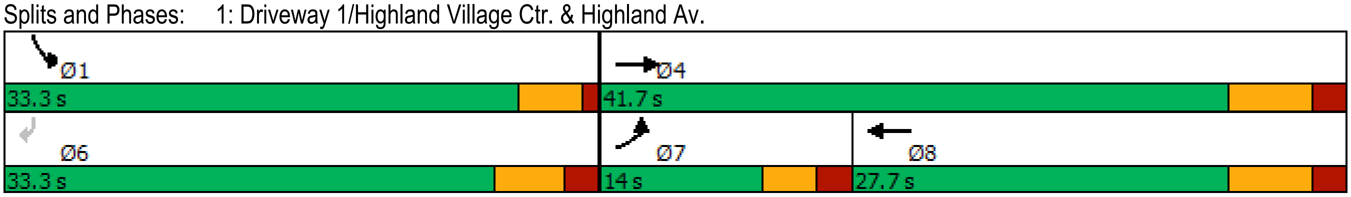
OPENING YEAR CUMULATIVE (2023) WITHOUT PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	161	453	568	18	89
Future Volume (vph)	161	453	568	18	89
Turn Type	Prot	NA	NA	Prot	Perm
Protected Phases	7	4	8	1	
Permitted Phases					6
Detector Phase	7	4	8	1	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	5.0	7.0
Minimum Split (s)	12.0	13.7	27.7	9.6	33.0
Total Split (s)	14.0	41.7	27.7	33.3	33.3
Total Split (%)	18.7%	55.6%	36.9%	44.4%	44.4%
Yellow Time (s)	3.0	4.7	4.7	3.6	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	6.7	4.6	6.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	None	None	None	None

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 48.8
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	161	453	0	0	568	18	0	0	0	18	0	89
Future Volume (veh/h)	161	453	0	0	568	18	0	0	0	18	0	89
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				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
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	192	539	0	0	676	17				21	0	70
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84				0.84	0.84	0.84
Percent Heavy Veh, %	2	2	0	0	2	2				2	0	2
Cap, veh/h	300	2114	0	0	1005	25				149	0	133
Arrive On Green	0.17	0.59	0.00	0.00	0.28	0.28				0.08	0.00	0.08
Sat Flow, veh/h	1781	3647	0	0	3633	89				1781	0	1585
Grp Volume(v), veh/h	192	539	0	0	339	354				21	0	70
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1852				1781	0	1585
Q Serve(g_s), s	3.5	2.5	0.0	0.0	5.9	5.9				0.4	0.0	1.5
Cycle Q Clear(g_c), s	3.5	2.5	0.0	0.0	5.9	5.9				0.4	0.0	1.5
Prop In Lane	1.00		0.00	0.00		0.05				1.00		1.00
Lane Grp Cap(c), veh/h	300	2114	0	0	505	526				149	0	133
V/C Ratio(X)	0.64	0.25	0.00	0.00	0.67	0.67				0.14	0.00	0.53
Avail Cap(c_a), veh/h	456	3538	0	0	1061	1106				1454	0	1294
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	13.6	3.4	0.0	0.0	11.1	11.1				14.9	0.0	15.4
Incr Delay (d2), s/veh	0.8	0.0	0.0	0.0	0.6	0.6				0.4	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
%ile BackOfQ(50%),veh/ln	1.0	0.1	0.0	0.0	1.4	1.5				0.2	0.0	1.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.5	3.4	0.0	0.0	11.7	11.7				15.4	0.0	18.7
LnGrp LOS	B	A	A	A	B	B				B	A	B
Approach Vol, veh/h		731			693						91	
Approach Delay, s/veh		6.3			11.7						17.9	
Approach LOS		A			B						B	
Timer - Assigned Phs				4		6	7	8				
Phs Duration (G+Y+Rc), s				27.6		7.5	10.9	16.7				
Change Period (Y+Rc), s				6.7		4.6	5.0	6.7				
Max Green Setting (Gmax), s				35.0		28.7	9.0	21.0				
Max Q Clear Time (g_c+I1), s				4.5		3.5	5.5	7.9				
Green Ext Time (p_c), s				2.1		0.2	0.1	1.9				
Intersection Summary												
HCM 6th Ctrl Delay			9.5									
HCM 6th LOS			A									

Intersection	
Int Delay, s/veh	12.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	308	164	70	362	224	111
Future Vol, veh/h	308	164	70	362	224	111
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	335	178	76	393	243	121

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	513	0	684	169
Stage 1	-	-	-	-	335	-
Stage 2	-	-	-	-	349	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1049	-	382	845
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	685	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1049	-	346	844
Mov Cap-2 Maneuver	-	-	-	-	346	-
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	621	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	45.1
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	430	-	-	1049	-
HCM Lane V/C Ratio	0.847	-	-	0.073	-
HCM Control Delay (s)	45.1	-	-	8.7	0.3
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	8.3	-	-	0.2	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	5	0	28	0	307	4	37	196	0
Future Vol, veh/h	0	0	0	5	0	28	0	307	4	37	196	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	5	0	30	0	334	4	40	213	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	635	635	342	-	0	0	344	0	0
Stage 1	342	342	-	-	-	-	-	-	-
Stage 2	293	293	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	443	396	701	0	-	-	1215	-	0
Stage 1	719	638	-	0	-	-	-	-	0
Stage 2	757	670	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	424	0	697	-	-	-	1208	-	-
Mov Cap-2 Maneuver	424	0	-	-	-	-	-	-	-
Stage 1	715	0	-	-	-	-	-	-	-
Stage 2	728	0	-	-	-	-	-	-	-

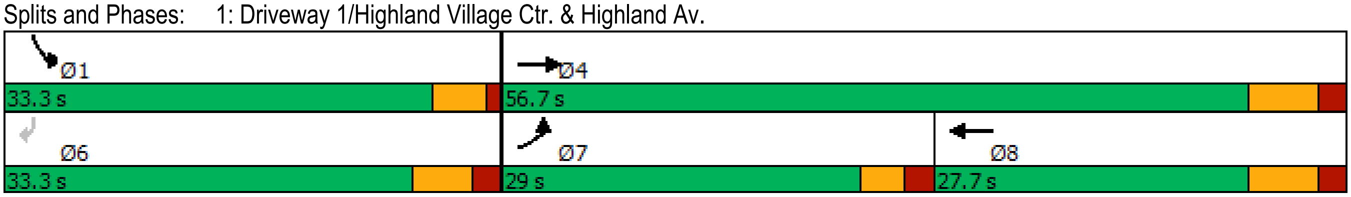
Approach	WB	NB	SB
HCM Control Delay, s	11	0	1.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	635	1208	-
HCM Lane V/C Ratio	-	-	0.056	0.033	-
HCM Control Delay (s)	-	-	11	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	313	498	465	70	211
Future Volume (vph)	313	498	465	70	211
Turn Type	Prot	NA	NA	Prot	Perm
Protected Phases	7	4	8	1	
Permitted Phases					6
Detector Phase	7	4	8	1	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	5.0	7.0
Minimum Split (s)	12.0	13.7	27.7	9.6	33.0
Total Split (s)	29.0	56.7	27.7	33.3	33.3
Total Split (%)	32.2%	63.0%	30.8%	37.0%	37.0%
Yellow Time (s)	3.0	4.7	4.7	3.6	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	6.7	4.6	6.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	None	None	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 61.3
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	313	498	0	0	465	33	0	0	0	70	0	211
Future Volume (veh/h)	313	498	0	0	465	33	0	0	0	70	0	211
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		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	373	593	0	0	554	35				83	0	215
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84				0.84	0.84	0.84
Percent Heavy Veh, %	2	2	0	0	2	2				2	0	2
Cap, veh/h	437	2054	0	0	773	49				331	0	294
Arrive On Green	0.25	0.58	0.00	0.00	0.23	0.23				0.19	0.00	0.19
Sat Flow, veh/h	1781	3647	0	0	3482	214				1781	0	1585
Grp Volume(v), veh/h	373	593	0	0	290	299				83	0	215
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1825				1781	0	1585
Q Serve(g_s), s	9.6	4.0	0.0	0.0	7.2	7.2				1.9	0.0	6.1
Cycle Q Clear(g_c), s	9.6	4.0	0.0	0.0	7.2	7.2				1.9	0.0	6.1
Prop In Lane	1.00		0.00	0.00		0.12				1.00		1.00
Lane Grp Cap(c), veh/h	437	2054	0	0	406	417				331	0	294
V/C Ratio(X)	0.85	0.29	0.00	0.00	0.72	0.72				0.25	0.00	0.73
Avail Cap(c_a), veh/h	894	3717	0	0	781	802				1070	0	952
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	17.2	5.1	0.0	0.0	17.0	17.0				16.6	0.0	18.3
Incr Delay (d2), s/veh	1.9	0.0	0.0	0.0	0.9	0.9				0.4	0.0	3.5
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	3.2	0.7	0.0	0.0	2.3	2.4				0.7	0.0	5.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.1	5.1	0.0	0.0	17.9	17.9				17.0	0.0	21.8
LnGrp LOS	B	A	A	A	B	B				B	A	C
Approach Vol, veh/h		966			589						298	
Approach Delay, s/veh		10.5			17.9						20.5	
Approach LOS		B			B						C	

Timer - Assigned Phs				4		6	7	8				
Phs Duration (G+Y+Rc), s				34.3		13.5	16.7	17.6				
Change Period (Y+Rc), s				6.7		4.6	5.0	6.7				
Max Green Setting (Gmax), s				50.0		28.7	24.0	21.0				
Max Q Clear Time (g_c+I1), s				6.0		8.1	11.6	9.2				
Green Ext Time (p_c), s				2.3		0.9	0.2	1.5				

Intersection Summary			
HCM 6th Ctrl Delay			14.5
HCM 6th LOS			B

Intersection	
Int Delay, s/veh	9.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	347	222	95	318	180	96
Future Vol, veh/h	347	222	95	318	180	96
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	377	241	103	346	196	104

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	618	0	756	190
Stage 1	-	-	-	-	377	-
Stage 2	-	-	-	-	379	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	958	-	344	820
Stage 1	-	-	-	-	663	-
Stage 2	-	-	-	-	662	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	958	-	298	819
Mov Cap-2 Maneuver	-	-	-	-	298	-
Stage 1	-	-	-	-	663	-
Stage 2	-	-	-	-	574	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	41.1
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	383	-	-	958	-
HCM Lane V/C Ratio	0.783	-	-	0.108	-
HCM Control Delay (s)	41.1	-	-	9.2	0.4
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	6.6	-	-	0.4	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	7	0	29	0	246	10	28	288	0
Future Vol, veh/h	0	0	0	7	0	29	0	246	10	28	288	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	8	0	32	0	267	11	30	313	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	652	652	279	-	0	0	284	0	0
Stage 1	279	279	-	-	-	-	-	-	-
Stage 2	373	373	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	433	387	760	0	-	-	1278	-	0
Stage 1	768	680	-	0	-	-	-	-	0
Stage 2	696	618	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	418	0	756	-	-	-	1271	-	-
Mov Cap-2 Maneuver	418	0	-	-	-	-	-	-	-
Stage 1	763	0	-	-	-	-	-	-	-
Stage 2	676	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.9	0	0.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	653	1271	-
HCM Lane V/C Ratio	-	-	0.06	0.024	-
HCM Control Delay (s)	-	-	10.9	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

APPENDIX 5.2:

OPENING YEAR CUMULATIVE (2023) WITH PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS

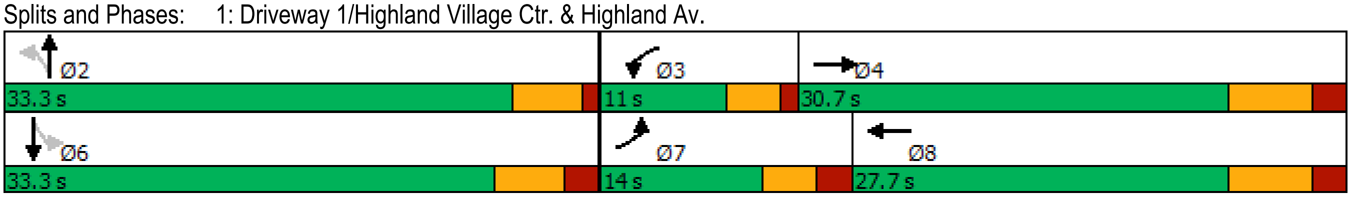
This Page Intentionally Left Blank

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	161	455	1	574	23	0	18	0
Future Volume (vph)	161	455	1	574	23	0	18	0
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases					2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	12.0	27.7	11.0	27.7	12.0	12.0	33.0	33.0
Total Split (s)	14.0	30.7	11.0	27.7	33.3	33.3	33.3	33.3
Total Split (%)	18.7%	40.9%	14.7%	36.9%	44.4%	44.4%	44.4%	44.4%
Yellow Time (s)	3.0	4.7	3.0	4.7	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	2.0	1.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	4.0	6.7		5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	Min	Min	None	None

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 52
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	161	455	7	1	574	18	23	0	2	18	0	89
Future Volume (veh/h)	161	455	7	1	574	18	23	0	2	18	0	89
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	192	542	8	1	683	17	27	0	2	21	0	70
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	264	1572	23	4	952	24	323	6	12	423	0	261
Arrive On Green	0.15	0.44	0.44	0.00	0.27	0.27	0.17	0.00	0.17	0.17	0.00	0.17
Sat Flow, veh/h	1781	3585	53	1781	3541	88	958	36	74	1415	0	1582
Grp Volume(v), veh/h	192	269	281	1	343	357	29	0	0	21	0	70
Grp Sat Flow(s),veh/h/ln	1781	1777	1861	1781	1777	1852	1069	0	0	1415	0	1582
Q Serve(g_s), s	4.4	4.2	4.2	0.0	7.4	7.4	0.6	0.0	0.0	0.0	0.0	1.6
Cycle Q Clear(g_c), s	4.4	4.2	4.2	0.0	7.4	7.4	2.2	0.0	0.0	0.4	0.0	1.6
Prop In Lane	1.00		0.03	1.00		0.05	0.93		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	264	779	816	4	478	498	341	0	0	423	0	261
V/C Ratio(X)	0.73	0.34	0.34	0.24	0.72	0.72	0.09	0.00	0.00	0.05	0.00	0.27
Avail Cap(c_a), veh/h	378	1007	1054	294	881	918	1016	0	0	1101	0	1020
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	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.2	7.9	7.9	21.1	14.0	14.0	16.0	0.0	0.0	14.9	0.0	15.4
Incr Delay (d2), s/veh	1.7	0.1	0.1	10.4	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.2
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	1.5	0.9	1.0	0.0	2.1	2.2	0.2	0.0	0.0	0.2	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.9	8.0	8.0	31.5	14.8	14.8	16.0	0.0	0.0	15.0	0.0	15.6
LnGrp LOS	B	A	A	C	B	B	B	A	A	B	A	B
Approach Vol, veh/h		742			701			29			91	
Approach Delay, s/veh		10.8			14.8			16.0			15.5	
Approach LOS		B			B			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		13.0	4.1	25.3		13.0	11.3	18.1				
Change Period (Y+Rc), s		* 6	4.0	6.7		6.0	5.0	6.7				
Max Green Setting (Gmax), s		* 28	7.0	24.0		27.3	9.0	21.0				
Max Q Clear Time (g_c+I1), s		4.2	2.0	6.2		3.6	6.4	9.4				
Green Ext Time (p_c), s		0.1	0.0	1.6		0.3	0.0	1.9				
Intersection Summary												
HCM 6th Ctrl Delay			13.0									
HCM 6th LOS			B									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	14.5					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	310	166	72	363	230	117
Future Vol, veh/h	310	166	72	363	230	117
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	337	180	78	395	250	127

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	517	0	691	170
Stage 1	-	-	-	-	337	-
Stage 2	-	-	-	-	354	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1045	-	378	844
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	681	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1045	-	342	843
Mov Cap-2 Maneuver	-	-	-	-	342	-
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	616	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	50.3
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	428	-	-	1045	-
HCM Lane V/C Ratio	0.881	-	-	0.075	-
HCM Control Delay (s)	50.3	-	-	8.7	0.3
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	9.1	-	-	0.2	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	0	2	5	0	28	1	307	4	37	196	3
Future Vol, veh/h	11	0	2	5	0	28	1	307	4	37	196	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	0	2	5	0	30	1	334	4	40	213	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	648	641	215	640	640	342	216	0	0	344	0	0
Stage 1	295	295	-	344	344	-	-	-	-	-	-	-
Stage 2	353	346	-	296	296	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	383	393	825	388	393	701	1354	-	-	1215	-	-
Stage 1	713	669	-	671	637	-	-	-	-	-	-	-
Stage 2	664	635	-	712	668	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	355	375	825	373	375	697	1354	-	-	1208	-	-
Mov Cap-2 Maneuver	355	375	-	373	375	-	-	-	-	-	-	-
Stage 1	712	644	-	666	633	-	-	-	-	-	-	-
Stage 2	634	631	-	683	643	-	-	-	-	-	-	-

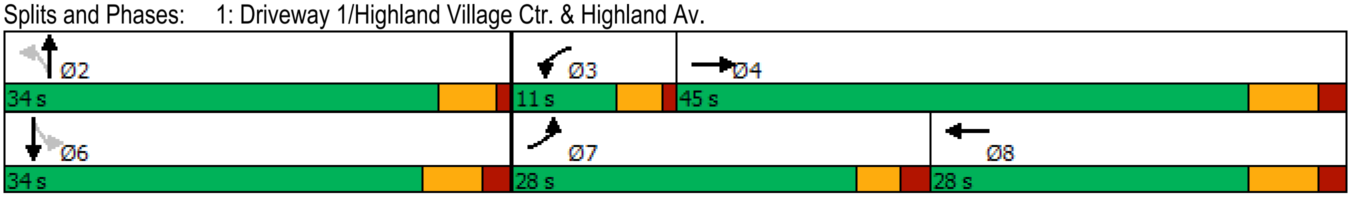
Approach	EB	WB	NB	SB
HCM Control Delay, s	14.6	11.2	0	1.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1354	-	-	389	616	1208	-	-
HCM Lane V/C Ratio	0.001	-	-	0.036	0.058	0.033	-	-
HCM Control Delay (s)	7.7	0	-	14.6	11.2	8.1	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.2	0.1	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	313	504	2	468	13	0	70	0
Future Volume (vph)	313	504	2	468	13	0	70	0
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases					2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	12.0	27.7	11.0	27.7	12.0	12.0	33.0	33.0
Total Split (s)	28.0	45.0	11.0	28.0	34.0	34.0	34.0	34.0
Total Split (%)	31.1%	50.0%	12.2%	31.1%	37.8%	37.8%	37.8%	37.8%
Yellow Time (s)	3.0	4.7	3.0	4.7	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	2.0	1.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	4.0	6.7		5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	Min	Min	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 62.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	313	504	23	2	468	33	13	0	1	70	0	211
Future Volume (veh/h)	313	504	23	2	468	33	13	0	1	70	0	211
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	373	600	27	2	557	35	15	0	1	83	0	215
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	433	1674	75	7	761	48	202	5	5	452	0	296
Arrive On Green	0.24	0.48	0.48	0.00	0.22	0.22	0.19	0.00	0.19	0.19	0.00	0.19
Sat Flow, veh/h	1781	3463	156	1781	3390	213	351	24	25	1416	0	1583
Grp Volume(v), veh/h	373	308	319	2	291	301	16	0	0	83	0	215
Grp Sat Flow(s),veh/h/ln	1781	1777	1842	1781	1777	1825	400	0	0	1416	0	1583
Q Serve(g_s), s	10.3	5.5	5.6	0.1	7.8	7.8	0.4	0.0	0.0	0.0	0.0	6.5
Cycle Q Clear(g_c), s	10.3	5.5	5.6	0.1	7.8	7.8	7.0	0.0	0.0	2.1	0.0	6.5
Prop In Lane	1.00		0.08	1.00		0.12	0.94		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	433	859	890	7	399	410	211	0	0	452	0	296
V/C Ratio(X)	0.86	0.36	0.36	0.29	0.73	0.73	0.08	0.00	0.00	0.18	0.00	0.73
Avail Cap(c_a), veh/h	800	1329	1378	243	739	759	660	0	0	962	0	865
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	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.6	8.3	8.3	25.4	18.4	18.4	20.9	0.0	0.0	17.8	0.0	19.6
Incr Delay (d2), s/veh	2.0	0.1	0.1	8.5	1.0	1.0	0.1	0.0	0.0	0.1	0.0	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	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	1.3	1.4	0.0	2.6	2.7	0.2	0.0	0.0	0.8	0.0	2.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.6	8.4	8.4	33.9	19.4	19.4	20.9	0.0	0.0	17.8	0.0	20.9
LnGrp LOS	C	A	A	C	B	B	C	A	A	B	A	C
Approach Vol, veh/h		1000			594			16			298	
Approach Delay, s/veh		12.9			19.4			20.9			20.0	
Approach LOS		B			B			C			C	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		15.6	4.2	31.5		15.6	17.4	18.2				
Change Period (Y+Rc), s		* 6	4.0	6.7		6.0	5.0	6.7				
Max Green Setting (Gmax), s		* 29	7.0	38.3		28.0	23.0	21.3				
Max Q Clear Time (g_c+I1), s		9.0	2.1	7.6		8.5	12.3	9.8				
Green Ext Time (p_c), s		0.0	0.0	2.0		1.0	0.2	1.5				
Intersection Summary												
HCM 6th Ctrl Delay			16.1									
HCM 6th LOS			B									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	11.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	348	228	101	320	183	99
Future Vol, veh/h	348	228	101	320	183	99
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	378	248	110	348	199	108

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	626	0	772	190
Stage 1	-	-	-	-	378	-
Stage 2	-	-	-	-	394	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	952	-	336	820
Stage 1	-	-	-	-	663	-
Stage 2	-	-	-	-	650	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	952	-	288	819
Mov Cap-2 Maneuver	-	-	-	-	288	-
Stage 1	-	-	-	-	663	-
Stage 2	-	-	-	-	557	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.5	46.5
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	373	-	-	952	-
HCM Lane V/C Ratio	0.822	-	-	0.115	-
HCM Control Delay (s)	46.5	-	-	9.3	0.4
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	7.3	-	-	0.4	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	0	1	7	0	29	2	246	10	28	288	11
Future Vol, veh/h	7	0	1	7	0	29	2	246	10	28	288	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	0	1	8	0	32	2	267	11	30	313	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	672	667	319	663	668	279	325	0	0	284	0	0
Stage 1	379	379	-	283	283	-	-	-	-	-	-	-
Stage 2	293	288	-	380	385	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	370	380	722	375	379	760	1235	-	-	1278	-	-
Stage 1	643	615	-	724	677	-	-	-	-	-	-	-
Stage 2	715	674	-	642	611	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	346	366	722	363	365	756	1235	-	-	1271	-	-
Mov Cap-2 Maneuver	346	366	-	363	365	-	-	-	-	-	-	-
Stage 1	642	597	-	718	672	-	-	-	-	-	-	-
Stage 2	684	669	-	622	593	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15	11.1	0.1	0.7
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1235	-	-	370	625	1271	-	-
HCM Lane V/C Ratio	0.002	-	-	0.024	0.063	0.024	-	-
HCM Control Delay (s)	7.9	0	-	15	11.1	7.9	0	-
HCM Lane LOS	A	A	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.2	0.1	-	-

APPENDIX 5.3:

OPENING YEAR CUMULATIVE (2023) WITHOUT PROJECT CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **2023 Without Project Conditions - Weekday PM Peak Hour**

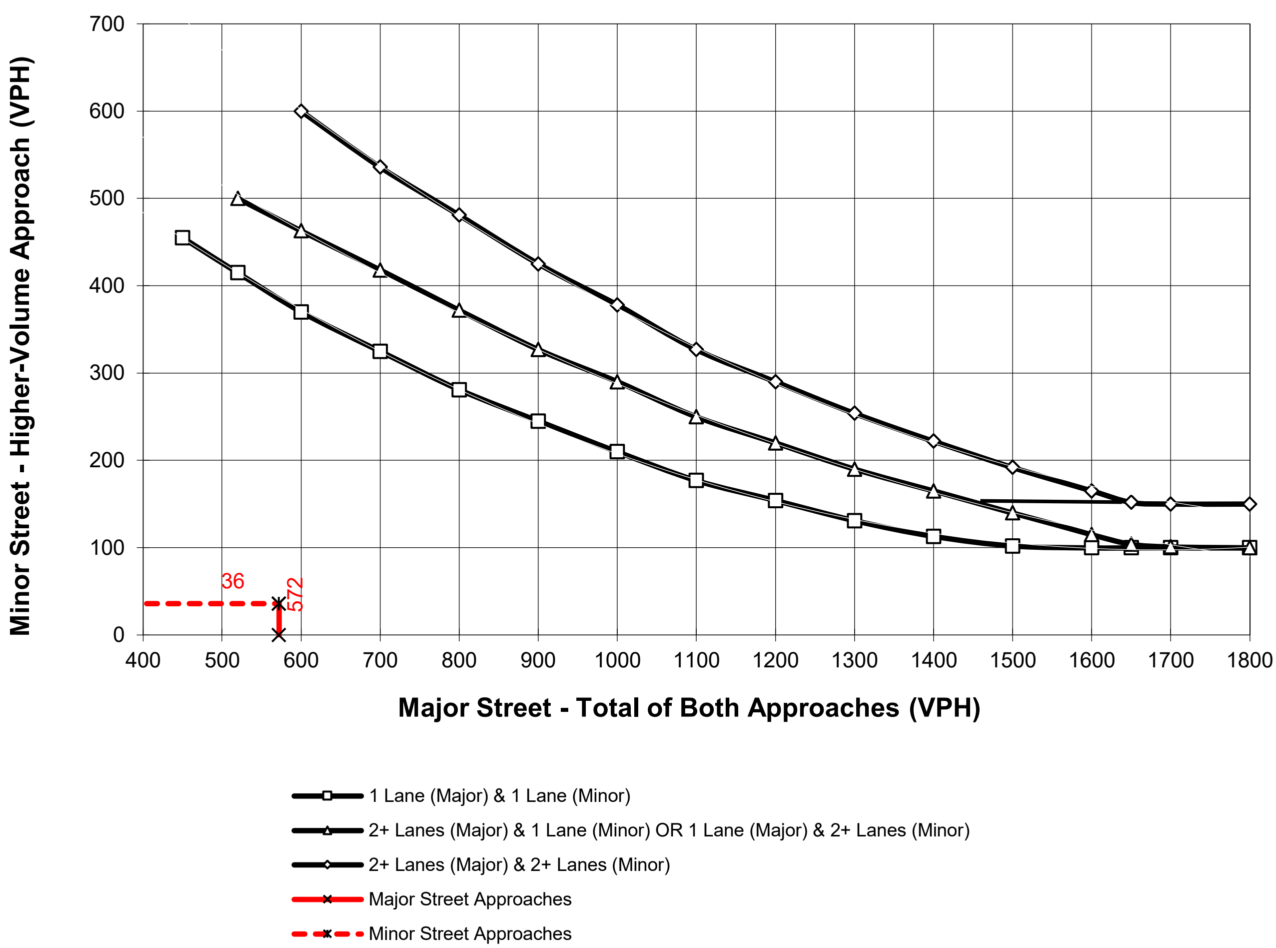
Major Street Name = **Mango Av.**

Total of Both Approaches (VPH) = **572**
Number of Approach Lanes on Major Street = **1**

Minor Street Name = **Walnut Grove Ct.**

High Volume Approach (VPH) = **36**
Number of Approach Lanes On Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold for a minor-street approach with one lane

This Page Intentionally Left Blank

APPENDIX 5.4:

OPENING YEAR CUMULATIVE (2023) WITH PROJECT CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **2023 With Project Conditions - Weekday PM Peak Hour**

Major Street Name = **Mango Av.**

Total of Both Approaches (VPH) = **585**

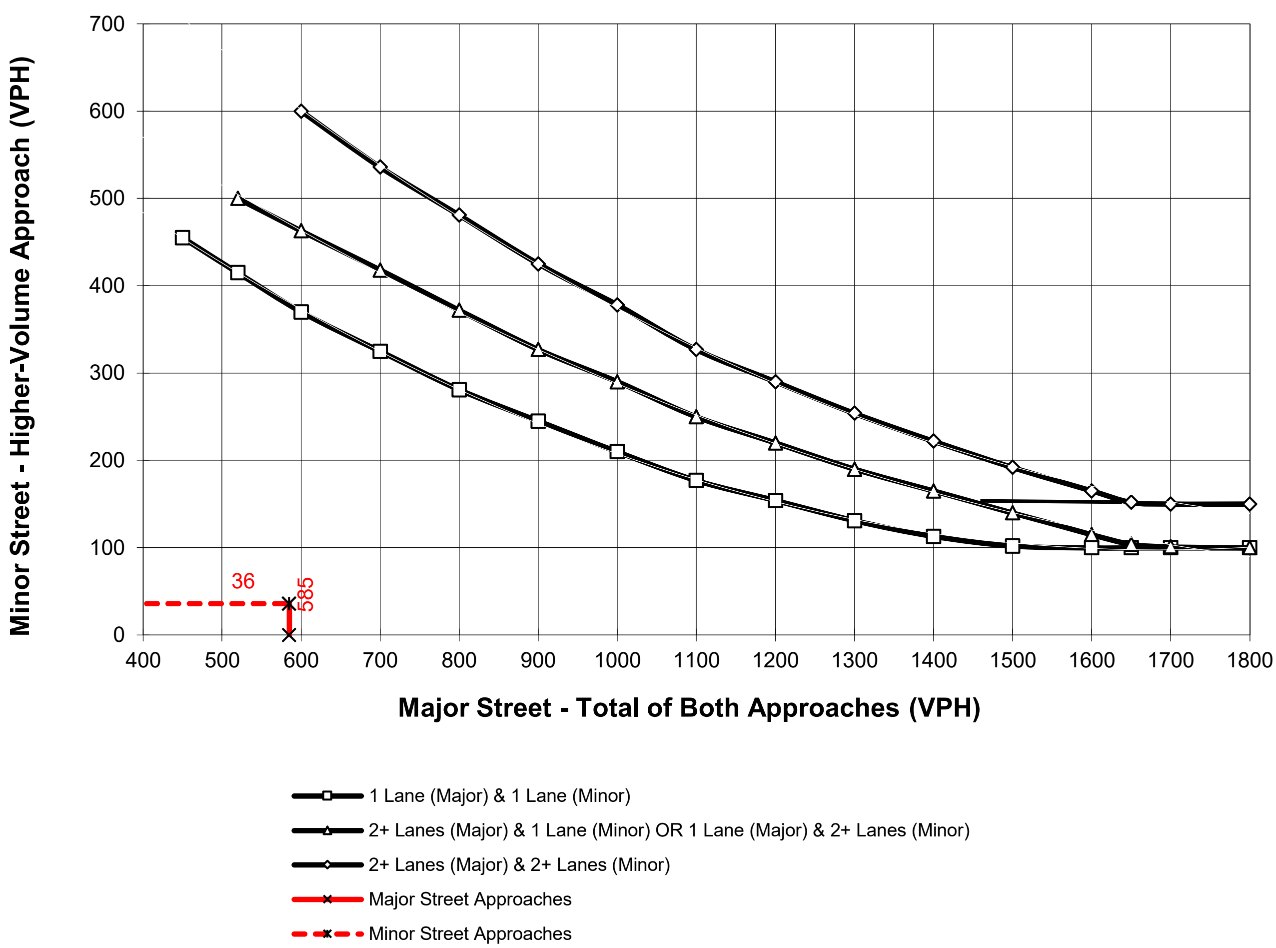
Number of Approach Lanes on Major Street = **1**

Minor Street Name = **Walnut Grove Ct.**

High Volume Approach (VPH) = **36**

Number of Approach Lanes On Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold for a minor-street approach with one lane

This Page Intentionally Left Blank

APPENDIX 5.5:

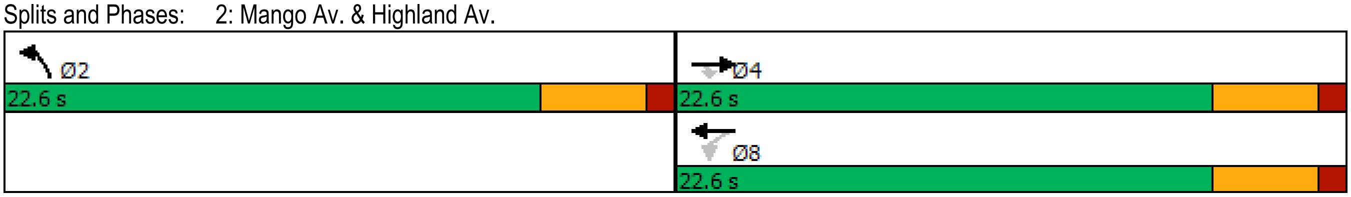
OPENING YEAR CUMULATIVE (2023) WITH PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS WITH IMPROVEMENTS

This Page Intentionally Left Blank

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	310	166	72	363	230
Future Volume (vph)	310	166	72	363	230
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	4			8	2
Permitted Phases		4	8		
Detector Phase	4	4	8	8	2
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.6	22.6	22.6	22.6	22.6
Total Split (s)	22.6	22.6	22.6	22.6	22.6
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.6	4.6	4.6	4.6	4.6
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Min

Intersection Summary
Cycle Length: 45.2
Actuated Cycle Length: 30.6
Natural Cycle: 50
Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Mango Av. & Highland Av.



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	310	166	72	363	230	117
Future Volume (veh/h)	310	166	72	363	230	117
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	337	180	78	395	250	127
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1111	485	504	1111	356	181
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31
Sat Flow, veh/h	3647	1551	884	3647	1131	574
Grp Volume(v), veh/h	337	180	78	395	378	0
Grp Sat Flow(s),veh/h/ln	1777	1551	884	1777	1710	0
Q Serve(g_s), s	1.8	2.2	1.8	2.1	4.8	0.0
Cycle Q Clear(g_c), s	1.8	2.2	3.6	2.1	4.8	0.0
Prop In Lane		1.00	1.00		0.66	0.34
Lane Grp Cap(c), veh/h	1111	485	504	1111	538	0
V/C Ratio(X)	0.30	0.37	0.15	0.36	0.70	0.00
Avail Cap(c_a), veh/h	2592	1132	873	2592	1247	0
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	6.4	6.6	7.8	6.6	7.4	0.0
Incr Delay (d2), s/veh	0.2	0.5	0.1	0.2	1.7	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	0.2	0.2	0.1	0.2	0.9	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	6.6	7.1	7.9	6.8	9.1	0.0
LnGrp LOS	A	A	A	A	A	A
Approach Vol, veh/h	517			473	378	
Approach Delay, s/veh	6.8			7.0	9.1	
Approach LOS	A			A	A	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Timer - Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		12.4		12.3				12.3
Change Period (Y+Rc), s		4.6		4.6				4.6
Max Green Setting (Gmax), s		18.0		18.0				18.0
Max Q Clear Time (g_c+I1), s		6.8		4.2				5.6
Green Ext Time (p_c), s		0.9		2.1				2.1

Intersection Summary		
HCM 6th Ctrl Delay		7.5
HCM 6th LOS		A

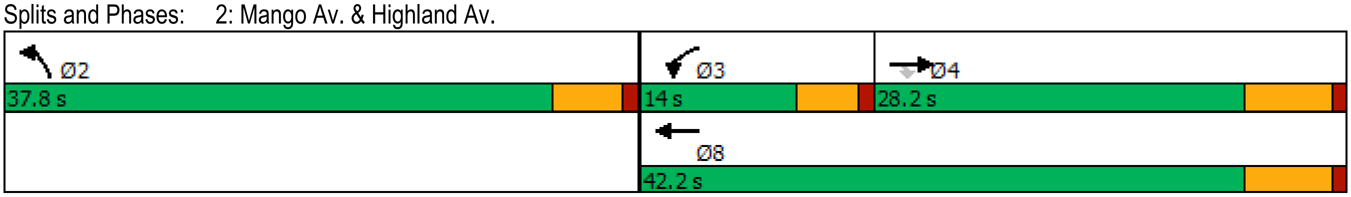
Notes

User approved volume balancing among the lanes for turning movement.

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	348	228	101	320	183
Future Volume (vph)	348	228	101	320	183
Turn Type	NA	Perm	Prot	NA	Prot
Protected Phases	4		3	8	2
Permitted Phases		4			
Detector Phase	4	4	3	8	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	28.2	28.2	11.7	24.2	37.2
Total Split (s)	28.2	28.2	14.0	42.2	37.8
Total Split (%)	35.3%	35.3%	17.5%	52.8%	47.3%
Yellow Time (s)	5.2	5.2	3.7	5.2	4.2
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	4.7	6.2	5.2
Lead/Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		
Recall Mode	None	None	None	None	Min

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 50
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Mango Av. & Highland Av.



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	348	228	101	320	183	99
Future Volume (veh/h)	348	228	101	320	183	99
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	378	248	110	348	199	108
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	862	376	217	1699	271	147
Arrive On Green	0.24	0.24	0.12	0.48	0.25	0.25
Sat Flow, veh/h	3647	1551	1781	3647	1103	598
Grp Volume(v), veh/h	378	248	110	348	308	0
Grp Sat Flow(s),veh/h/ln	1777	1551	1781	1777	1707	0
Q Serve(g_s), s	3.7	5.9	2.4	2.3	6.9	0.0
Cycle Q Clear(g_c), s	3.7	5.9	2.4	2.3	6.9	0.0
Prop In Lane		1.00	1.00		0.65	0.35
Lane Grp Cap(c), veh/h	862	376	217	1699	419	0
V/C Ratio(X)	0.44	0.66	0.51	0.20	0.73	0.00
Avail Cap(c_a), veh/h	1896	827	402	3102	1349	0
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	13.2	14.1	17.0	6.2	14.3	0.0
Incr Delay (d2), s/veh	0.1	0.7	0.7	0.0	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	1.0	1.5	0.8	0.4	2.1	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	13.4	14.8	17.6	6.3	15.3	0.0
LnGrp LOS	B	B	B	A	B	A
Approach Vol, veh/h	626			458	308	
Approach Delay, s/veh	13.9			9.0	15.3	
Approach LOS	B			A	B	

Timer - Assigned Phs	2	3	4	8
Phs Duration (G+Y+Rc), s	15.3	9.7	16.2	25.9
Change Period (Y+Rc), s	5.2	* 4.7	6.2	6.2
Max Green Setting (Gmax), s	32.6	* 9.3	22.0	36.0
Max Q Clear Time (g_c+I1), s	8.9	4.4	7.9	4.3
Green Ext Time (p_c), s	0.4	0.0	1.6	1.3

Intersection Summary	
HCM 6th Ctrl Delay	12.6
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

APPENDIX 6.1:

HORIZON YEAR (2040) WITHOUT PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	196	552	691	22	108
Future Volume (vph)	196	552	691	22	108
Turn Type	Prot	NA	NA	Prot	Perm
Protected Phases	7	4	8	1	
Permitted Phases					6
Detector Phase	7	4	8	1	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	5.0	7.0
Minimum Split (s)	12.0	13.7	27.7	9.6	33.0
Total Split (s)	14.0	41.7	27.7	33.3	33.3
Total Split (%)	18.7%	55.6%	36.9%	44.4%	44.4%
Yellow Time (s)	3.0	4.7	4.7	3.6	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	6.7	4.6	6.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	None	None	None	None

Intersection Summary

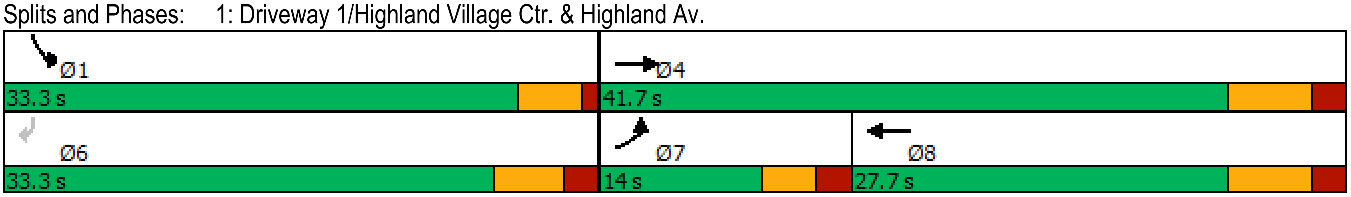
Cycle Length: 75

Actuated Cycle Length: 52

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	196	552	0	0	691	22	0	0	0	22	0	108
Future Volume (veh/h)	196	552	0	0	691	22	0	0	0	22	0	108
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				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
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	233	657	0	0	823	22				26	0	93
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84				0.84	0.84	0.84
Percent Heavy Veh, %	2	2	0	0	2	2				2	0	2
Cap, veh/h	296	2185	0	0	1130	30				166	0	148
Arrive On Green	0.17	0.61	0.00	0.00	0.32	0.32				0.09	0.00	0.09
Sat Flow, veh/h	1781	3647	0	0	3627	94				1781	0	1585
Grp Volume(v), veh/h	233	657	0	0	414	431				26	0	93
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1851				1781	0	1585
Q Serve(g_s), s	4.9	3.4	0.0	0.0	8.0	8.0				0.5	0.0	2.2
Cycle Q Clear(g_c), s	4.9	3.4	0.0	0.0	8.0	8.0				0.5	0.0	2.2
Prop In Lane	1.00		0.00	0.00		0.05				1.00		1.00
Lane Grp Cap(c), veh/h	296	2185	0	0	568	592				166	0	148
V/C Ratio(X)	0.79	0.30	0.00	0.00	0.73	0.73				0.16	0.00	0.63
Avail Cap(c_a), veh/h	414	3212	0	0	964	1004				1320	0	1175
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	15.5	3.5	0.0	0.0	11.7	11.7				16.2	0.0	16.9
Incr Delay (d2), s/veh	4.2	0.0	0.0	0.0	0.7	0.7				0.4	0.0	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	1.7	0.2	0.0	0.0	2.0	2.1				0.2	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.7	3.5	0.0	0.0	12.4	12.3				16.6	0.0	21.3
LnGrp LOS	B	A	A	A	B	B				B	A	C
Approach Vol, veh/h		890			845						119	
Approach Delay, s/veh		7.8			12.3						20.2	
Approach LOS		A			B						C	

Timer - Assigned Phs				4		6	7	8				
Phs Duration (G+Y+Rc), s				30.5		8.2	11.4	19.1				
Change Period (Y+Rc), s				6.7		4.6	5.0	6.7				
Max Green Setting (Gmax), s				35.0		28.7	9.0	21.0				
Max Q Clear Time (g_c+I1), s				5.4		4.2	6.9	10.0				
Green Ext Time (p_c), s				2.6		0.3	0.0	2.3				

Intersection Summary		
HCM 6th Ctrl Delay		10.7
HCM 6th LOS		B

Intersection						
Int Delay, s/veh	49.9					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	374	200	85	440	273	135
Future Vol, veh/h	374	200	85	440	273	135
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	407	217	92	478	297	147

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	624	0	830	205
Stage 1	-	-	-	-	407	-
Stage 2	-	-	-	-	423	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	953	-	308	802
Stage 1	-	-	-	-	641	-
Stage 2	-	-	-	-	629	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	953	-	~ 268	801
Mov Cap-2 Maneuver	-	-	-	-	~ 268	-
Stage 1	-	-	-	-	641	-
Stage 2	-	-	-	-	547	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	182
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	344	-	-	953	-
HCM Lane V/C Ratio	1.289	-	-	0.097	-
HCM Control Delay (s)	182	-	-	9.2	0.4
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	20.5	-	-	0.3	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	6	0	35	0	373	4	45	240	0
Future Vol, veh/h	0	0	0	6	0	35	0	373	4	45	240	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	7	0	38	0	405	4	49	261	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	772	772	413	-	0	0	415	0	0
Stage 1	413	413	-	-	-	-	-	-	-
Stage 2	359	359	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	368	330	639	0	-	-	1144	-	0
Stage 1	668	594	-	0	-	-	-	-	0
Stage 2	707	627	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	347	0	635	-	-	-	1137	-	-
Mov Cap-2 Maneuver	347	0	-	-	-	-	-	-	-
Stage 1	664	0	-	-	-	-	-	-	-
Stage 2	672	0	-	-	-	-	-	-	-

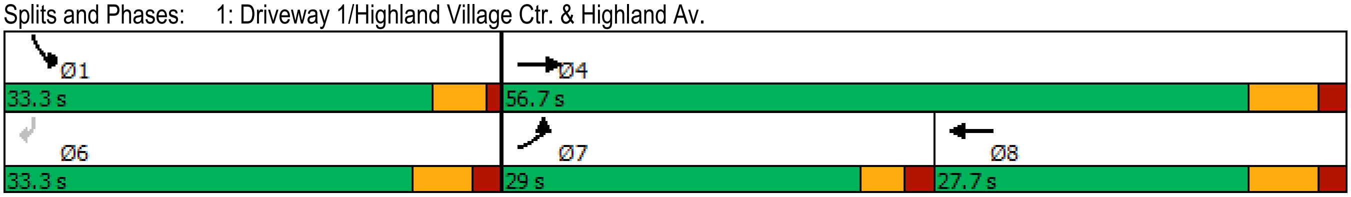
Approach	WB	NB	SB
HCM Control Delay, s	11.9	0	1.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	566	1137	-
HCM Lane V/C Ratio	-	-	0.079	0.043	-
HCM Control Delay (s)	-	-	11.9	8.3	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	380	605	565	86	257
Future Volume (vph)	380	605	565	86	257
Turn Type	Prot	NA	NA	Prot	Perm
Protected Phases	7	4	8	1	
Permitted Phases					6
Detector Phase	7	4	8	1	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	5.0	7.0
Minimum Split (s)	12.0	13.7	27.7	9.6	33.0
Total Split (s)	29.0	56.7	27.7	33.3	33.3
Total Split (%)	32.2%	63.0%	30.8%	37.0%	37.0%
Yellow Time (s)	3.0	4.7	4.7	3.6	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	6.7	4.6	6.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	None	None	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 70.3
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	380	605	0	0	565	40	0	0	0	86	0	257
Future Volume (veh/h)	380	605	0	0	565	40	0	0	0	86	0	257
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		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870				1870	0	1870
Adj Flow Rate, veh/h	452	720	0	0	673	44				102	0	270
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84				0.84	0.84	0.84
Percent Heavy Veh, %	2	2	0	0	2	2				2	0	2
Cap, veh/h	500	2157	0	0	832	54				377	0	336
Arrive On Green	0.28	0.61	0.00	0.00	0.25	0.25				0.21	0.00	0.21
Sat Flow, veh/h	1781	3647	0	0	3473	221				1781	0	1585
Grp Volume(v), veh/h	452	720	0	0	354	363				102	0	270
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1824				1781	0	1585
Q Serve(g_s), s	15.3	6.2	0.0	0.0	11.7	11.7				3.0	0.0	10.1
Cycle Q Clear(g_c), s	15.3	6.2	0.0	0.0	11.7	11.7				3.0	0.0	10.1
Prop In Lane	1.00		0.00	0.00		0.12				1.00		1.00
Lane Grp Cap(c), veh/h	500	2157	0	0	437	449				377	0	336
V/C Ratio(X)	0.90	0.33	0.00	0.00	0.81	0.81				0.27	0.00	0.80
Avail Cap(c_a), veh/h	685	2849	0	0	598	614				820	0	729
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	21.6	6.0	0.0	0.0	22.1	22.1				20.5	0.0	23.3
Incr Delay (d2), s/veh	10.2	0.0	0.0	0.0	4.1	4.1				0.4	0.0	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	6.7	1.4	0.0	0.0	4.6	4.7				1.2	0.0	8.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.9	6.1	0.0	0.0	26.2	26.2				20.9	0.0	27.9
LnGrp LOS	C	A	A	A	C	C				C	A	C
Approach Vol, veh/h		1172			717						372	
Approach Delay, s/veh		16.0			26.2						26.0	
Approach LOS		B			C						C	
Timer - Assigned Phs				4		6	7	8				
Phs Duration (G+Y+Rc), s				44.6		17.8	22.5	22.0				
Change Period (Y+Rc), s				6.7		4.6	5.0	6.7				
Max Green Setting (Gmax), s				50.0		28.7	24.0	21.0				
Max Q Clear Time (g_c+I1), s				8.2		12.1	17.3	13.7				
Green Ext Time (p_c), s				2.9		1.1	0.3	1.5				
Intersection Summary												
HCM 6th Ctrl Delay			20.9									
HCM 6th LOS			C									

Intersection	
Int Delay, s/veh	39.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	421	270	115	387	219	116
Future Vol, veh/h	421	270	115	387	219	116
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	458	293	125	421	238	126

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	751	0	919	230
Stage 1	-	-	-	-	458	-
Stage 2	-	-	-	-	461	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	854	-	270	772
Stage 1	-	-	-	-	604	-
Stage 2	-	-	-	-	601	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	854	-	~ 218	771
Mov Cap-2 Maneuver	-	-	-	-	~ 218	-
Stage 1	-	-	-	-	604	-
Stage 2	-	-	-	-	486	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	176.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	290	-	-	854	-
HCM Lane V/C Ratio	1.256	-	-	0.146	-
HCM Control Delay (s)	176.5	-	-	9.9	0.6
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	17.2	-	-	0.5	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	9	0	35	0	300	12	34	351	0
Future Vol, veh/h	0	0	0	9	0	35	0	300	12	34	351	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	10	0	38	0	326	13	37	382	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	795	795	339	-	0	0	345	0	0
Stage 1	339	339	-	-	-	-	-	-	-
Stage 2	456	456	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	357	320	703	0	-	-	1214	-	0
Stage 1	722	640	-	0	-	-	-	-	0
Stage 2	638	568	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	341	0	699	-	-	-	1207	-	-
Mov Cap-2 Maneuver	341	0	-	-	-	-	-	-	-
Stage 1	718	0	-	-	-	-	-	-	-
Stage 2	613	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.8	0	0.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	575	1207	-
HCM Lane V/C Ratio	-	-	0.083	0.031	-
HCM Control Delay (s)	-	-	11.8	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

APPENDIX 6.2:

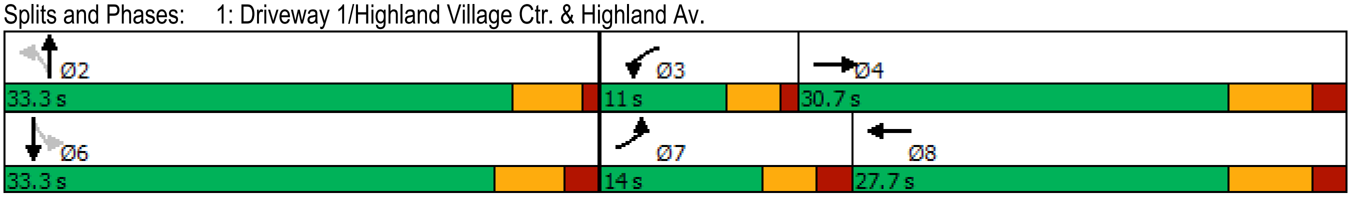
HORIZON YEAR (2040) WITH PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	196	554	1	697	23	0	22	0
Future Volume (vph)	196	554	1	697	23	0	22	0
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases					2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	12.0	27.7	11.0	27.7	12.0	12.0	33.0	33.0
Total Split (s)	14.0	30.7	11.0	27.7	33.3	33.3	33.3	33.3
Total Split (%)	18.7%	40.9%	14.7%	36.9%	44.4%	44.4%	44.4%	44.4%
Yellow Time (s)	3.0	4.7	3.0	4.7	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	2.0	1.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	4.0	6.7		5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	Min	Min	None	None

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 55.3
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	196	554	7	1	697	22	23	0	2	22	0	108
Future Volume (veh/h)	196	554	7	1	697	22	23	0	2	22	0	108
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	233	660	8	1	830	22	27	0	2	26	0	93
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	288	1747	21	4	1076	29	271	6	9	395	0	239
Arrive On Green	0.16	0.49	0.49	0.00	0.30	0.30	0.15	0.00	0.15	0.15	0.00	0.15
Sat Flow, veh/h	1781	3596	44	1781	3534	94	797	36	62	1415	0	1582
Grp Volume(v), veh/h	233	326	342	1	417	435	29	0	0	26	0	93
Grp Sat Flow(s),veh/h/ln	1781	1777	1863	1781	1777	1851	895	0	0	1415	0	1582
Q Serve(g_s), s	5.8	5.3	5.3	0.0	9.9	9.9	0.7	0.0	0.0	0.0	0.0	2.5
Cycle Q Clear(g_c), s	5.8	5.3	5.3	0.0	9.9	9.9	3.2	0.0	0.0	0.6	0.0	2.5
Prop In Lane	1.00		0.02	1.00		0.05	0.93		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	288	863	905	4	541	564	286	0	0	395	0	239
V/C Ratio(X)	0.81	0.38	0.38	0.26	0.77	0.77	0.10	0.00	0.00	0.07	0.00	0.39
Avail Cap(c_a), veh/h	347	922	966	270	807	840	892	0	0	1016	0	934
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	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.7	7.5	7.5	23.0	14.6	14.6	18.6	0.0	0.0	16.9	0.0	17.7
Incr Delay (d2), s/veh	9.5	0.1	0.1	12.6	1.2	1.2	0.1	0.0	0.0	0.0	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	2.6	1.1	1.2	0.0	3.0	3.1	0.3	0.0	0.0	0.2	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	28.2	7.6	7.6	35.7	15.9	15.8	18.6	0.0	0.0	16.9	0.0	18.1
LnGrp LOS	C	A	A	D	B	B	B	A	A	B	A	B
Approach Vol, veh/h		901			853			29			119	
Approach Delay, s/veh		12.9			15.9			18.6			17.8	
Approach LOS		B			B			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		13.0	4.1	29.2		13.0	12.5	20.8				
Change Period (Y+Rc), s		* 6	4.0	6.7		6.0	5.0	6.7				
Max Green Setting (Gmax), s		* 28	7.0	24.0		27.3	9.0	21.0				
Max Q Clear Time (g_c+I1), s		5.2	2.0	7.3		4.5	7.8	11.9				
Green Ext Time (p_c), s		0.1	0.0	2.0		0.4	0.0	2.1				
Intersection Summary												
HCM 6th Ctrl Delay			14.6									
HCM 6th LOS			B									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	57.2					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	376	202	87	441	279	141
Future Vol, veh/h	376	202	87	441	279	141
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	409	220	95	479	303	153

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	629	0	839	206
Stage 1	-	-	-	-	409	-
Stage 2	-	-	-	-	430	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	949	-	304	800
Stage 1	-	-	-	-	639	-
Stage 2	-	-	-	-	624	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	949	-	~ 263	799
Mov Cap-2 Maneuver	-	-	-	-	~ 263	-
Stage 1	-	-	-	-	639	-
Stage 2	-	-	-	-	539	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	205.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	339	-	-	949	-
HCM Lane V/C Ratio	1.347	-	-	0.1	-
HCM Control Delay (s)	205.5	-	-	9.2	0.4
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	22.4	-	-	0.3	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	0	2	6	0	35	1	373	4	45	240	3
Future Vol, veh/h	11	0	2	6	0	35	1	373	4	45	240	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	0	2	7	0	38	1	405	4	49	261	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	789	778	263	777	777	413	264	0	0	415	0	0
Stage 1	361	361	-	415	415	-	-	-	-	-	-	-
Stage 2	428	417	-	362	362	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	308	328	776	314	328	639	1300	-	-	1144	-	-
Stage 1	657	626	-	615	592	-	-	-	-	-	-	-
Stage 2	605	591	-	657	625	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	278	309	776	299	309	635	1300	-	-	1137	-	-
Mov Cap-2 Maneuver	278	309	-	299	309	-	-	-	-	-	-	-
Stage 1	656	594	-	611	588	-	-	-	-	-	-	-
Stage 2	568	587	-	622	593	-	-	-	-	-	-	-

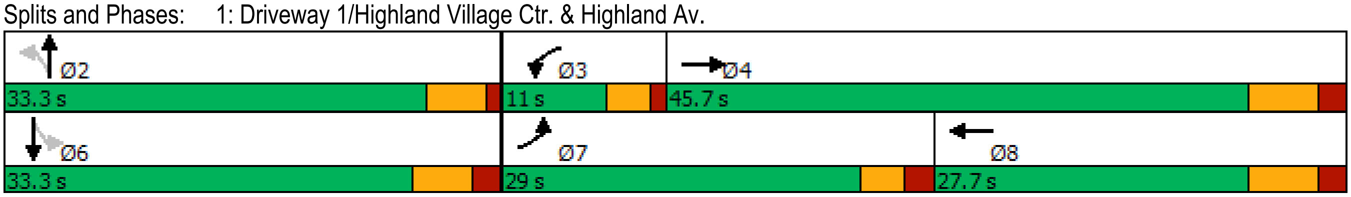
Approach	EB	WB	NB	SB
HCM Control Delay, s	17.3	12.2	0	1.3
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1300	-	-	308	545	1137	-	-
HCM Lane V/C Ratio	0.001	-	-	0.046	0.082	0.043	-	-
HCM Control Delay (s)	7.8	0	-	17.3	12.2	8.3	0	-
HCM Lane LOS	A	A	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.3	0.1	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	380	611	2	568	13	0	86	0
Future Volume (vph)	380	611	2	568	13	0	86	0
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	NA
Protected Phases	7	4	3	8		2		6
Permitted Phases					2		6	
Detector Phase	7	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	12.0	27.7	11.0	27.7	12.0	12.0	33.0	33.0
Total Split (s)	29.0	45.7	11.0	27.7	33.3	33.3	33.3	33.3
Total Split (%)	32.2%	50.8%	12.2%	30.8%	37.0%	37.0%	37.0%	37.0%
Yellow Time (s)	3.0	4.7	3.0	4.7	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	2.0	1.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.7	4.0	6.7		5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Recall Mode	None	None	None	None	Min	Min	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 71.4
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Driveway 1/Highland Village Ctr. & Highland Av.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	380	611	23	2	568	40	13	0	1	86	0	257
Future Volume (veh/h)	380	611	23	2	568	40	13	0	1	86	0	257
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.97	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	452	727	27	2	676	44	15	0	1	102	0	270
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	497	1862	69	7	821	53	158	3	4	467	0	335
Arrive On Green	0.28	0.53	0.53	0.00	0.24	0.24	0.21	0.00	0.21	0.21	0.00	0.21
Sat Flow, veh/h	1781	3494	130	1781	3381	220	249	16	18	1416	0	1583
Grp Volume(v), veh/h	452	370	384	2	355	365	16	0	0	102	0	270
Grp Sat Flow(s),veh/h/ln	1781	1777	1847	1781	1777	1824	283	0	0	1416	0	1583
Q Serve(g_s), s	16.3	8.1	8.2	0.1	12.6	12.6	0.7	0.0	0.0	0.0	0.0	10.8
Cycle Q Clear(g_c), s	16.3	8.1	8.2	0.1	12.6	12.6	11.4	0.0	0.0	3.2	0.0	10.8
Prop In Lane	1.00		0.07	1.00		0.12	0.94		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	497	947	984	7	431	443	165	0	0	467	0	335
V/C Ratio(X)	0.91	0.39	0.39	0.29	0.82	0.82	0.10	0.00	0.00	0.22	0.00	0.81
Avail Cap(c_a), veh/h	644	1044	1085	188	562	577	407	0	0	749	0	651
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	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.1	9.1	9.2	33.0	23.8	23.8	27.7	0.0	0.0	21.9	0.0	24.9
Incr Delay (d2), s/veh	12.6	0.1	0.1	8.6	5.8	5.8	0.1	0.0	0.0	0.1	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	7.5	2.3	2.4	0.0	5.2	5.4	0.2	0.0	0.0	1.3	0.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.7	9.2	9.2	41.6	29.6	29.6	27.8	0.0	0.0	22.0	0.0	26.6
LnGrp LOS	D	A	A	D	C	C	C	A	A	C	A	C
Approach Vol, veh/h		1206			722			16			372	
Approach Delay, s/veh		19.2			29.6			27.8			25.3	
Approach LOS		B			C			C			C	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		20.1	4.3	42.1		20.1	23.5	22.8
Change Period (Y+Rc), s		* 6	4.0	6.7		6.0	5.0	6.7
Max Green Setting (Gmax), s		* 28	7.0	39.0		27.3	24.0	21.0
Max Q Clear Time (g_c+I1), s		13.4	2.1	10.2		12.8	18.3	14.6
Green Ext Time (p_c), s		0.0	0.0	2.5		1.2	0.2	1.4

Intersection Summary	
HCM 6th Ctrl Delay	23.5
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	45.5					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	422	276	121	389	222	119
Future Vol, veh/h	422	276	121	389	222	119
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	225	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	459	300	132	423	241	129

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	759	0	935	231
Stage 1	-	-	-	-	459	-
Stage 2	-	-	-	-	476	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	848	-	264	771
Stage 1	-	-	-	-	603	-
Stage 2	-	-	-	-	591	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	848	-	~ 210	770
Mov Cap-2 Maneuver	-	-	-	-	~ 210	-
Stage 1	-	-	-	-	603	-
Stage 2	-	-	-	-	471	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.8	202.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	281	-	-	848	-
HCM Lane V/C Ratio	1.319	-	-	0.155	-
HCM Control Delay (s)	202.5	-	-	10	0.6
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	18.7	-	-	0.5	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s   +: Computation Not Defined   *: All major volume in platoon

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	0	1	9	0	35	2	300	12	34	351	11
Future Vol, veh/h	7	0	1	9	0	35	2	300	12	34	351	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	6	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	0	1	10	0	38	2	326	13	37	382	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	818	811	388	806	811	339	394	0	0	345	0	0
Stage 1	462	462	-	343	343	-	-	-	-	-	-	-
Stage 2	356	349	-	463	468	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	295	313	660	300	313	703	1165	-	-	1214	-	-
Stage 1	580	565	-	672	637	-	-	-	-	-	-	-
Stage 2	661	633	-	579	561	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	270	298	660	289	298	699	1165	-	-	1207	-	-
Mov Cap-2 Maneuver	270	298	-	289	298	-	-	-	-	-	-	-
Stage 1	579	543	-	667	632	-	-	-	-	-	-	-
Stage 2	624	628	-	556	539	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.7	12.3	0.1	0.7
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1165	-	-	292	542	1207	-	-
HCM Lane V/C Ratio	0.002	-	-	0.03	0.088	0.031	-	-
HCM Control Delay (s)	8.1	0	-	17.7	12.3	8.1	0	-
HCM Lane LOS	A	A	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.3	0.1	-	-

APPENDIX 6.3:

HORIZON YEAR (2040) WITHOUT PROJECT CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **2040 Without Project Conditions - Weekday PM Peak Hour**

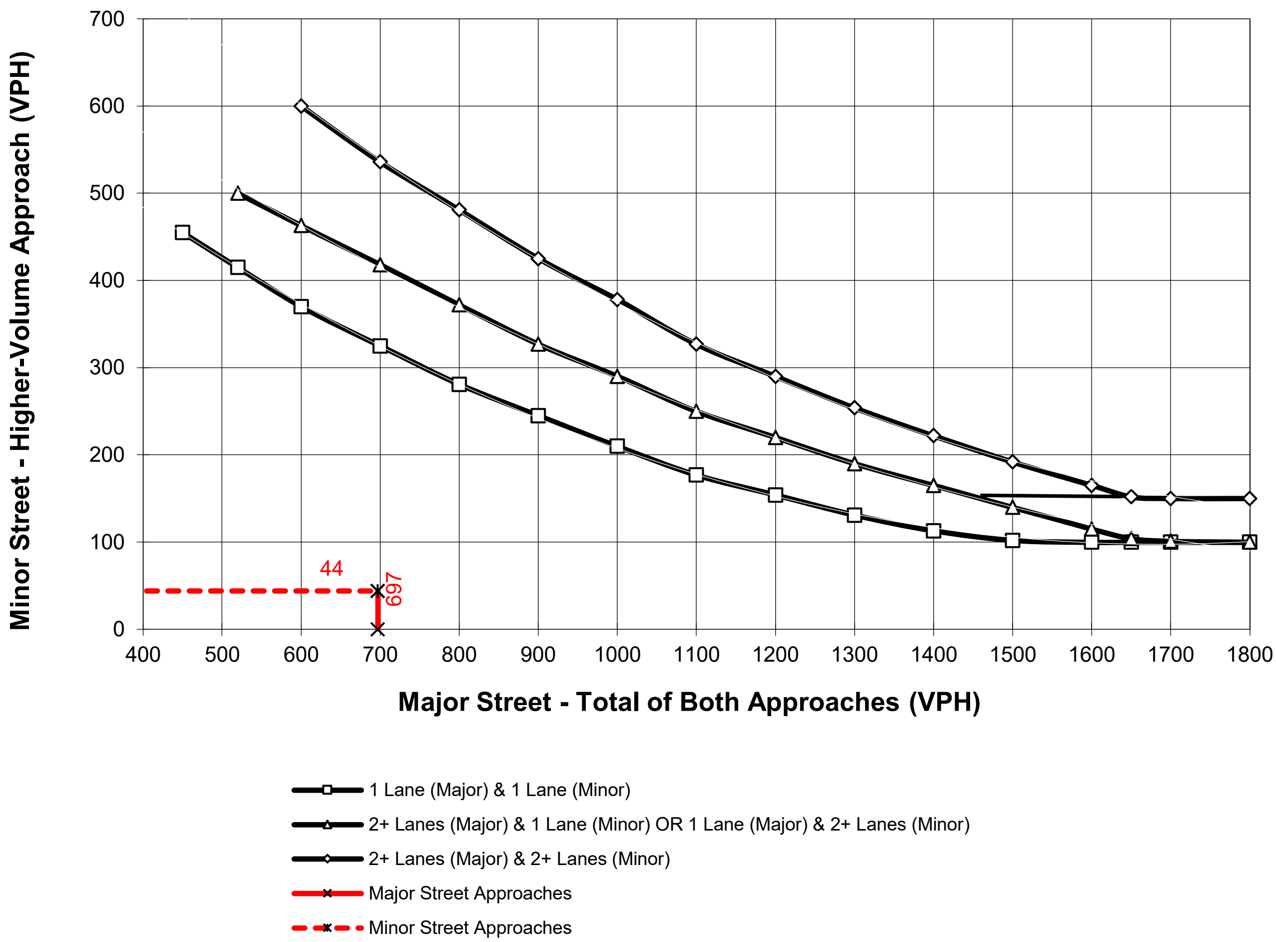
Major Street Name = **Mango Av.**

Total of Both Approaches (VPH) = **697**
Number of Approach Lanes on Major Street = **1**

Minor Street Name = **Walnut Grove Ct.**

High Volume Approach (VPH) = **44**
Number of Approach Lanes On Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold for a minor-street approach with one lane

This Page Intentionally Left Blank

APPENDIX 6.4:

HORIZON YEAR (2040) WITH PROJECT CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS

This Page Intentionally Left Blank

Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **2040 With Project Conditions - Weekday PM Peak Hour**

Major Street Name = **Mango Av.**

Total of Both Approaches (VPH) = **710**

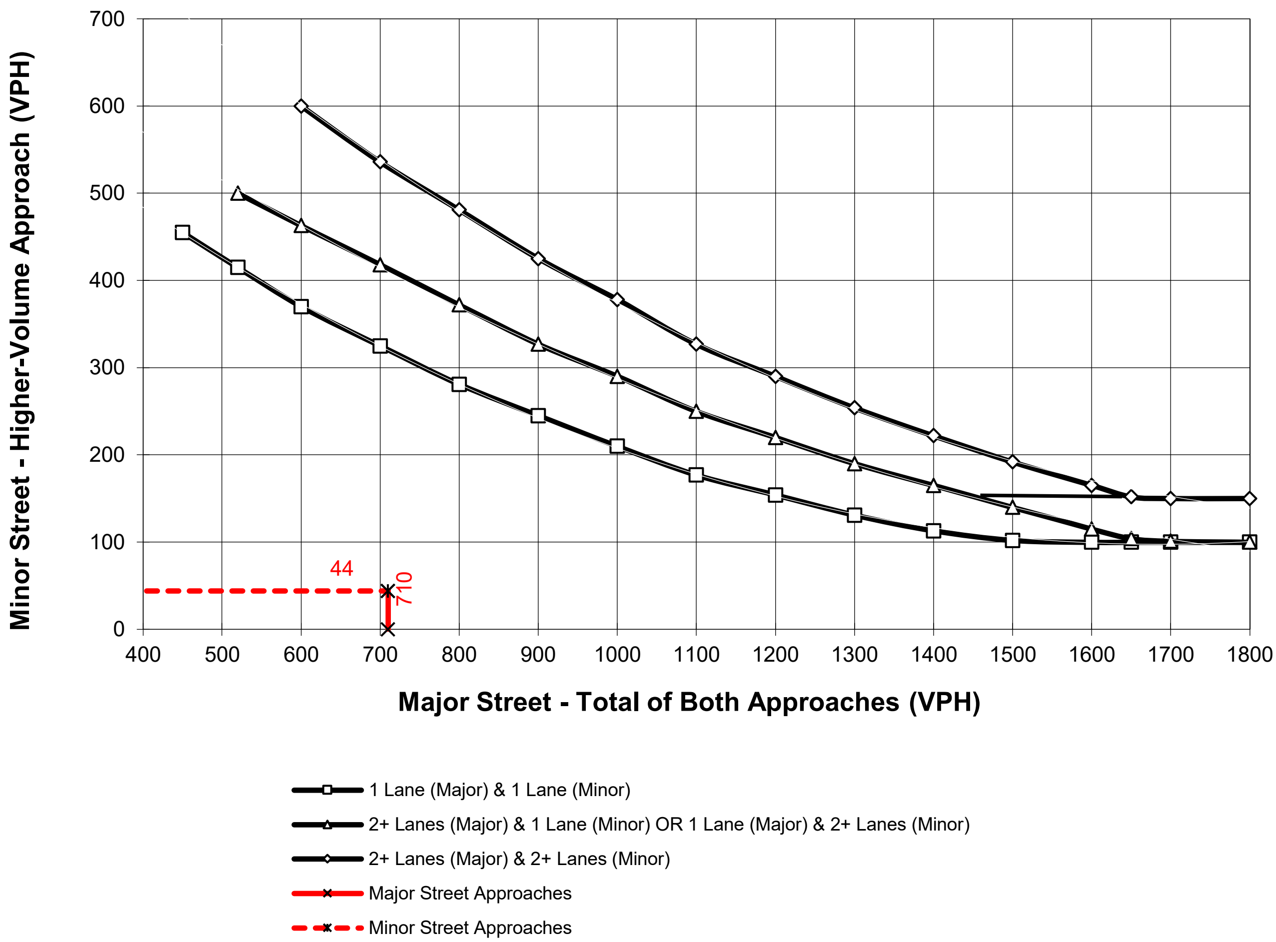
Number of Approach Lanes on Major Street = **1**

Minor Street Name = **Walnut Grove Ct.**

High Volume Approach (VPH) = **44**

Number of Approach Lanes On Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold for a minor-street approach with one lane

This Page Intentionally Left Blank

APPENDIX 6.5:

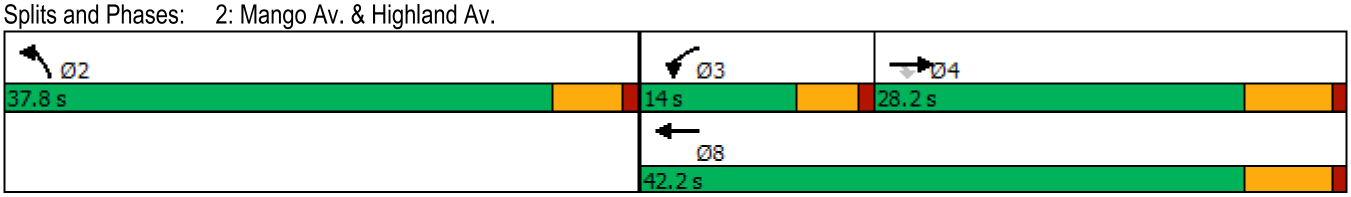
HORIZON YEAR (2040) WITH PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS WITH IMPROVEMENTS

This Page Intentionally Left Blank

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	376	202	87	441	279
Future Volume (vph)	376	202	87	441	279
Turn Type	NA	Perm	Prot	NA	Prot
Protected Phases	4		3	8	2
Permitted Phases		4			
Detector Phase	4	4	3	8	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	28.2	28.2	11.7	24.2	37.2
Total Split (s)	28.2	28.2	14.0	42.2	37.8
Total Split (%)	35.3%	35.3%	17.5%	52.8%	47.3%
Yellow Time (s)	5.2	5.2	3.7	5.2	4.2
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	4.7	6.2	5.2
Lead/Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		
Recall Mode	None	None	None	None	Min

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 54
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Mango Av. & Highland Av.



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	376	202	87	441	279	141
Future Volume (veh/h)	376	202	87	441	279	141
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	409	220	95	479	303	153
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	789	344	192	1543	355	179
Arrive On Green	0.22	0.22	0.11	0.43	0.31	0.31
Sat Flow, veh/h	3647	1551	1781	3647	1134	572
Grp Volume(v), veh/h	409	220	95	479	457	0
Grp Sat Flow(s),veh/h/ln	1777	1551	1781	1777	1710	0
Q Serve(g_s), s	4.6	5.8	2.3	4.0	11.3	0.0
Cycle Q Clear(g_c), s	4.6	5.8	2.3	4.0	11.3	0.0
Prop In Lane		1.00	1.00		0.66	0.33
Lane Grp Cap(c), veh/h	789	344	192	1543	535	0
V/C Ratio(X)	0.52	0.64	0.49	0.31	0.85	0.00
Avail Cap(c_a), veh/h	1735	757	368	2839	1237	0
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	15.4	15.9	18.9	8.3	14.5	0.0
Incr Delay (d2), s/veh	0.2	0.7	0.7	0.0	1.6	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	1.4	1.6	0.8	0.9	3.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	15.6	16.6	19.7	8.4	16.1	0.0
LnGrp LOS	B	B	B	A	B	A
Approach Vol, veh/h	629			574	457	
Approach Delay, s/veh	16.0			10.2	16.1	
Approach LOS	B			B	B	

Timer - Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		19.3	9.6	16.2				25.8
Change Period (Y+Rc), s		5.2	* 4.7	6.2				6.2
Max Green Setting (Gmax), s		32.6	* 9.3	22.0				36.0
Max Q Clear Time (g_c+I1), s		13.3	4.3	7.8				6.0
Green Ext Time (p_c), s		0.7	0.0	1.6				1.8

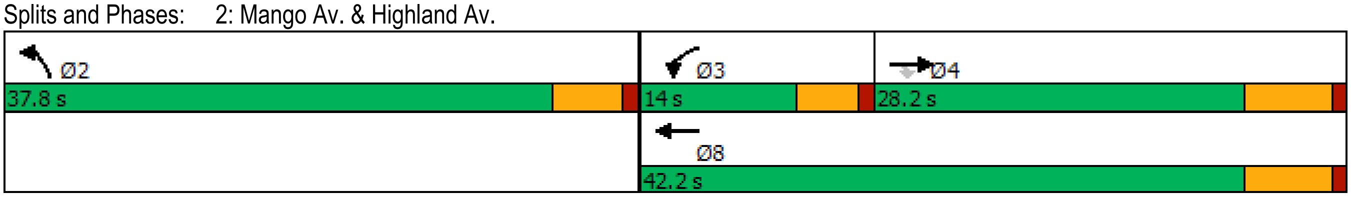
Intersection Summary			
HCM 6th Ctrl Delay			14.0
HCM 6th LOS			B

Notes
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	422	276	121	389	222
Future Volume (vph)	422	276	121	389	222
Turn Type	NA	Perm	Prot	NA	Prot
Protected Phases	4		3	8	2
Permitted Phases		4			
Detector Phase	4	4	3	8	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	28.2	28.2	11.7	24.2	37.2
Total Split (s)	28.2	28.2	14.0	42.2	37.8
Total Split (%)	35.3%	35.3%	17.5%	52.8%	47.3%
Yellow Time (s)	5.2	5.2	3.7	5.2	4.2
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	4.7	6.2	5.2
Lead/Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		
Recall Mode	None	None	None	None	Min

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 52.9
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Mango Av. & Highland Av.



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	422	276	121	389	222	119
Future Volume (veh/h)	422	276	121	389	222	119
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	459	300	132	423	241	129
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	929	405	221	1735	292	156
Arrive On Green	0.26	0.26	0.12	0.49	0.26	0.26
Sat Flow, veh/h	3647	1551	1781	3647	1109	594
Grp Volume(v), veh/h	459	300	132	423	371	0
Grp Sat Flow(s),veh/h/ln	1777	1551	1781	1777	1707	0
Q Serve(g_s), s	5.0	8.1	3.2	3.2	9.4	0.0
Cycle Q Clear(g_c), s	5.0	8.1	3.2	3.2	9.4	0.0
Prop In Lane		1.00	1.00		0.65	0.35
Lane Grp Cap(c), veh/h	929	405	221	1735	449	0
V/C Ratio(X)	0.49	0.74	0.60	0.24	0.83	0.00
Avail Cap(c_a), veh/h	1707	745	362	2792	1215	0
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	14.4	15.5	19.0	6.8	15.9	0.0
Incr Delay (d2), s/veh	0.2	1.0	1.0	0.0	1.5	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	1.5	2.2	1.1	0.7	3.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	14.5	16.5	19.9	6.8	17.4	0.0
LnGrp LOS	B	B	B	A	B	A
Approach Vol, veh/h	759			555	371	
Approach Delay, s/veh	15.3			9.9	17.4	
Approach LOS	B			A	B	

Timer - Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		17.2	10.4	18.2				28.6
Change Period (Y+Rc), s		5.2	* 4.7	6.2				6.2
Max Green Setting (Gmax), s		32.6	* 9.3	22.0				36.0
Max Q Clear Time (g_c+I1), s		11.4	5.2	10.1				5.2
Green Ext Time (p_c), s		0.5	0.0	1.9				1.6

Intersection Summary			
HCM 6th Ctrl Delay			14.0
HCM 6th LOS			B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.