Michael Baker INTERNATIONAL

We Make a Difference

TECHNICAL MEMORANDUM

To: Donald Young, City of Redlands, Manager – One Stop Permit Center
Ryan Murphy, City of Redlands, Contract Planner

From: Carla Dietrich, Michael Baker International

CC: Emily Elliott, Michael Baker International
John Deacon, Redlands Summit LLC

Date: June 23, 2023

Subject: **Neighborhoods at Lugonia Village LOS Study Addendum**

Introduction

The projected traffic operations for the proposed Neighborhoods at Lugonia Village project (Project) residential development in Redlands, California has been previously documented in the February 10, 2023 Traffic Study (**February 2023 Study**). The Project site plan has been modified since the completion of that study. The purpose of this memorandum is to document additional traffic operations analysis for the proposed Project to address the planned modification to the Project's site plan including a slight overall increase in the number of proposed units. This document is intended to serve as a supplemental analysis to the original **February 2023 Study**. A separate VMT analysis in support of the Transportation component of the California Environmental Quality Act (CEQA) process has also been prepared.

Project Information

Table 1 provides key Project information. **Exhibit 1** shows the Project location and **Exhibit 2** shows the site plan.

Table 1: Project Information

Item	Description
Project Title	Neighborhoods at Lugonia Village
Project Location	City of Redlands; Northwest quadrant of West Lugonia Ave and Karon St.
Assessor's Parcel Numbers [APN]	APN 0167-171-06, 0167-171-05, 0167-171-04
Tentative Tract Map No.	40490 & 40491
Site Area	The Project site consists of a total of 24.4 acres.
Existing Use	Currently vacant. Surrounding roads are paved. Power lines are present on W Lugonia Ave. and Karon St.
Surrounding Land Use	Vacant land use to the north and west, Karon St. and residential uses to the east, and vacant land and commercial uses to the south uses to the south.
Proposed Project (Updated from February 2023 Study)	The Project proposes to construct 451 multi-family dwelling units, 72 townhomes, and 18 single family dwelling units.

Exhibit 1: Project Location

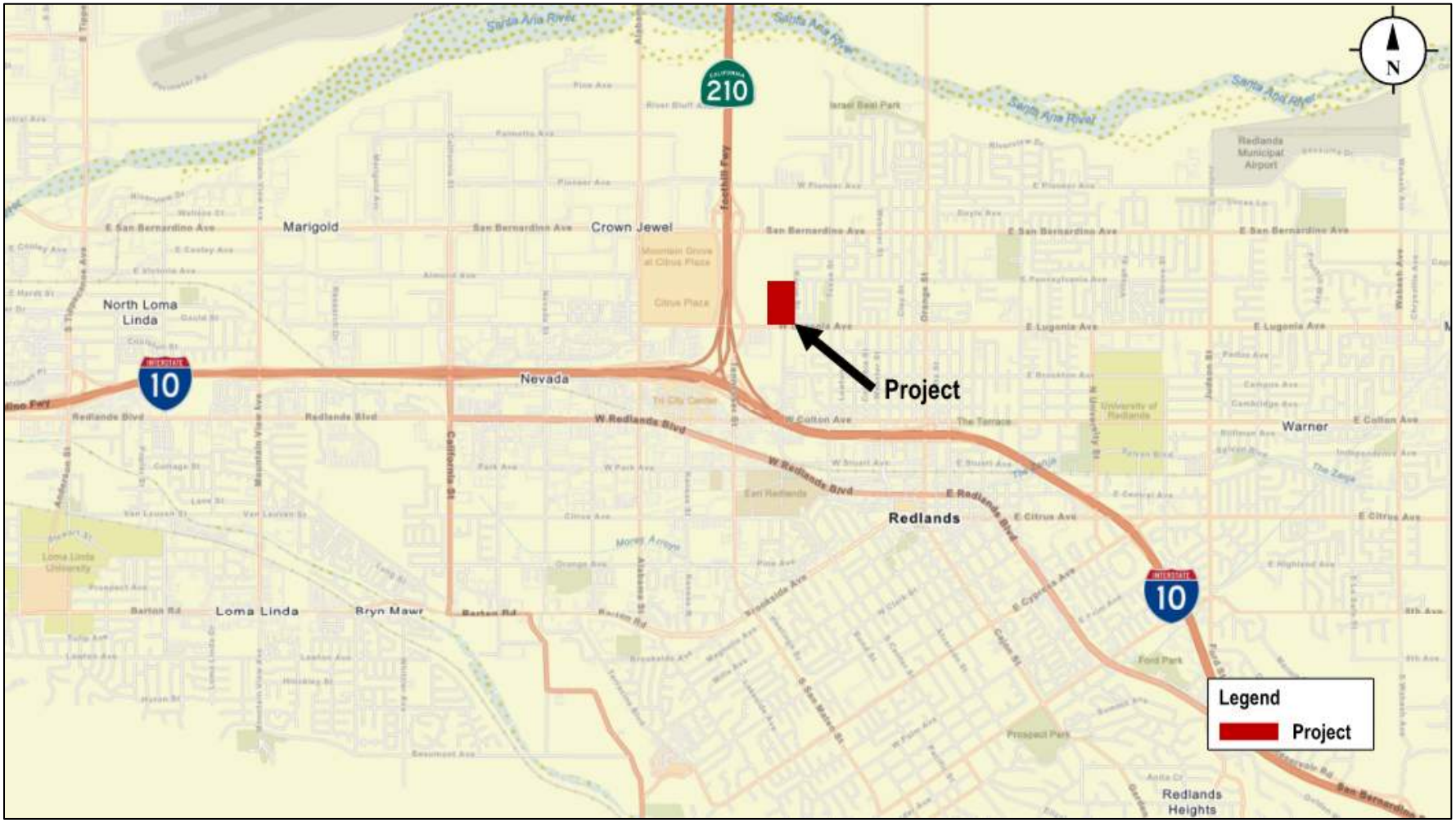
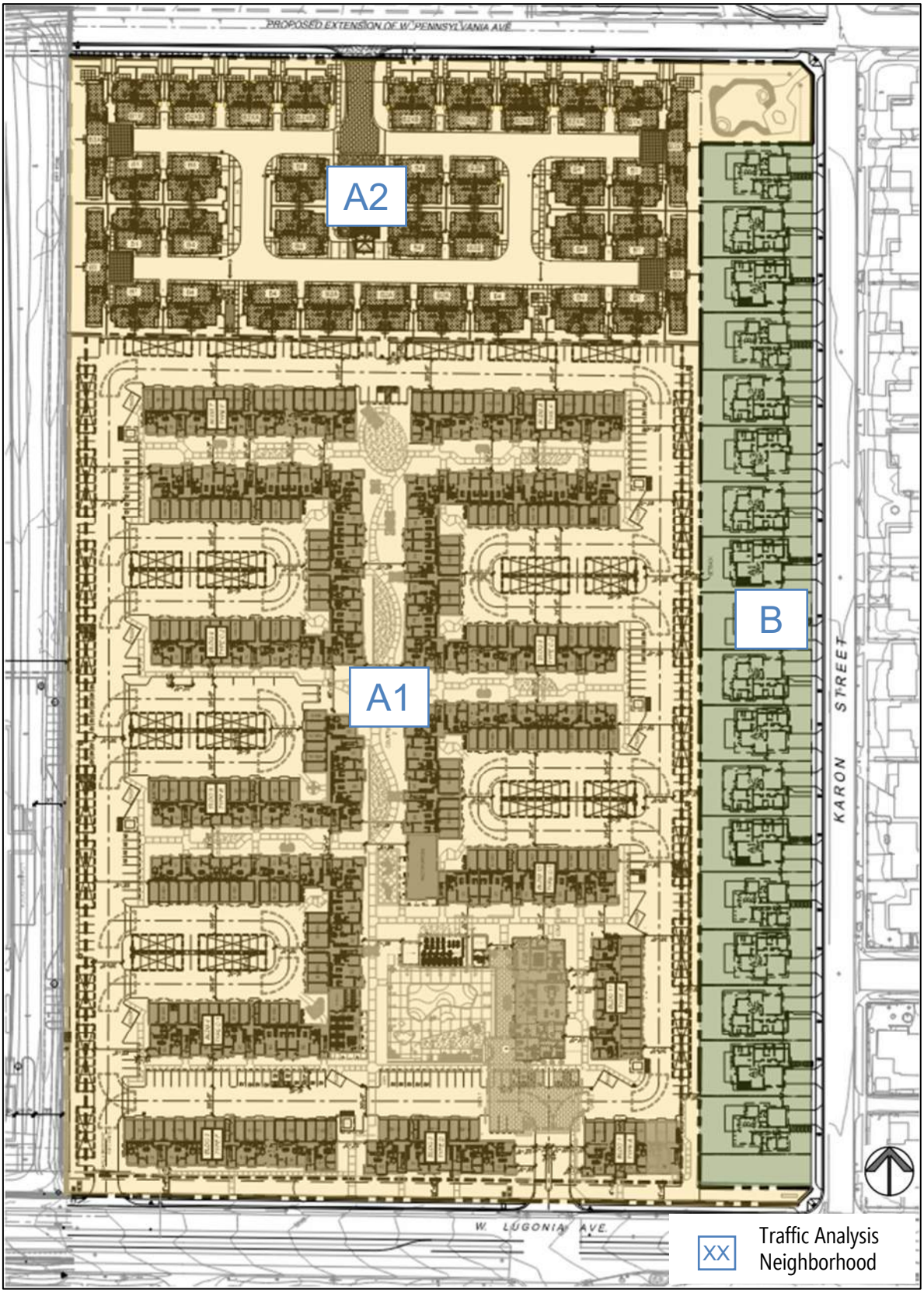


Exhibit 2: Conceptual Site Plan



Notes: 1) Sourced from Architects Orange, Angeleno Associates Inc., and Archi2Group. Traffic Analysis Neighborhood labels added by MBI.
2) Site plan shows the Scenario B condition with Pennsylvania Avenue connection.
3) Site plan depicts full-width construction on Pennsylvania Avenue rather than the recommended interim half-width construction.

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Scoping Update

An updated scoping document for this analysis dated June 16, 2023 was submitted and approved by City staff. That document is included as **Attachment 1**.

Methodologies and Process

The methodologies and assumptions utilized in this memorandum are consistent with those applied in the **February 2023 Study**. This memorandum is intended to serve as a supplemental analysis document to the **February 2023 Study** to confirm if the original study findings are still valid, or if the study findings need to be amended.

Revised Trip Generation

The Project trip generation was revised to calculate the estimated number of site trips based on the updated number of units. The scoping document in **Attachment 1** contains details on unit changes and anticipated site trip increases. Compared to the February 2023 Study, an additional 147 site trips are expected to be generated under the new site plan. **Table 2** reflects the updated Project trip generation results.

Table 2: Estimated Site Trips

Land Use	ITE Code	Neighborhood	Intensity	Daily Trips	AM Peak Hour			PM Peak Hour		
					Volume	In	Out	Volume	In	Out
Single-Family Detached	210	Neighborhood B	18 DU	170	13	3	10	17	11	6
Single-Family Attached	215	Neighborhood A2	72 DU	518	35	11	24	41	23	18
Multifamily (Low Rise)	220	Neighborhood A1	451 DU	3,040	180	43	137	230	145	85
Total			**541 DU**	**3,728**	**228**	**57**	**171**	**288**	**179**	**109**

Notes:
1) DU = Dwelling Units.

Analysis Scenarios & Conditions

No changes are proposed to the analysis scenarios documented in the **February 2023 Study**, and that study provides a detailed explanation of Scenarios A and B.

- Scenario A – Cul-de-sac Pennsylvania Avenue
- Scenario B – Pennsylvania Avenue Connection

In accordance with the Measure U Growth Management Initiative, the analysis scenarios are as follows:

1. Existing Conditions
2. Existing With Project Conditions (Scenario A)
3. Existing With Project Conditions (Scenario B)

Traffic Volumes

The updated site trip exhibits are included in the scoping document in **Attachment 1. Attachment 2** contains the updated exhibits as follows:

- Exhibit B-1: Existing With Project (Scenario A) Peak Hour Volumes
- Exhibit B-2: Existing With Project (Scenario B) Peak Hour Volumes

Analysis Intersections

The following intersections were identified as the study intersections for this supplemental evaluation as documented in the **Attachment 1** scoping document:

- Tennessee Street / W Lugonia Avenue (#4)
- Tennessee Street / I-10 Eastbound Ramps (#6)
- W Lugonia Avenue / New York Street (#9)
- W Lugonia Avenue / Texas Street (#13)

The analysis intersections were based on the additional peak hour trips at the study intersections and the worst LOS documented in the Traffic Study.

Analysis Results

Table 3 summarizes the results of the operations analysis. The updated results for the study intersections under both Scenario A and Scenario B are summarized along with the Adverse Effect conclusion. No changes were made to the Existing Year (without Project) analysis since the change in Project trips does not affect this condition. Three (3) of the four (4) study intersections are under City jurisdiction while one study intersection is under Caltrans jurisdiction; therefore, the analysis results were evaluated to determine if improvements would be required based on the appropriate jurisdictional thresholds.

Under all scenarios, the Caltrans intersection operates at overall acceptable LOS D or better. All City intersections operate at overall acceptable LOS C or better under all scenarios except the following:

- Tennessee Street and W Lugonia Avenue (#4) LOS D or E during the PM Peak Hour
- W Lugonia Avenue and Texas Street (#13) LOS F during the PM Peak Hour

At the intersection of Tennessee Street and W Lugonia Avenue (#4), the Project degrades operations below existing conditions during the PM Peak Hour. As a result, an adverse project effect is identified at the intersection of Tennessee Street and W Lugonia Avenue (#4) under both Scenarios A and B. The adverse project effect identified at this intersection was not identified in the **February 2023 Study.**

The intersection of W Lugonia Avenue and Texas Street (#13) operates below acceptable LOS C under Existing Conditions without the Project, and the Project contributes to the existing deficiency. The Project does not degrade operations below existing conditions at this intersection. As a result, an adverse project effect is not identified at the intersection of Lugonia Avenue and Texas Street (#13) and no improvements are needed or proposed.

The Synchro analysis worksheets for Scenario A are included in **Attachment 3** while the Synchro analysis worksheets for Scenario B are included in **Attachment 4**.

Table 3: Intersection LOS Summary

ID	Intersection	Control Type	Jurisdiction	Existing Year		Existing With Project (Scenario A)		Existing With Project (Scenario B)		Adverse Effect? (Scenario A)		Adverse Effect? (Scenario A)	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
				LOS / Delay	LOS / Delay	LOS / Delay	LOS / Delay	LOS / Delay	LOS / Delay				
4	Tennessee Street / W Lugonia Avenue	SIG	Redlands	C / 23.4	**D / 44.4**	C / 31.0	**E / 55.1**	C / 30.4	**E / 55.4**	No	**Yes**	No	**Yes**
6	Tennessee Street / I-10 Eastbound Ramps	SIG	Caltrans	C / 28.0	D / 46.9	C / 28.7	D / 53.5	C / 28.7	D / 53.5	No	No	No	No
9	W Lugonia Avenue / New York Street and Project Driveway	SIG	Redlands	B / 11.2	B / 14.4	B / 10.8	B / 13.7	B / 10.8	B / 13.6	No	No	No	No
13	W Lugonia Avenue / Texas Street	SIG	Redlands	C / 22.3	**F / 138.2**	C / 23.1	**F / 138.1**	C / 24.1	**F / 138.1**	No	No	No	No

Notes:
1) SIG = Signalized
2) Overall intersection LOS provided for signalized intersections.
3) City Intersections – LOS C or better is the preferred acceptable operation. Bold text with yellow highlight indicates LOS D, E, or F.
4) Caltrans Intersection – LOS D or better is the preferred acceptable operation at Caltrans intersections.
5) Adverse effect determined if With Project scenario degrades operations below the Existing Conditions without Project level of service grade.
6) Delay shown in average seconds per vehicle.

Improvement Evaluation

The following findings are based on the operations analysis results:

Adverse Effect Conditions #1 (Scenario A) – The intersection of Tennessee Street and W Lugonia Avenue (#4) under the Existing With Project (Scenario A) condition is projected to operate at an overall LOS E during the PM Peak Hour. A potential improvement at this location would be to evaluate the existing signal timing at this location and modify the signal timing. While the existing signal timing sheet for this intersection does not include the cycle length, the Existing condition analysis in this memorandum and in the **February 2023 Study** assumed an existing 90 second cycle. Adjusting the cycle length to 100 seconds instead of the assumed 90 seconds would adequately improve the adverse condition.

Recommendation #1 (Scenario A) – Evaluate existing signal timing parameters and optimize signal timing at the intersection of Tennessee Street and W Lugonia Avenue (#4) under the Existing With Project (Scenario A) condition.

Adverse Effect Condition #2 (Scenario B) – Similar to Scenario A, the intersection of Tennessee Street and W Lugonia Avenue (#4) under the Existing With Project (Scenario B) condition is projected to operate at an overall LOS E during the PM Peak Hour. A potential improvement at this location would be to evaluate the existing signal timing at this location and modify the signal timing. While the existing signal timing sheet for this intersection does not include the cycle length, the Existing condition analysis in this memorandum and in the **February 2023 Study** assumed an existing 90 second cycle. Adjusting the cycle length to 100 seconds instead of the assumed 90 seconds would adequately improve the adverse condition.

Recommendation #2 (Scenario B) – Evaluate existing signal timing parameters and optimize signal timing at the intersection of Tennessee Street and W Lugonia Avenue (#4) under the Existing With Project (Scenario B) condition.

As shown in **Table 4**, the intersection is projected to operate at acceptable LOS D during the PM Peak Hour under both With Project scenarios with the signal timing improvements. Therefore, the adverse project effect at Tennessee Street and W Lugonia Avenue (#4) is expected to be addressed by the signal timing optimization. **Attachment 5** contains the Synchro analysis worksheets for all Improvement scenarios.

Table 4: Improvement Condition LOS Summary

ID	Intersection	Existing With Project					
		Without Improvement			With Improvement		
		Control Type	(Scenario A)	(Scenario B)	Improvement	(Scenario A)	(Scenario B)
			PM Peak Hour	PM Peak Hour		PM Peak Hour	PM Peak Hour
			LOS / Delay	LOS / Delay		LOS / Delay	LOS / Delay
4	Tennessee Street / W Lugonia Avenue	SIG	**E / 55.1**	**E / 55.4**	Signal Timing Optimization	**D / 36.7**	**D / 36.5**

Notes:
1) SIG = Signalized
2) Overall intersection LOS provided for signalized intersections.
3) Delay shown in average seconds per vehicle.

Fair Share Contribution

Due to the adverse project effects at the intersection of Tennessee Street and W Lugonia Avenue (#4), a fair share payment is required toward reducing the effect. The fair share payment was estimated in accordance with the fair share equation detailed in the San Bernardino County Transportation Study Guidelines (2019):

$$\text{Fair share} = \frac{\text{project trips}}{\text{project trips + future development trips}} \text{ X } 100\%$$

The City's guidelines require only Existing conditions and Existing With Project conditions analysis scenarios. As such, in accordance with the Measure U Growth Management Initiative Policy 5.20c and the San Bernardino County Fair Share equation, **the Project is estimated to be responsible for 100% of any mitigation improvements.**

Analysis Findings Summary

Existing Condition

The analysis results show all City intersections operate at overall acceptable LOS C or better during the AM Peak Hour. During the PM Peak Hour, all City intersections operate at overall LOS C or better except for the following:

- Tennessee Street and W Lugonia Avenue (#4) operates at an overall LOS D
- W Lugonia Avenue and Texas Street (#13) operates at an overall LOS F

All Caltrans intersections operate at overall acceptable LOS D or better during both the AM Peak Hour and the PM Peak Hour.

Existing With Project (Scenario A)

The analysis results show all City intersections operate at overall acceptable LOS C or better during the AM Peak Hour. During the PM Peak Hour, all City intersections operate at overall LOS C or better except for the following:

- Tennessee Street and W Lugonia Avenue (#4) operates at an overall LOS E
- W Lugonia Avenue and Texas Street (#13) operates at an overall LOS F

These locations operate below acceptable LOS C under Existing Conditions without the Project, and the Project contributes to the existing deficiency. At the intersection of Tennessee Street and W Lugonia Avenue (#4), the Project degrades operations below existing conditions during the PM Peak Hour. As a result, **an adverse project effect is identified** at the intersection under both scenarios. The adverse project effect identified at this intersection was not identified in the **February 2023 Study.** At the intersection of W Lugonia Avenue and Texas Street (#13), the Project does not degrade operations below existing conditions. As a result, an adverse project effect is not identified at the intersection and no improvements are needed or proposed.

All Caltrans intersections operate at overall acceptable LOS D or better during both the AM Peak Hour and the PM Peak Hour.

Due to the adverse project effect at Tennessee Street and W Lugonia Avenue (#4), the following improvement is recommended:

Recommendation #1 (Scenario A) – Evaluate existing signal timing parameters and optimize signal timing at the intersection of Tennessee Street and W Lugonia Avenue (#4) under the Existing With Project (Scenario A) condition.

With the improvement implemented, the intersection is projected to operate at acceptable LOS D during the PM Peak Hour. Therefore, the adverse project effect is expected to be addressed by the recommended improvement.

Existing With Project (Scenario B)

The analysis results show all intersections operate at overall acceptable LOS C or better during the AM Peak Hour. During the PM Peak Hour, all City intersections operate at overall LOS C or better except for the following:

- Tennessee Street and W Lugonia Avenue (#4) operates at an overall LOS E.
- W Lugonia Avenue and Texas Street (#13) operates at an overall LOS F.

These locations operate below acceptable LOS C under Existing Conditions without the Project, and the Project contributes to the existing deficiency. At the intersection of Tennessee Street and W Lugonia Avenue (#4), the Project degrades operations below existing conditions during the PM Peak Hour. As a result, **an adverse project effect is identified** at the intersection under both scenarios. The adverse project effect identified at this intersection was not identified in the **February 2023 Study.** At the intersection

of W Lugonia Avenue and Texas Street (#13), the Project does not degrade operations below existing conditions. As a result, an adverse project effect is not identified at the intersection and no improvements are needed or proposed.
All Caltrans intersections operate at overall acceptable LOS D or better during both the AM Peak Hour and the PM Peak Hour.

Due to the adverse project effect at Tennessee Street and W Lugonia Avenue (#4), the following improvement is recommended:

Recommendation #2 (Scenario B) – Evaluate existing signal timing parameters and optimize signal timing at the intersection of Tennessee Street and W Lugonia Avenue (#4) under the Existing With Project (Scenario B) condition.

With the improvement implemented, the intersection is projected to operate at acceptable LOS D during the PM Peak Hour. Therefore, the adverse project effect is expected to be addressed by the recommended improvement.

Vehicle Miles Traveled

An VMT assessment was prepared for the Neighborhoods at Lugonia Village Project under a separate memorandum. The VMT assessment reflects the updated site plan analyzed in this memorandum.

Roadway Improvements

The updated site plan only revised the number of proposed units. All roadway improvements listed in the **February 2023 Study** remain applicable.

Conclusions

The **February 2023 Study** prepared to evaluate the proposed Neighborhoods at Lugonia Village residential project in the City of Redlands determined that additional off-site roadway improvements would not be required beyond the list of roadway network improvements associated with the development operations. This addendum evaluated the traffic operations of the proposed site plan modification which would result in a slight increase in the number of units. As shown, an adverse project effect is projected at the intersection of Tennessee Street and W Lugonia Avenue (#4) under both Scenario A and Scenario B when the additional Project site trips due the site plan modification are considered. With the proposed recommendation of modifying signal timing, all adverse project effects are expected to be addressed. The Project is estimated to be responsible for 100% of the improvements at the intersection of Tennessee Street and W Lugonia Avenue (#4).

Attachment 1 – Addendum Scoping Document

Michael Baker
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June 16, 2023

City of Redlands
35 Cajon Street, Suite 15A
Redlands, CA 92373

Attn: Ryan Murphy
CC: Donald Young

Subject: Neighborhoods at Lugonia Village - Traffic Impact Study Scope of Work (Site Plan Update)

Michael Baker International (Michael Baker) prepared a Traffic Study report and VMT Assessment memorandum for the Neighborhoods at Lugonia Village project located in the northwest quadrant of the intersection of West Lugonia Avenue and Karon Street in the City of Redlands. The analysis was prepared consistent with the City of Redlands *CEQA Assessment VMT Analysis Guidelines*, the County of San Bernardino *Transportation Impact Study Guidelines*, and the provisions of the City's Growth Management Initiative, Measure U. The traffic operations analysis was documented in the February 10, 2023 Traffic Study and January 13 2023, VMT Assessment memorandum. Both documents have been reviewed and approved by City staff.

The purpose of this document is to update the project scoping to account for a site plan change which impacted the number of proposed residential units, and to outline the proposed study modifications and/or addendums recommended to document these changes. The project includes three (3) neighborhoods that offer varying types of residential units. The table below summarizes the changes to the site plan.

Neighborhood	Residential Type	Documented in January 2023 VMT Memo & February 2023 Traffic Study		Proposed Site Plan Change		Difference in Estimated Daily Site Trips
		Number of Units	Estimated Daily Site Trips	Number of Units (Change)	Estimated Daily Site Trips	
A1	Multifamily (Low Rise)	430	2,898	451 (+21)	3,040	**142**
A2	Single Family Attached	70	504	72 (+2)	518	**14**
B	Single Family Detached	19	179	18 (-1)	170	**-9**

Based on the information contained in this document, the following addendum and study update are recommended to evaluate the site plan change which includes 451 multi-family dwelling units, 72 townhomes, and 18 single family dwelling:

- **LOS Study Addendum:** Michael Baker will prepare a Technical Memorandum as an addendum to the Traffic Study with the new Project site plan and Project information. The addendum will focus on the project effects on four (4) study intersections, selected based on additional project trips and documented worst LOS in the January 2023 Traffic Study.
- **VMT Study Update:** Michael Baker will update the VMT Assessment memorandum with the new Project site plan and trip generation analysis. A new version of the memorandum will be submitted; however, no changes to the findings are anticipated.

Please review this scoping agreement and let us know if you would like any adjustments to be made to the proposed analysis approach or the assumptions.

Sincerely,

Carla Dietrich, P.E. (PA), PTOE
Transportation Planner

1. Project Information

Project Location:	West Lugonia Ave / Karon St, Redlands, CA	
Project Description:	Multi-family residential (451 units), Townhomes (72 units), Single Family Residential (18 units)	
Project Opening Year:	2024	
Location:	North-west quadrant of West Lugonia Ave / Karon St (See **Exhibit 1**)	
Previous Approved Studies:	1) February 10, 2023, Traffic Study 2) January 13, 2023, VMT Assessment memorandum Both documents have been prepared by Michael Baker International, and reviewed/approved by City staff.	
Site Plan:	**Exhibit 1** shows the updated proposed project site plan.	
	Engineer	**Applicant**
Company:	Michael Baker International	Redlands Summit, LLC.
Name:	Carla Dietrich	John Deacon (Applicant's Representative)
Address:	3536 Concours	202 South Lake Ave, Suite 300
City, State, Zip Code:	Ontario, CA 91764	Pasadena, CA 91101
Phone #:	(909) 974-4908	(818) 209-4564
Fax #:	N/A	N/A
Email:	cdietrich@mbakerintl.com	jdeacon@satusgroupllc.com

2. Trip Generation

Trip Credit:

No trip generation credits are being proposed for this project.

Trip Credit Type	Taken?	Explanation
Existing Active Land Use	No	Vacant Land
Previous Land Use	No	Undeveloped
Internal Trip Reduction	No	Not Applicable
Pass-by Trip Reduction	No	Not Applicable

Trip Generation:

See **Table 1** for the trip generation rates and **Table 2** for the project trip summary. The trip generation rates are taken from the ITE Trip Generation Manual, 11th Edition. As shown, the project is anticipated to generate 3,728 daily trips with 228 AM peak hour trips and 288 PM peak hour trips. This is equivalent to a change of +147 daily trips with +9 AM peak hour trips and +11 PM peak hour trips compared to the project size evaluated in the previous studies.

Table 1 – Trip Generation Rates

Land Use	ITE Code	Neighborhood	Daily Trips Rate	AM Peak Hour			PM Peak Hour		
				Rate	In / Out		Rate	In / Out	
Single-Family Detached	210	Neighborhood B	9.43 / DU	0.70	26%	/ 74%	0.94	63%	/ 37%
Single-Family Attached	215	Neighborhood A2	7.2 / DU	0.48	31%	/ 69%	0.57	57%	/ 43%
Multifamily (Low Rise)	220	Neighborhood A1	6.74 / DU	0.40	24%	/ 76%	0.51	63%	/ 37%

Source: ITE Trip Generation Manual, 11th Edition

Table 2– Trip Generation

Land Use	ITE Code	Neighborhood	Intensity		Daily Trips	AM Peak Hour			PM Peak Hour		
						Volume	In	Out	Volume	In	Out
Single-Family Detached	210	Neighborhood B	18	DU	170	13	3	10	17	11	6
Single-Family Attached	215	Neighborhood A2	72	DU	518	35	11	24	41	23	18
Multifamily (Low Rise)	220	Neighborhood A1	451	DU	3,040	180	43	137	230	145	85
Total			**541**	**DU**	**3,728**	**228**	**57**	**171**	**288**	**179**	**109**

Notes: 1) DU = Dwelling Unit

3. Analysis Scenarios

No changes are proposed to the analysis scenarios documented in the February 2023 Traffic Study:

- Scenario A – Cul-de-sac Pennsylvania Avenue
- Scenario B – Pennsylvania Avenue Connection

In accordance with the Measure U Growth Management Initiative, the analysis scenarios are as follows:

1. Existing Conditions
2. Existing With Project Conditions (Scenario A)
3. Existing With Project Conditions (Scenario B)

4. Traffic Distribution

No changes are proposed to the traffic distribution patterns documented in the February 2023 Traffic Study.

Trip Assignment:

While the trip distribution patterns will not change, the number of trips assigned to study intersections will vary due to the increase in site trips evaluated in the trip generation analysis. The updated trip assignment is shown in the following exhibits:

Scenario A

- Exhibit 2 – Neighborhood A1
- Exhibit 3 – Neighborhood A2
- Exhibit 4 – Neighborhood B
- Exhibit 5 – Total of all neighborhoods under Scenario A

Scenario B

- Exhibit 6 – Neighborhood A1
- Exhibit 7 – Neighborhood A2
- Exhibit 8 – Neighborhood B
- Exhibit 9 – Total of all neighborhoods under Scenario B

5. Study Area

The February 2023 Traffic Study analysis intersections were as follows:

1. W San Bernardino Avenue / I-210 Southbound Ramps
2. W San Bernardino Avenue / I-210 Northbound Ramps
3. Tennessee Street / Pennsylvania Avenue (Future)
4. Tennessee Street / W Lugonia Avenue
5. Tennessee Street / I-10 Westbound Ramps
6. Tennessee Street / I-10 Eastbound Ramps
7. W San Bernardino Avenue / Citrus Plaza Drive
8. W San Bernardino Avenue / Project Driveway

9. W Lugonia Avenue / New York Street
10. W Lugonia Avenue / Karon Street
11. Pennsylvania Avenue / Karon Street
12. Pennsylvania Avenue / Texas Street
13. W Lugonia Avenue / Texas Street

Table 3 lists the entering trips at each study intersection. As shown, with the new site plan there is a general increase in trips at each of the study intersection due to the proposed site plan change; however, the increase in trips is small in many cases. The intersections of Tennessee Street and W Lugonia Ave (#4) and W Lugonia Avenue and New York Street (#9) experience the largest increase in intersection volume during both peak hours. Given these results, a Traffic Study Addendum focusing on a few locations is recommended to capture the effects of the site plan change.

Table 3: Anticipated Project Trips Entering Intersection

Intersection		Project Trips Entering Intersection											
		February 2023 Study				New Site Plan				Difference			
		Scenario A		Scenario B		Scenario A		Scenario B		Scenario A		Scenario B	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	W San Bernardino Avenue / I-210 Southbound Ramps	26	45	27	46	27	48	28	49	+1	+3	+1	+3
2	W San Bernardino Avenue / I-210 Northbound Ramps	27	34	27	34	28	36	28	36	+1	+2	+1	+2
3	Tennessee Street / Pennsylvania Avenue	51	62	50	61	53	65	51	64	+2	+3	+1	+3
4	Tennessee Street / W Lugonia Avenue	170	216	166	210	179	227	174	220	+9	+11	+8	+10
5	Tennessee Street / I-10 Westbound Ramps	89	112	90	113	94	117	94	118	+5	+5	+4	+5
6	Tennessee Street / I-10 Eastbound Ramps	34	64	35	64	37	68	37	67	+3	+4	+2	+3
7	W Lugonia Avenue / Citrus Plaza Drive	61	78	59	75	64	82	62	79	+3	+4	+3	+4
8	W San Bernardino Avenue / Project Driveway	155	194	150	187	156	200	151	192	+1	+6	+1	+5
9	W Lugonia Avenue / New York Street	132	204	127	197	137	213	132	205	+5	+9	+5	+8
10	W Lugonia Avenue / Karon Street	39	52	34	45	39	53	34	46	0	+1	0	+1
11	Pennsylvania Avenue / Karon Street	3	3	10	12	3	3	11	12	0	0	+1	0
12	Pennsylvania Avenue / Texas Street	12	14	15	18	12	14	16	18	0	0	+1	0
13	W Lugonia Avenue / Texas Street	30	39	30	39	30	40	31	41	0	+1	+1	+2

Table 4 lists the additional project trips at each study intersection and their worst-scenario LOS documented in the Traffic Study. Based on the additional peak hour trips at the study intersections and the worst LOS documented in the Traffic Study, the following four (4) intersections are recommended to be analyzed in a Traffic Study Addendum:

- Tennessee Street / W Lugonia Avenue (#4)
- Tennessee Street / I-10 Eastbound Ramps (#6)
- W Lugonia Avenue / New York Street (#9)
- W Lugonia Avenue / Texas Street (#13)

Table 4: Additional Project Trips & Traffic Study LOS

Intersection		Additional Project Trips due to New Site Plan				Worst Scenario LOS (Traffic Study February 2023)	
		Scenario A		Scenario B			
		AM	PM	AM	PM	LOS	Delay
1	W San Bernardino Avenue / I-210 Southbound Ramps	+1	+3	+1	+3	C	25.9
2	W San Bernardino Avenue / I-210 Northbound Ramps	+1	+2	+1	+2	C	32.2
3	Tennessee Street / Pennsylvania Avenue (Future)	+2	+3	+1	+3	B	14.5
4	Tennessee Street / W Lugonia Avenue	+9	+11	+8	+10	D	54.5
5	Tennessee Street / I-10 Westbound Ramps	+5	+5	+4	+5	C	21.1
6	Tennessee Street / I-10 Eastbound Ramps	+3	+4	+2	+3	D	53.1
7	W Lugonia Avenue / Citrus Plaza Drive	+3	+4	+3	+4	B	13.5
8	W San Bernardino Avenue / Project Driveway	+1	+6	+1	+5	B	11.3
9	W Lugonia Avenue / New York Street	+5	+9	+5	+8	B	13.7
10	W Lugonia Avenue / Karon Street	0	+1	0	+1	C	15.2
11	Pennsylvania Avenue / Karon Street	0	0	+1	0	A	9.5
12	Pennsylvania Avenue / Texas Street	0	0	+1	0	B	11.3
13	W Lugonia Avenue / Texas Street	0	+1	+1	+2	F	138.2

No new traffic counts are required for the analysis of these intersections.

Recommended LOS Study Update: Michael Baker will prepare a Technical Memorandum as an addendum to the Traffic Study with the new Project site plan and Project information. The addendum will focus on the project effects on four (4) study intersections, selected based on additional project trips and documented worst LOS in the January 2023 Traffic Study.

6. Vehicle Miles Travelled (VMT) Analysis

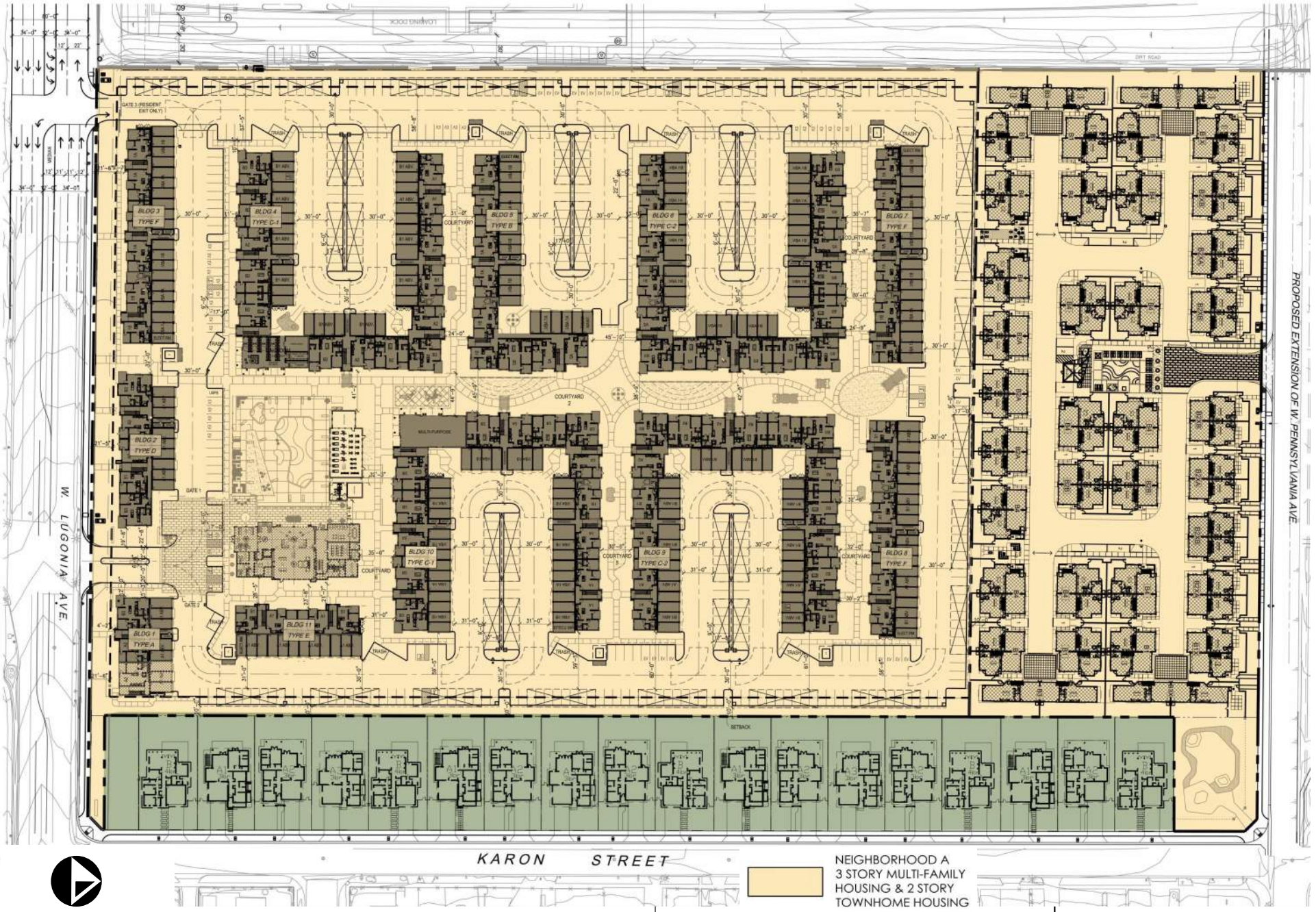
Based on the *City of Redlands CEQA Assessment VMT Analysis Guidelines* (June 2020) (*City Guidelines*) land use projects that meet any of the screening thresholds based on size, location, proximity to transit or trip-making potential identified in **Table 5** are presumed to result in a less-than-significant transportation impact under CEQA and do not require a detailed quantitative VMT assessment. **Table 5** has been updated to reflect the new site plan. The screening analysis finding is anticipated to remain be unchanged since **the Project meets the Screening Criteria allowing for a determination of a less-than-significant impact on VMT. Therefore, a detailed project-specific VMT analysis is NOT required**.

Table 5: Screening Assessment Summary

Category (City Guidelines)	Description	Project Assessment	Result
Step 1: Transit Priority Area (TPA)	Is the project located within a half mile area around an existing major transit stop or an existing stop along a high-quality transit corridor?	No. The project is located within a half mile of OmniTrans Route 15 transit stops. Route 15 has service intervals of 60 minutes, and thus does not meet the criteria of a 15-minute service interval for a "high-quality transit corridor."	Does Not Meet Criteria
Step 2: Low VMT Area	Is the project located in a low VMT generating area (less 15% below the San Bernardino County regional average VMT per service population)	Yes. Using the SBCTA VMT screening tool referenced in the City Guidelines, the project is in a Low VMT Area.	**Meets Criteria**
Step 3: Project Type	Is the project a local servicing retail project with less than 50,000 square feet, or a locally serving use including (but not limited to) the following? • Public/Community Use (school/library/park/fire station/ local government) • Day Care • Locally serving Bank • Assisted living/senior housing **Or**, Does the project generate less than 3,000 MT CO2e per year? Including projects such as: • Single Family Res. – 167 DU's or fewer • Multifamily Res. (1-2 stories) – 232 DU's or fewer • Multifamily Res. (3+ stories) – 299 DU's or fewer • Office – 59,100 square feet or less • Local Serving Retail Center – 112,400 SF or less • Warehousing – 463,600 SF or less • Light Industrial – 74,600 SF or less	No. The project proposes the construction of 451 multi-family dwelling units, 72 townhomes, and 18 single family dwelling units	Does Not Meet Criteria

Source: Category and Description obtained from the *City of Redlands CEQA Assessment VMT Analysis Guidelines* (June 2020)

Recommended VMT Study Update: Michael Baker will update the VMT Assessment memorandum with the new Project site plan and trip generation analysis. A new version of the memorandum will be submitted; however, no changes to the findings are anticipated.



Not to Scale

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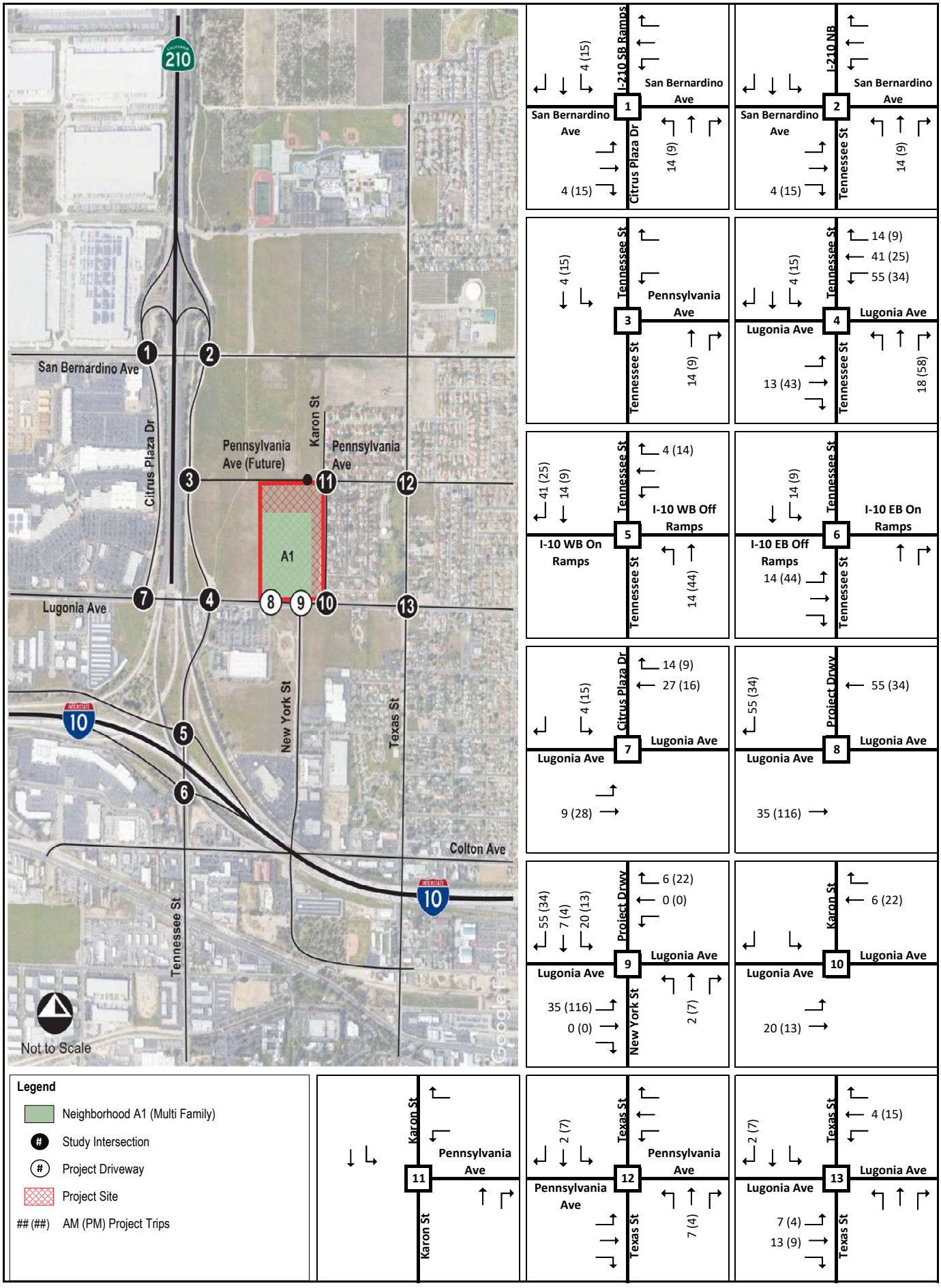
Proposed Site Plan

Exhibit 1

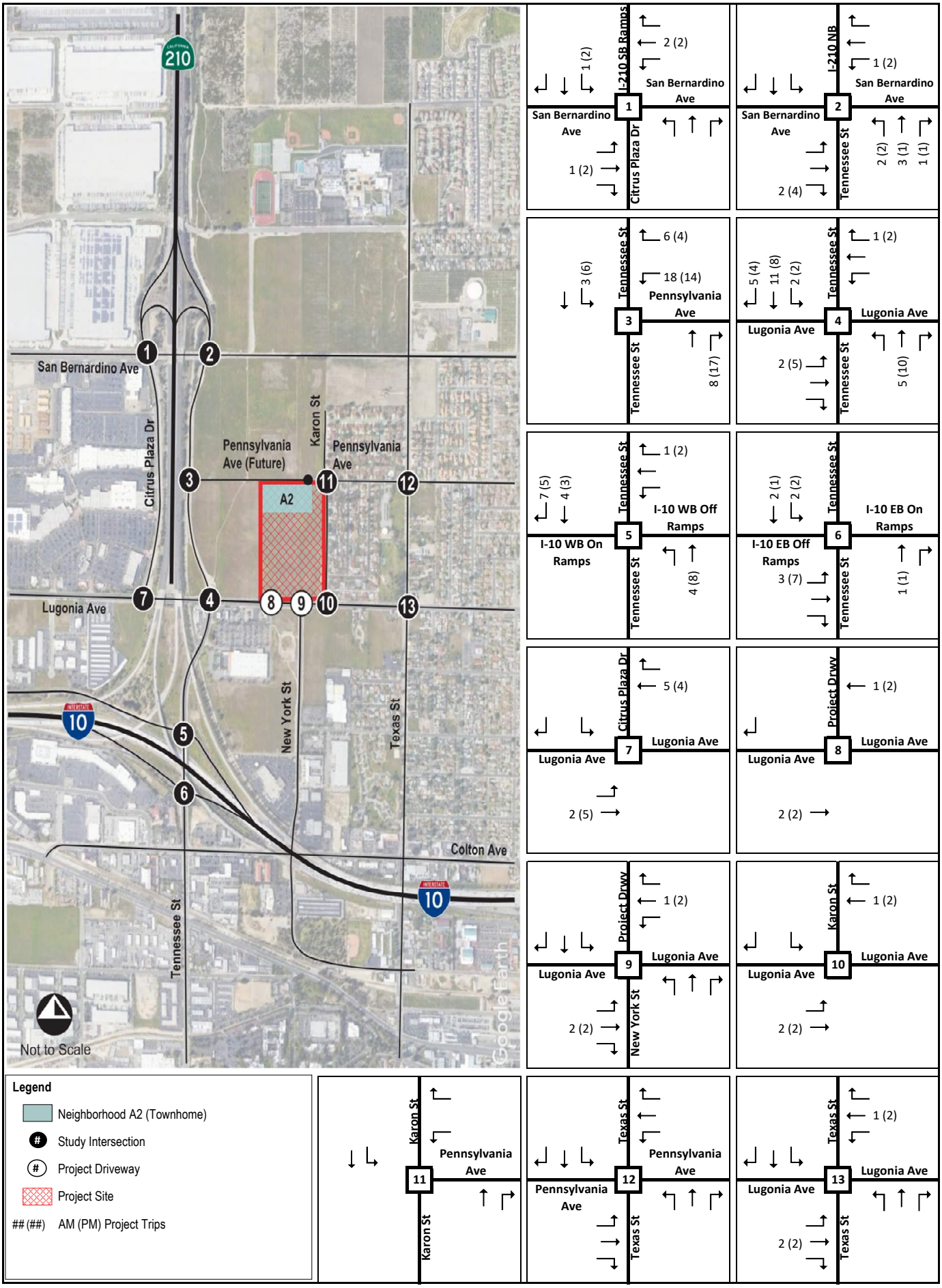


Scenario A:
Intersection Project Trips (Neighborhood A1)

Note: Scenario A = Without Pennsylvania Ave Connection

Exhibit 2

Michael Baker INTERNATIONAL

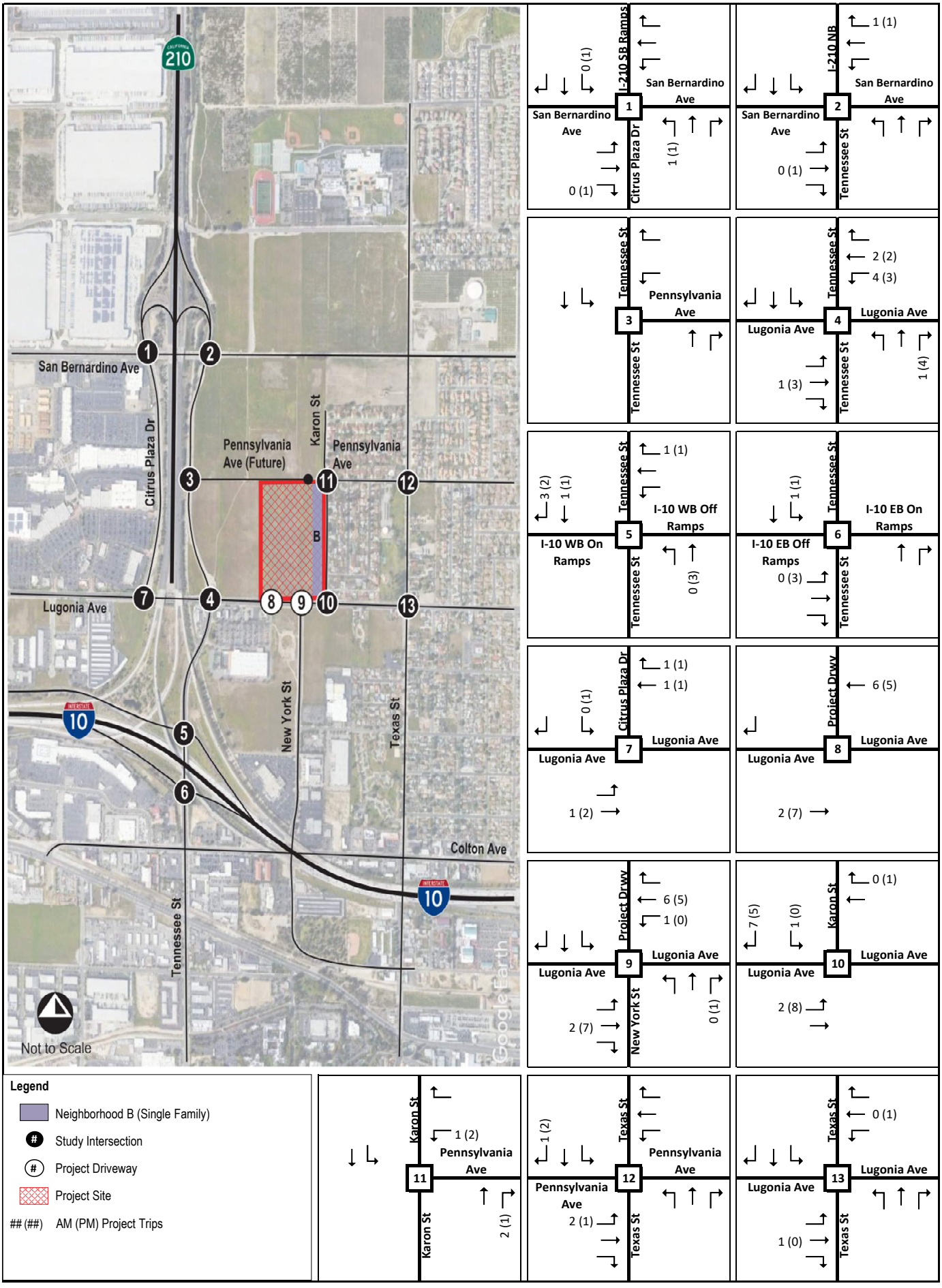


Scenario A: Intersection Project Trips (Neighborhood A2)

Note: Scenario A = Without Pennsylvania Ave Connection

Exhibit 3

Michael Baker INTERNATIONAL

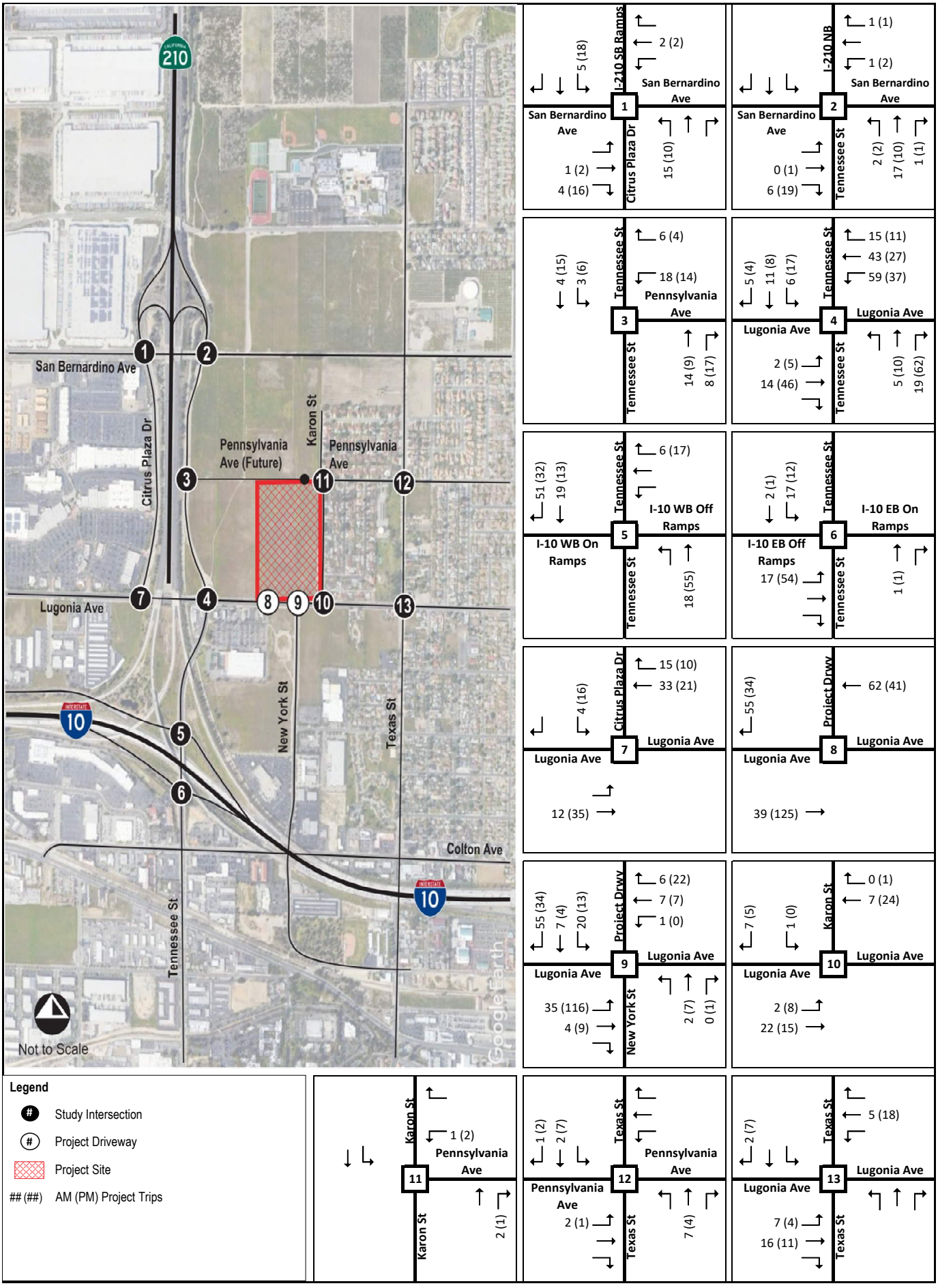


Scenario A: Intersection Project Trips (Neighborhood B)

Note: Scenario A = Without Pennsylvania Ave Connection

Exhibit 4

Michael Baker INTERNATIONAL

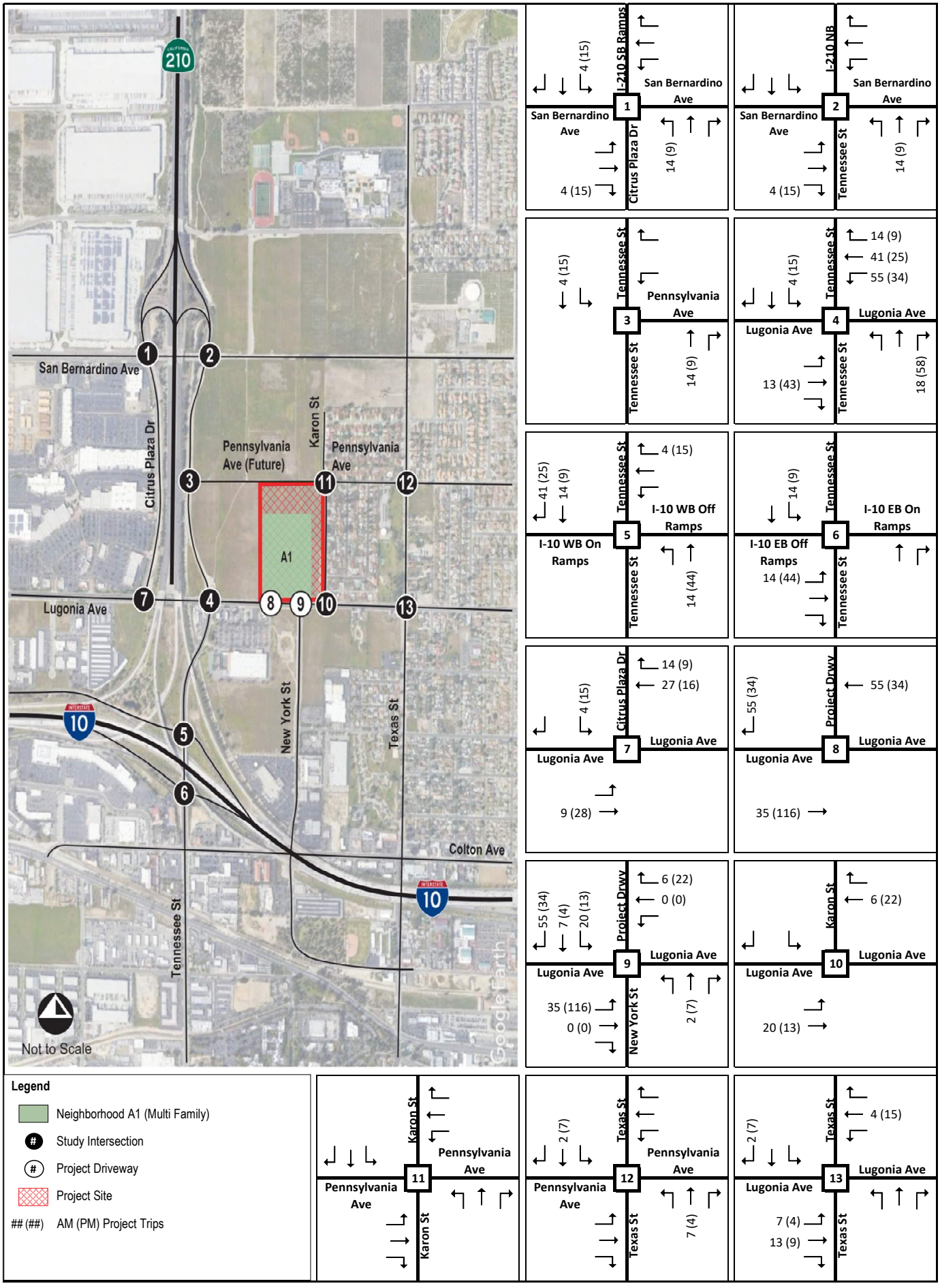


Scenario A: Intersection Project Trip

Note: Scenario A = Without Pennsylvania Ave Connection

Exhibit 5

Michael Baker INTERNATIONAL



Scenario B: Intersection Project Trips (Neighborhood A1)

Note: Scenario B = With Pennsylvania Ave Connection

Exhibit 6

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Scenario B: Intersection Project Trips (Neighborhood A2)

Note: Scenario B = With Pennsylvania Ave Connection

Exhibit 7

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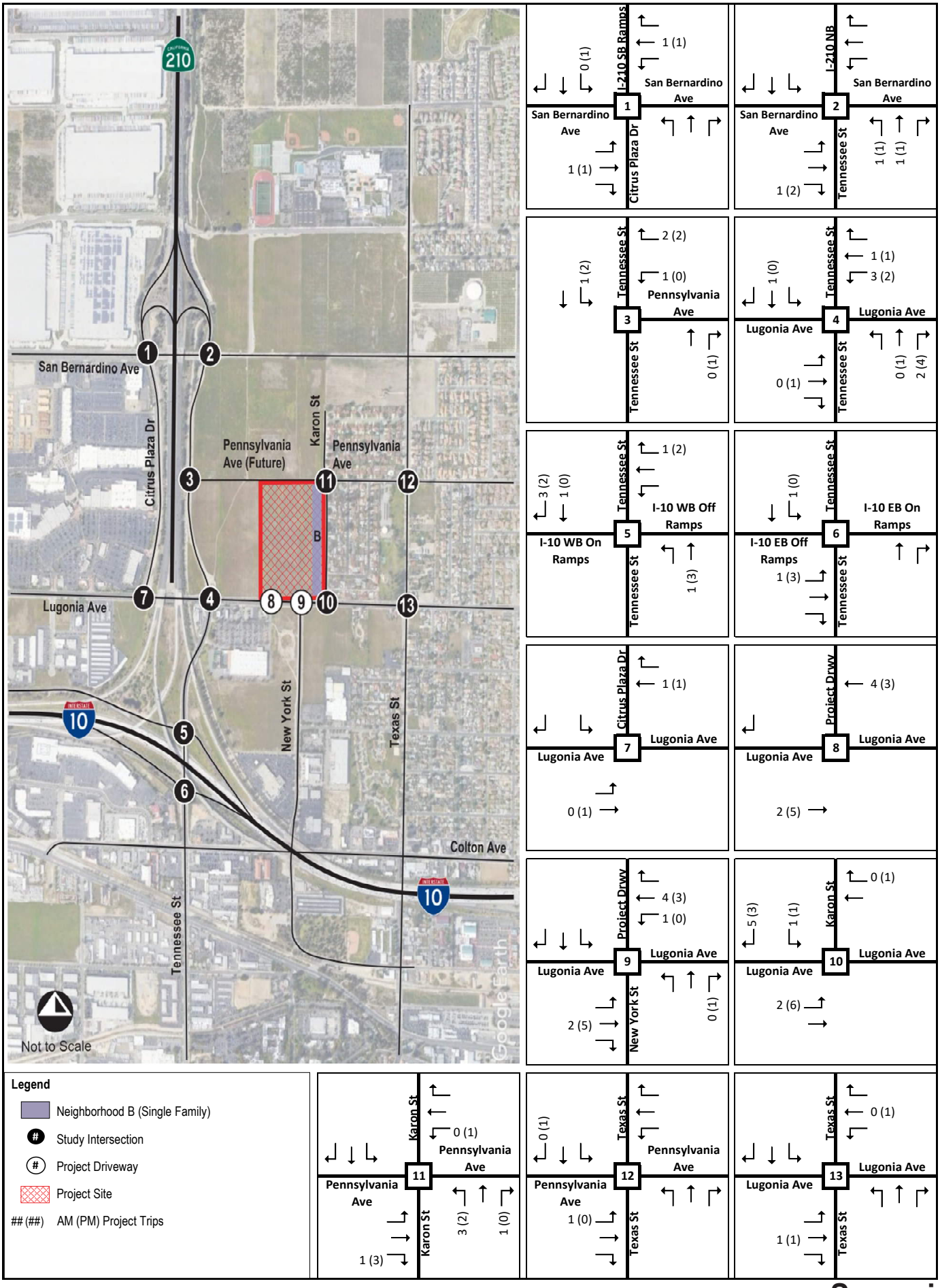

Scenario B: Intersection Project Trips (Neighborhood B)

Note: Scenario B = With Pennsylvania Ave Connection

Exhibit 8

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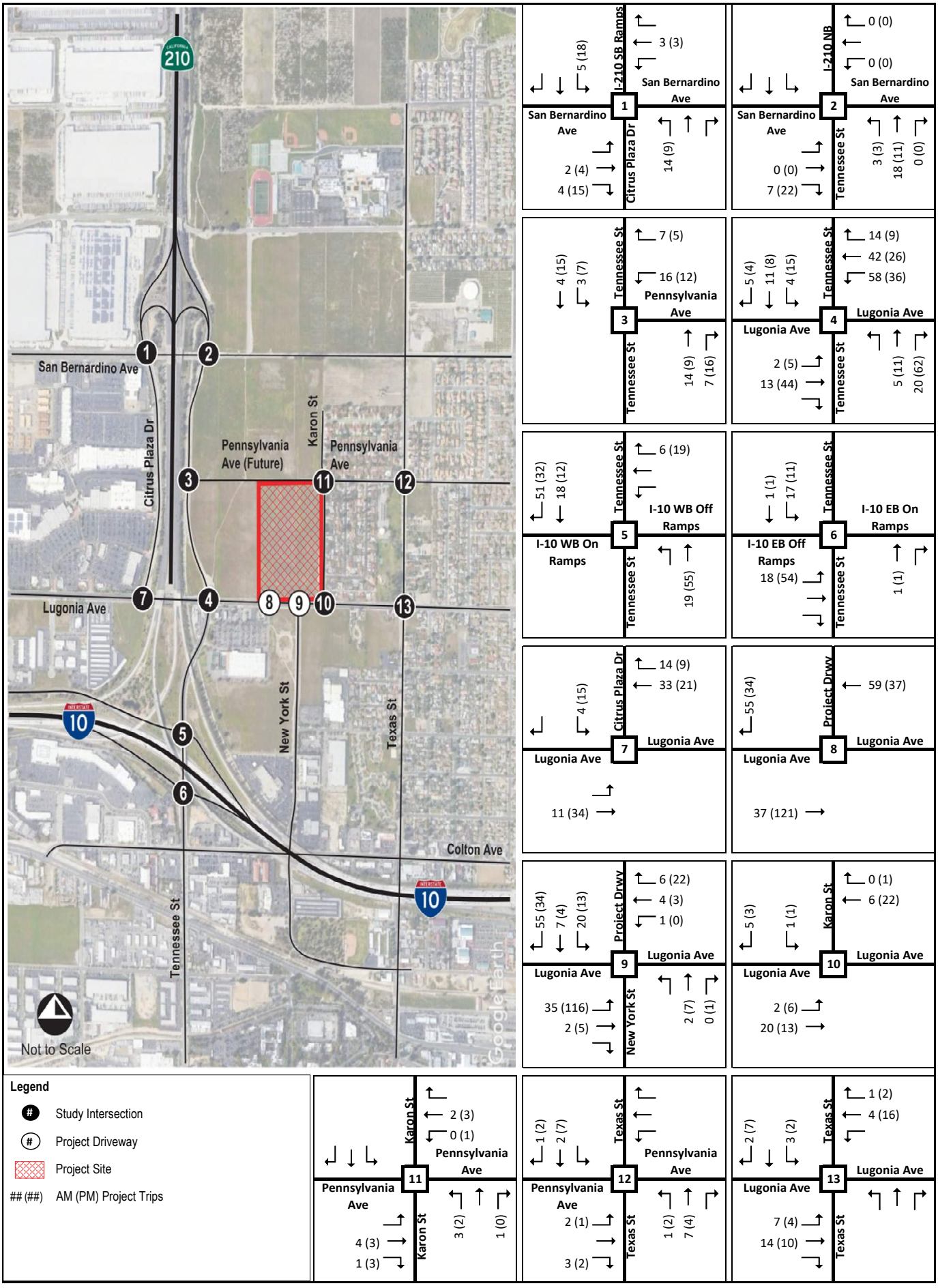


Scenario B: Intersection Project Trip

Note: Scenario B = With Pennsylvania Ave Connection

Exhibit 9

Michael Baker INTERNATIONAL

Dietrich, Carla

From: Don Young <dyoung@cityofredlands.org>
Sent: Friday, June 16, 2023 2:21 PM
To: Dietrich, Carla; Ryan Murphy
Cc: Elliott, Emily; Gleason, Renee
Subject: EXTERNAL: RE: Redlands Neighborhoods at Lugonia Village - Draft Scoping

Scoping is satisfactory.

Please be very clear in the Addendum that the analysis goes back to the original concept of E and E+P.

Donald Young
Manager - One Stop Permit Center
City of Redlands
909-798-7585 x6
dyoung@cityofredlands.org

From: Dietrich, Carla <CDietrich@mbakerintl.com>
Sent: Friday, June 16, 2023 12:47 PM
To: Don Young <dyoung@cityofredlands.org>; Ryan Murphy <rmurphy@cityofredlands.org>
Cc: Elliott, Emily <Emily.Elliott@mbakerintl.com>; Gleason, Renee <Renee.Gleason@mbakerintl.com>
Subject: Redlands Neighborhoods at Lugonia Village - Draft Scoping

Hi Don and Ryan,

Attached is **Redlands Neighborhoods at Lugonia Village Scoping Memorandum (Addendum)** which documents recommended analysis needs to address a recent site plan change. I'm submitting this document for City review.

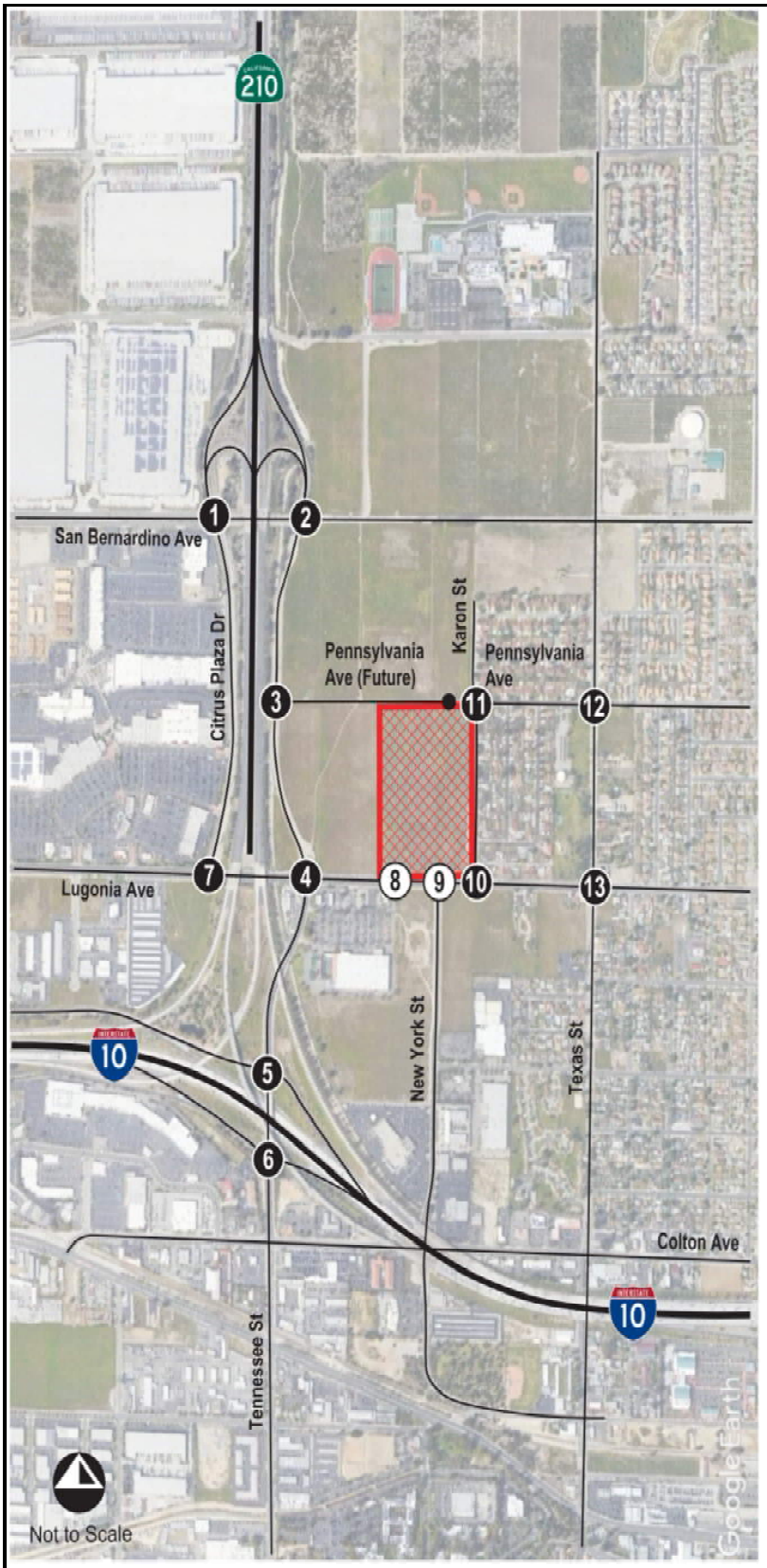
The memo shows the anticipated change in the number of site trips by location, as well as the recommended study approach and study locations. Please review and let us know any questions or comments you may have.

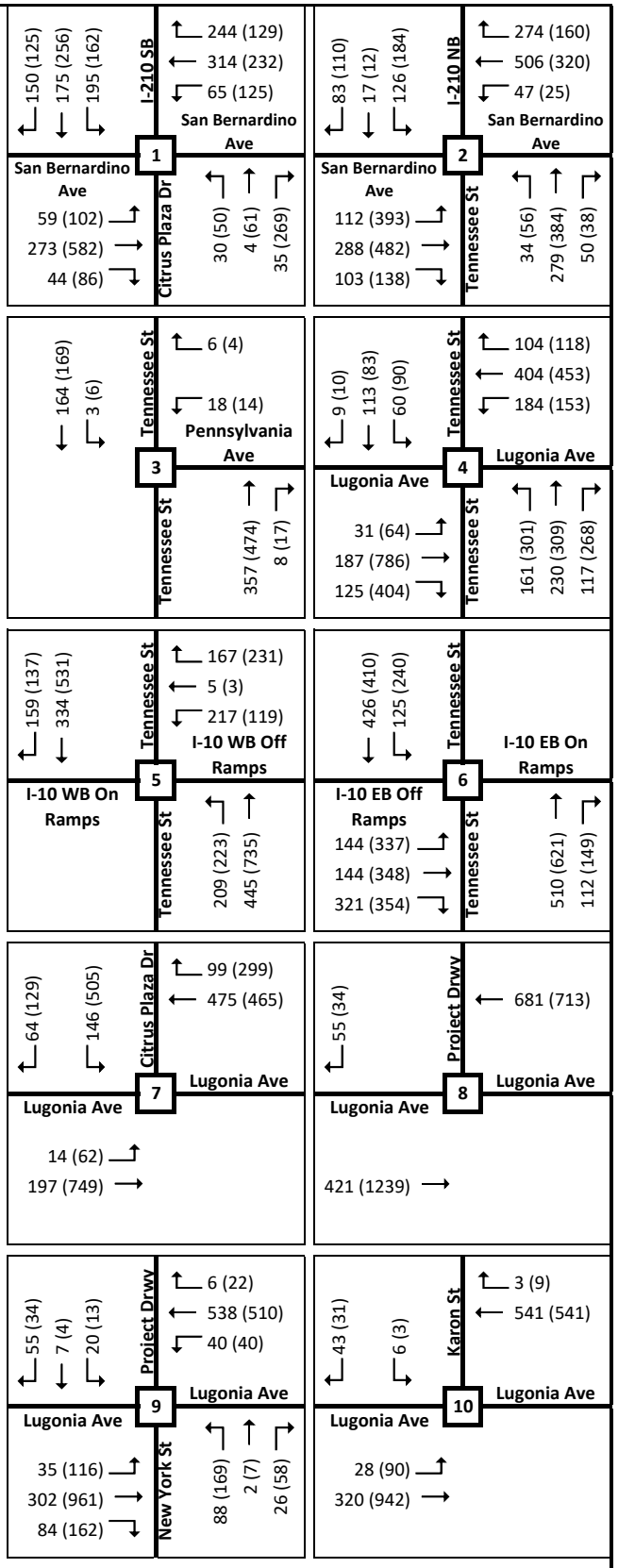
While this typically is submitted by Emily, I've sent it directly in an effort to facilitate the schedule while Emily is out of the office. She will be back in the office early next week to continue coordination.

Thanks,
Carla Dietrich, P.E. (PA), PTOE | she/her/hers | Senior Associate, Technical Manager - Transportation
3536 Concours, Suite 100 | Ontario, CA 91764 | [O] 909-974-4908
cdietrich@mbakerintl.com | www.mbakerintl.com

Michael Baker INTERNATIONAL | *We Make a Difference*

Attachment 2 – Exhibit B-1 and Exhibit B-2

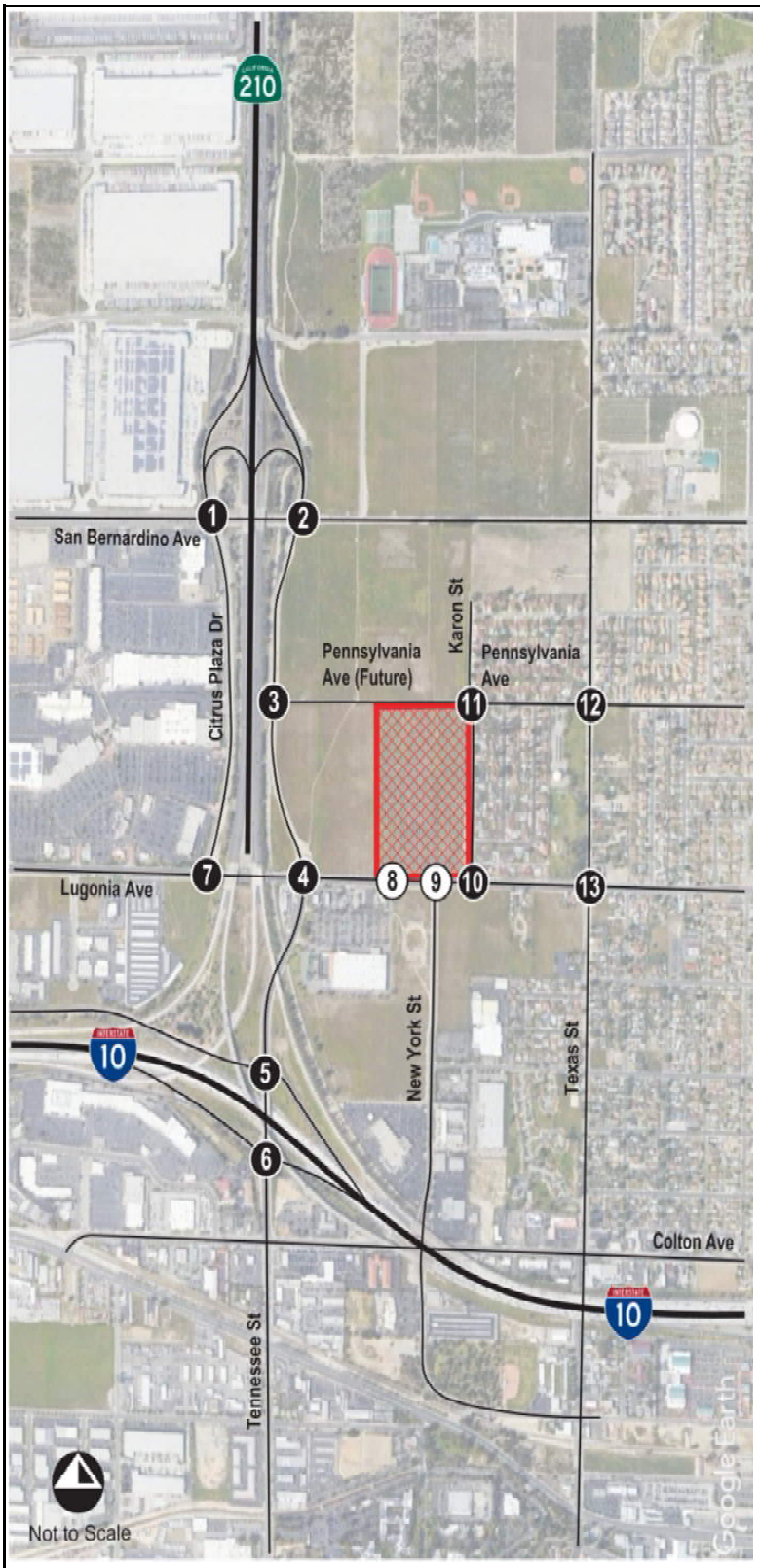


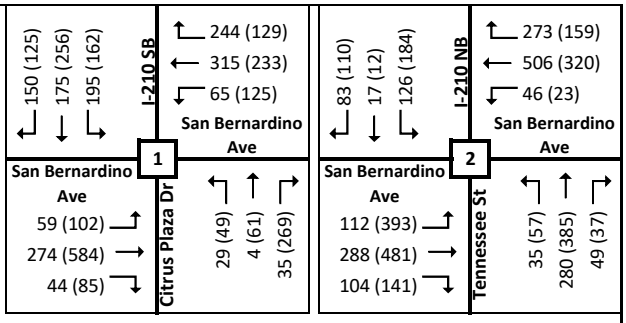


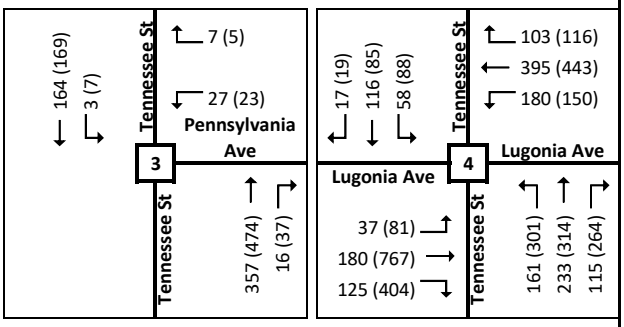
Legend

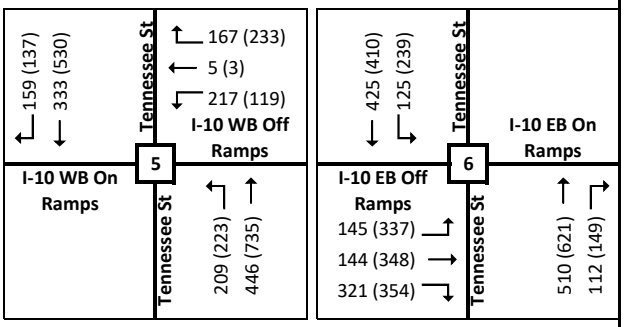
- # Study Intersection
- (#) Project Driveway
- Project Site
- ## (##) AM (PM) Peak Hour Volumes

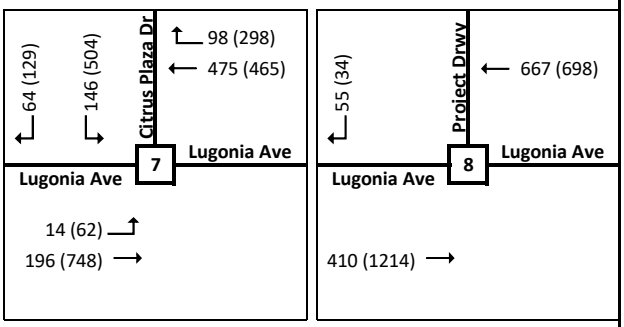
Exhibit B-1

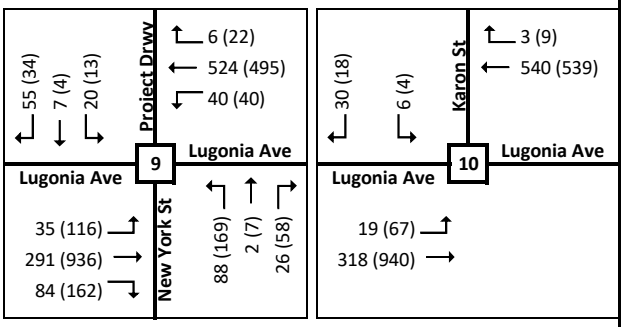






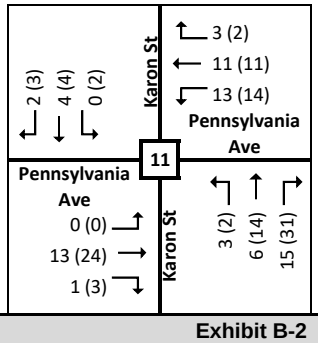






Legend

- Study Intersection
- Project Driveway
- Project Site
- ## (##) AM (PM) Peak Hour Volumes



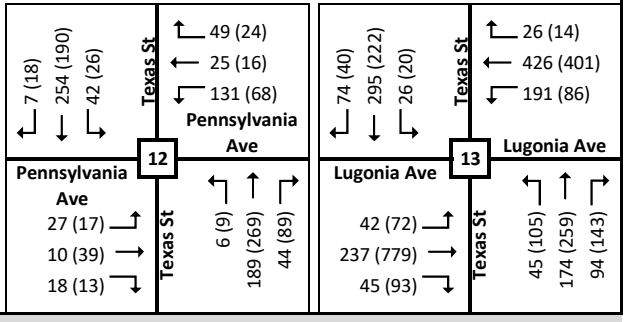
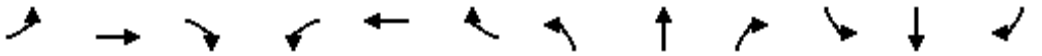


Exhibit B-2

Note: Existing With Project (Scenario B) Final assumed a 40% redistribution of Existing project trips due to new connection at #11

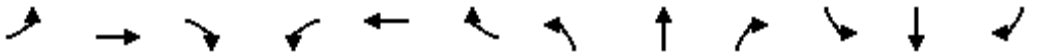
Attachment 3 – Scenario A Synchro Worksheets



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	187	125	184	404	104	161	230	117	60	113	9
Future Volume (veh/h)	31	187	125	184	404	104	161	230	117	60	113	9
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1501	1772	1772	1634	1758	1730	1647	1716	1744	1647	1716	1772
Adj Flow Rate, veh/h	33	201	134	198	434	112	173	247	126	65	122	10
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	15	2	2	5	3	5	4	6	4	4	6	2
Cap, veh/h	51	963	427	202	512	132	209	343	295	88	210	184
Arrive On Green	0.04	0.29	0.29	0.13	0.38	0.38	0.13	0.20	0.20	0.06	0.12	0.12
Sat Flow, veh/h	1430	3367	1494	1556	1347	348	1569	1716	1476	1569	1716	1502
Grp Volume(v), veh/h	33	201	134	198	0	546	173	247	126	65	122	10
Grp Sat Flow(s),veh/h/ln	1430	1683	1494	1556	0	1695	1569	1716	1476	1569	1716	1502
Q Serve(g_s), s	1.3	2.6	4.1	7.3	0.0	17.0	6.2	7.8	4.3	2.4	3.9	0.3
Cycle Q Clear(g_c), s	1.3	2.6	4.1	7.3	0.0	17.0	6.2	7.8	4.3	2.4	3.9	0.3
Prop In Lane	1.00		1.00	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	51	963	427	202	0	644	209	343	295	88	210	184
V/C Ratio(X)	0.65	0.21	0.31	0.98	0.00	0.85	0.83	0.72	0.43	0.74	0.58	0.05
Avail Cap(c_a), veh/h	126	1630	723	202	0	891	230	813	699	220	801	701
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	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.5	15.7	16.2	25.1	0.0	16.4	24.4	21.6	20.2	26.9	24.0	22.4
Incr Delay (d2), s/veh	13.1	0.1	0.4	57.8	0.0	5.6	19.9	2.9	1.0	11.5	2.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.9	1.3	5.7	0.0	6.5	3.3	3.1	1.4	1.1	1.6	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.6	15.8	16.6	82.9	0.0	22.0	44.3	24.5	21.2	38.3	26.5	22.5
LnGrp LOS	D	B	B	F	A	C	D	C	C	D	C	C
Approach Vol, veh/h		368			744			546			197	
Approach Delay, s/veh		18.3			38.2			30.0			30.2	
Approach LOS		B			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	21.5	12.2	12.1	6.6	27.0	7.7	16.6
Change Period (Y+Rc), s	4.5	5.0	4.5	5.0	4.5	5.0	4.5	5.0
Max Green Setting (Gmax), s	7.5	28.0	8.5	27.0	5.1	30.4	8.1	27.4
Max Q Clear Time (g_c+I1), s	9.3	6.1	8.2	5.9	3.3	19.0	4.4	9.8
Green Ext Time (p_c), s	0.0	1.5	0.0	0.6	0.0	2.7	0.0	1.6

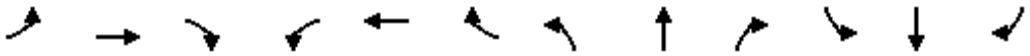
Intersection Summary	
HCM 6th Ctrl Delay	31.0
HCM 6th LOS	C



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	144	144	321	0	0	0	0	510	112	125	426	0
Future Volume (veh/h)	144	144	321	0	0	0	0	510	112	125	426	0
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	1730	1702	1758				0	1730	1730	1647	1772	0
Adj Flow Rate, veh/h	147	147	328				0	520	114	128	435	0
Peak Hour Factor	0.98	0.98	0.98				0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	5	7	3				0	5	5	4	2	0
Cap, veh/h	213	213	370				0	1247	272	158	2090	0
Arrive On Green	0.26	0.26	0.26				0.00	0.46	0.46	0.03	0.20	0.00
Sat Flow, veh/h	830	830	1442				0	2769	585	1569	3455	0
Grp Volume(v), veh/h	294	0	328				0	318	316	128	435	0
Grp Sat Flow(s),veh/h/ln	1660	0	1442				0	1643	1624	1569	1683	0
Q Serve(g_s), s	14.4	0.0	19.7				0.0	11.5	11.6	7.3	9.7	0.0
Cycle Q Clear(g_c), s	14.4	0.0	19.7				0.0	11.5	11.6	7.3	9.7	0.0
Prop In Lane	0.50		1.00				0.00		0.36	1.00		0.00
Lane Grp Cap(c), veh/h	426	0	370				0	764	755	158	2090	0
V/C Ratio(X)	0.69	0.00	0.89				0.00	0.42	0.42	0.81	0.21	0.00
Avail Cap(c_a), veh/h	470	0	409				0	764	755	261	2090	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.94	0.94	0.00
Uniform Delay (d), s/veh	30.2	0.0	32.2				0.0	16.0	16.0	42.7	17.4	0.0
Incr Delay (d2), s/veh	3.8	0.0	19.0				0.0	1.7	1.7	9.0	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	0.0	8.6				0.0	4.4	4.4	3.3	4.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.0	0.0	51.1				0.0	17.6	17.7	51.7	17.6	0.0
LnGrp LOS	C	A	D				A	B	B	D	B	A
Approach Vol, veh/h		622						634			563	
Approach Delay, s/veh		43.0						17.7			25.4	
Approach LOS		D						B			C	

Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		61.4			14.0	47.3		28.6				
Change Period (Y+Rc), s		5.5			5.0	5.5		5.5				
Max Green Setting (Gmax), s		53.5			15.0	33.5		25.5				
Max Q Clear Time (g_c+I1), s		11.7			9.3	13.6		21.7				
Green Ext Time (p_c), s		3.1			0.1	3.7		1.4				

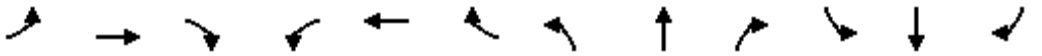
Intersection Summary			
HCM 6th Ctrl Delay		28.7	
HCM 6th LOS		C	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	302	84	40	538	6	88	2	26	20	7	55
Future Volume (veh/h)	35	302	84	40	538	6	88	2	26	20	7	55
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		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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1772	1730	1786	1673	1772	1772	1758	1772	1660	1772	1772	1772
Adj Flow Rate, veh/h	38	343	95	45	611	7	100	2	30	22	8	60
Peak Hour Factor	0.92	0.88	0.88	0.88	0.88	0.92	0.88	0.92	0.88	0.92	0.92	0.92
Percent Heavy Veh, %	2	5	1	2	2	2	3	2	10	2	2	2
Cap, veh/h	397	1014	466	149	1722	20	429	23	95	159	82	298
Arrive On Green	0.31	0.31	0.31	0.09	0.51	0.51	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow, veh/h	805	3287	1511	1594	3409	39	1019	79	323	228	280	1016
Grp Volume(v), veh/h	38	343	95	45	302	316	132	0	0	90	0	0
Grp Sat Flow(s),veh/h/ln	805	1643	1511	1594	1683	1765	1422	0	0	1524	0	0
Q Serve(g_s), s	1.7	3.9	2.3	1.3	5.3	5.3	1.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	1.7	3.9	2.3	1.3	5.3	5.3	3.1	0.0	0.0	2.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.02	0.76		0.23	0.24		0.67
Lane Grp Cap(c), veh/h	397	1014	466	149	850	892	547	0	0	539	0	0
V/C Ratio(X)	0.10	0.34	0.20	0.30	0.35	0.35	0.24	0.00	0.00	0.17	0.00	0.00
Avail Cap(c_a), veh/h	706	2279	1048	393	1756	1841	695	0	0	700	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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	0.00
Uniform Delay (d), s/veh	12.2	13.0	12.4	20.5	7.2	7.3	13.2	0.0	0.0	12.9	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.2	0.2	1.1	0.3	0.2	0.2	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.2	0.7	0.5	1.4	1.4	0.9	0.0	0.0	0.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.3	13.2	12.6	21.7	7.5	7.5	13.4	0.0	0.0	13.0	0.0	0.0
LnGrp LOS	B	B	B	C	A	A	B	A	A	B	A	A
Approach Vol, veh/h		476			663			132			90	
Approach Delay, s/veh		13.0			8.5			13.4			13.0	
Approach LOS		B			A			B			B	

Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	9.6	20.3		18.8		29.9		18.8				
Change Period (Y+Rc), s	5.0	5.3		4.5		5.3		4.5				
Max Green Setting (Gmax), s	12.0	33.7		19.5		50.7		19.5				
Max Q Clear Time (g_c+I1), s	3.3	5.9		4.1		7.3		5.1				
Green Ext Time (p_c), s	0.0	2.8		0.3		4.0		0.5				

Intersection Summary												
HCM 6th Ctrl Delay			10.8									
HCM 6th LOS			B									



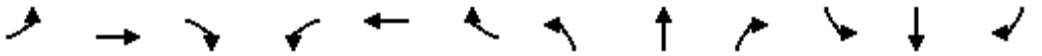
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	239	45	191	427	25	45	174	94	23	295	74
Future Volume (veh/h)	42	239	45	191	427	25	45	174	94	23	295	74
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1687	1744	1758	1687	1772	1688	1786	1786	1716	1758	1786	1772
Adj Flow Rate, veh/h	46	260	49	208	464	27	49	189	102	25	321	80
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	4	3	1	2	8	1	1	6	3	1	2
Cap, veh/h	70	408	76	253	841	49	71	218	683	63	466	705
Arrive On Green	0.04	0.15	0.15	0.16	0.26	0.26	0.47	0.47	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1606	2789	518	1606	3234	188	3	465	1454	1	992	1502
Grp Volume(v), veh/h	46	153	156	208	241	250	238	0	102	346	0	80
Grp Sat Flow(s),veh/h/ln	1606	1657	1651	1606	1683	1738	468	0	1454	993	0	1502
Q Serve(g_s), s	1.8	5.4	5.6	7.8	7.7	7.7	0.2	0.0	2.5	0.2	0.0	1.9
Cycle Q Clear(g_c), s	1.8	5.4	5.6	7.8	7.7	7.7	29.2	0.0	2.5	29.2	0.0	1.9
Prop In Lane	1.00		0.31	1.00		0.11	0.21		1.00	0.07		1.00
Lane Grp Cap(c), veh/h	70	242	241	253	438	452	289	0	683	529	0	705
V/C Ratio(X)	0.66	0.63	0.65	0.82	0.55	0.55	0.82	0.00	0.15	0.65	0.00	0.11
Avail Cap(c_a), veh/h	165	727	724	498	1088	1123	291	0	685	531	0	707
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	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.3	25.0	25.0	25.4	19.9	19.9	15.1	0.0	9.4	12.8	0.0	9.2
Incr Delay (d2), s/veh	9.9	2.7	2.9	6.6	1.1	1.1	16.9	0.0	0.1	2.9	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	2.1	2.2	3.2	2.9	3.0	3.1	0.0	0.7	3.0	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.2	27.7	27.9	31.9	21.0	21.0	32.0	0.0	9.5	15.7	0.0	9.3
LnGrp LOS	D	C	C	C	C	C	C	A	A	B	A	A
Approach Vol, veh/h		355			699			340			426	
Approach Delay, s/veh		29.3			24.2			25.3			14.5	
Approach LOS		C			C			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	14.5	13.8		34.0	7.4	20.9		34.0				
Change Period (Y+Rc), s	* 4.7	* 4.7		* 4.7	* 4.7	* 4.7		* 4.7				
Max Green Setting (Gmax), s	* 19	* 27		* 29	* 6.4	* 40		* 29				
Max Q Clear Time (g_c+I1), s	9.8	7.6		31.2	3.8	9.7		31.2				
Green Ext Time (p_c), s	0.4	1.6		0.0	0.0	3.0		0.0				

Intersection Summary	
HCM 6th Ctrl Delay	23.1
HCM 6th LOS	C

Notes

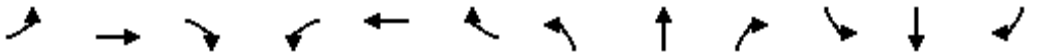
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	64	786	404	153	453	118	301	309	268	90	83	10
Future Volume (veh/h)	64	786	404	153	453	118	301	309	268	90	83	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.99
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	1673	1772	1772	1673	1772	1772	1673	1772	1744	1673	1758	1772
Adj Flow Rate, veh/h	66	810	416	158	467	122	310	319	276	93	86	10
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	4	2	3	2
Cap, veh/h	81	1130	500	142	506	132	229	429	356	116	300	254
Arrive On Green	0.05	0.34	0.34	0.09	0.37	0.37	0.14	0.24	0.24	0.07	0.17	0.17
Sat Flow, veh/h	1594	3367	1491	1594	1353	353	1594	1772	1472	1594	1758	1488
Grp Volume(v), veh/h	66	810	416	158	0	589	310	319	276	93	86	10
Grp Sat Flow(s),veh/h/ln	1594	1683	1491	1594	0	1707	1594	1772	1472	1594	1758	1488
Q Serve(g_s), s	3.0	15.4	18.8	6.5	0.0	24.1	10.5	12.1	12.8	4.2	3.1	0.4
Cycle Q Clear(g_c), s	3.0	15.4	18.8	6.5	0.0	24.1	10.5	12.1	12.8	4.2	3.1	0.4
Prop In Lane	1.00		1.00	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	81	1130	500	142	0	639	229	429	356	116	300	254
V/C Ratio(X)	0.82	0.72	0.83	1.11	0.00	0.92	1.35	0.74	0.77	0.80	0.29	0.04
Avail Cap(c_a), veh/h	109	1246	552	142	0	667	229	658	547	227	651	551
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	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.3	21.2	22.3	33.2	0.0	21.8	31.2	25.6	25.8	33.3	26.4	25.2
Incr Delay (d2), s/veh	28.5	1.8	9.7	109.0	0.0	18.0	184.1	2.6	3.7	12.0	0.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	5.7	7.3	6.7	0.0	11.8	15.5	5.1	4.5	1.9	1.3	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	62.8	23.0	32.0	142.2	0.0	39.8	215.3	28.1	29.5	45.3	26.9	25.3
LnGrp LOS	E	C	C	F	A	D	F	C	C	D	C	C
Approach Vol, veh/h		1292			747			905			189	
Approach Delay, s/veh		27.9			61.5			92.7			35.9	
Approach LOS		C			E			F			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.0	29.5	15.0	17.5	8.2	32.3	9.8	22.7
Change Period (Y+Rc), s	4.5	5.0	4.5	5.0	4.5	5.0	4.5	5.0
Max Green Setting (Gmax), s	6.5	27.0	10.5	27.0	5.0	28.5	10.4	27.1
Max Q Clear Time (g_c+I1), s	8.5	20.8	12.5	5.1	5.0	26.1	6.2	14.8
Green Ext Time (p_c), s	0.0	3.4	0.0	0.4	0.0	0.9	0.1	2.3

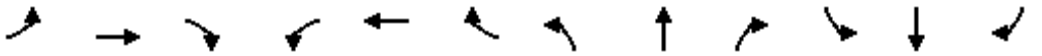
Intersection Summary	
HCM 6th Ctrl Delay	55.1
HCM 6th LOS	E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	337	348	354	0	0	0	0	621	149	240	410	0
Future Volume (veh/h)	337	348	354	0	0	0	0	621	149	240	410	0
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	1758	1772	1772				0	1772	1772	1673	1758	0
Adj Flow Rate, veh/h	355	366	373				0	654	157	253	432	0
Peak Hour Factor	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	2	2				0	2	2	2	3	0
Cap, veh/h	334	356	385				0	853	205	283	1837	0
Arrive On Green	0.33	0.33	0.33				0.00	0.32	0.32	0.06	0.18	0.00
Sat Flow, veh/h	1020	1086	1176				0	2782	646	1594	3428	0
Grp Volume(v), veh/h	599	0	495				0	408	403	253	432	0
Grp Sat Flow(s),veh/h/ln	1721	0	1560				0	1683	1656	1594	1670	0
Q Serve(g_s), s	29.5	0.0	28.1				0.0	19.7	19.8	14.2	10.0	0.0
Cycle Q Clear(g_c), s	29.5	0.0	28.1				0.0	19.7	19.8	14.2	10.0	0.0
Prop In Lane	0.59		0.75				0.00		0.39	1.00		0.00
Lane Grp Cap(c), veh/h	564	0	511				0	533	524	283	1837	0
V/C Ratio(X)	1.06	0.00	0.97				0.00	0.77	0.77	0.89	0.24	0.00
Avail Cap(c_a), veh/h	564	0	511				0	533	524	283	1837	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.91	0.91	0.00
Uniform Delay (d), s/veh	30.3	0.0	29.8				0.0	27.7	27.8	41.5	20.6	0.0
Incr Delay (d2), s/veh	55.4	0.0	31.6				0.0	10.1	10.3	26.0	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.4	0.0	14.6				0.0	9.0	8.9	8.1	4.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	85.7	0.0	61.4				0.0	37.8	38.1	67.5	20.9	0.0
LnGrp LOS	F	A	E				A	D	D	E	C	A
Approach Vol, veh/h		1094						811			685	
Approach Delay, s/veh		74.7						38.0			38.1	
Approach LOS		E						D			D	

Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		55.0			21.0	34.0		35.0				
Change Period (Y+Rc), s		5.5			5.0	5.5		5.5				
Max Green Setting (Gmax), s		49.5			16.0	28.5		29.5				
Max Q Clear Time (g_c+I1), s		12.0			16.2	21.8		31.5				
Green Ext Time (p_c), s		3.0			0.0	2.7		0.0				

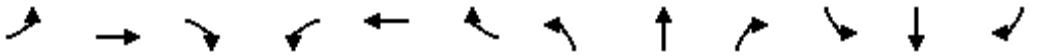
Intersection Summary			
HCM 6th Ctrl Delay		53.5	
HCM 6th LOS		D	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	116	961	162	40	510	22	169	7	58	13	4	34
Future Volume (veh/h)	116	961	162	40	510	22	169	7	58	13	4	34
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		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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1772	1772	1758	1660	1772	1772	1772	1772	1772	1772	1772	1772
Adj Flow Rate, veh/h	126	1056	178	44	560	24	186	8	64	14	4	37
Peak Hour Factor	0.92	0.91	0.91	0.91	0.91	0.92	0.91	0.92	0.91	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	3	3	2	2	2	2	2	2	2	2
Cap, veh/h	475	1449	640	136	1966	84	343	21	87	138	62	259
Arrive On Green	0.43	0.43	0.43	0.09	0.60	0.60	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	831	3367	1486	1581	3289	141	996	87	357	264	256	1067
Grp Volume(v), veh/h	126	1056	178	44	286	298	258	0	0	55	0	0
Grp Sat Flow(s),veh/h/ln	831	1683	1486	1581	1683	1747	1441	0	0	1587	0	0
Q Serve(g_s), s	6.3	16.0	4.8	1.6	5.1	5.1	8.3	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	6.3	16.0	4.8	1.6	5.1	5.1	10.0	0.0	0.0	1.7	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.08	0.72		0.25	0.25		0.67
Lane Grp Cap(c), veh/h	475	1449	640	136	1006	1044	451	0	0	459	0	0
V/C Ratio(X)	0.27	0.73	0.28	0.32	0.28	0.29	0.57	0.00	0.00	0.12	0.00	0.00
Avail Cap(c_a), veh/h	600	1956	863	257	1389	1441	556	0	0	568	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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	0.00
Uniform Delay (d), s/veh	11.8	14.5	11.3	26.4	6.0	6.0	21.3	0.0	0.0	18.2	0.0	0.0
Incr Delay (d2), s/veh	0.3	0.9	0.2	1.4	0.2	0.1	1.1	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	5.3	1.4	0.6	1.3	1.4	3.1	0.0	0.0	0.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.0	15.5	11.6	27.8	6.1	6.1	22.4	0.0	0.0	18.4	0.0	0.0
LnGrp LOS	B	B	B	C	A	A	C	A	A	B	A	A
Approach Vol, veh/h		1360			628			258			55	
Approach Delay, s/veh		14.6			7.7			22.4			18.4	
Approach LOS		B			A			C			B	

Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	10.3	31.7		19.4		42.0		19.4				
Change Period (Y+Rc), s	5.0	5.3		4.5		5.3		4.5				
Max Green Setting (Gmax), s	10.0	35.7		19.5		50.7		19.5				
Max Q Clear Time (g_c+I1), s	3.6	18.0		3.7		7.1		12.0				
Green Ext Time (p_c), s	0.0	8.4		0.2		3.8		0.8				

Intersection Summary												
HCM 6th Ctrl Delay			13.7									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	72	780	93	86	403	12	105	259	143	18	222	40
Future Volume (veh/h)	72	780	93	86	403	12	105	259	143	18	222	40
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		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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1687	1786	1786	1673	1772	1786	1786	1786	1786	1786	1786	1786
Adj Flow Rate, veh/h	76	821	98	91	424	13	111	273	151	19	234	42
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	2	2	1	1	1	1	1	1	1
Cap, veh/h	95	992	118	113	1124	34	58	97	648	48	405	648
Arrive On Green	0.06	0.33	0.33	0.07	0.34	0.34	0.43	0.43	0.43	0.43	0.43	0.43
Sat Flow, veh/h	1606	3053	364	1594	3335	102	0	226	1514	0	946	1514
Grp Volume(v), veh/h	76	456	463	91	214	223	384	0	151	253	0	42
Grp Sat Flow(s),veh/h/ln	1606	1697	1720	1594	1683	1754	226	0	1514	946	0	1514
Q Serve(g_s), s	3.7	19.9	19.9	4.5	7.7	7.8	0.0	0.0	5.1	0.0	0.0	1.3
Cycle Q Clear(g_c), s	3.7	19.9	19.9	4.5	7.7	7.8	34.3	0.0	5.1	34.3	0.0	1.3
Prop In Lane	1.00		0.21	1.00		0.06	0.29		1.00	0.08		1.00
Lane Grp Cap(c), veh/h	95	552	559	113	567	591	155	0	648	453	0	648
V/C Ratio(X)	0.80	0.83	0.83	0.80	0.38	0.38	2.48	0.00	0.23	0.56	0.00	0.06
Avail Cap(c_a), veh/h	200	684	693	185	664	691	155	0	648	453	0	648
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	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.2	25.0	25.0	36.7	20.2	20.2	20.0	0.0	14.6	17.4	0.0	13.5
Incr Delay (d2), s/veh	14.4	6.9	6.8	12.4	0.4	0.4	685.3	0.0	0.2	1.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	8.5	8.6	2.1	2.9	3.0	31.1	0.0	1.6	3.0	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	51.6	31.8	31.8	49.1	20.6	20.6	705.2	0.0	14.7	19.0	0.0	13.5
LnGrp LOS	D	C	C	D	C	C	F	A	B	B	A	B
Approach Vol, veh/h		995			528			535			295	
Approach Delay, s/veh		33.3			25.5			510.4			18.2	
Approach LOS		C			C			F			B	

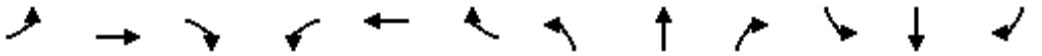
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.4	30.8		39.0	9.4	31.7		39.0				
Change Period (Y+Rc), s	* 4.7	* 4.7		* 4.7	* 4.7	* 4.7		* 4.7				
Max Green Setting (Gmax), s	* 9.3	* 32		* 34	* 10	* 32		* 34				
Max Q Clear Time (g_c+I1), s	6.5	21.9		36.3	5.7	9.8		36.3				
Green Ext Time (p_c), s	0.0	4.2		0.0	0.0	2.4		0.0				

Intersection Summary	
HCM 6th Ctrl Delay	138.1
HCM 6th LOS	F

Notes

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

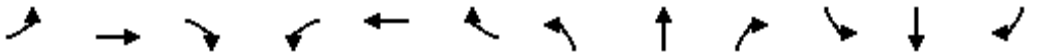
Attachment 4 – Scenario B Synchro Worksheets



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	180	125	180	395	103	161	233	115	58	116	17
Future Volume (veh/h)	37	180	125	180	395	103	161	233	115	58	116	17
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1501	1772	1772	1634	1758	1730	1647	1716	1744	1647	1716	1772
Adj Flow Rate, veh/h	40	194	134	194	425	111	173	251	124	62	125	18
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	15	2	2	5	3	5	4	6	4	4	6	2
Cap, veh/h	59	963	427	201	503	131	209	347	298	85	211	185
Arrive On Green	0.04	0.29	0.29	0.13	0.37	0.37	0.13	0.20	0.20	0.05	0.12	0.12
Sat Flow, veh/h	1430	3367	1494	1556	1343	351	1569	1716	1476	1569	1716	1502
Grp Volume(v), veh/h	40	194	134	194	0	536	173	251	124	62	125	18
Grp Sat Flow(s),veh/h/ln	1430	1683	1494	1556	0	1694	1569	1716	1476	1569	1716	1502
Q Serve(g_s), s	1.6	2.5	4.1	7.2	0.0	16.8	6.2	7.9	4.2	2.3	4.0	0.6
Cycle Q Clear(g_c), s	1.6	2.5	4.1	7.2	0.0	16.8	6.2	7.9	4.2	2.3	4.0	0.6
Prop In Lane	1.00		1.00	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	59	963	427	201	0	635	209	347	298	85	211	185
V/C Ratio(X)	0.68	0.20	0.31	0.96	0.00	0.84	0.83	0.72	0.42	0.73	0.59	0.10
Avail Cap(c_a), veh/h	126	1627	722	201	0	889	230	811	698	219	800	700
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.4	15.7	16.2	25.1	0.0	16.6	24.5	21.6	20.1	27.0	24.0	22.5
Incr Delay (d2), s/veh	13.1	0.1	0.4	52.7	0.0	5.4	20.0	2.9	0.9	11.0	2.6	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	0.7	0.8	1.3	5.4	0.0	6.4	3.3	3.1	1.4	1.0	1.6	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.5	15.8	16.6	77.8	0.0	22.0	44.4	24.5	21.1	38.0	26.7	22.8
LnGrp LOS	D	B	B	E	A	C	D	C	C	D	C	C
Approach Vol, veh/h		368			730			548			205	
Approach Delay, s/veh		18.8			36.8			30.0			29.7	
Approach LOS		B			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	21.6	12.2	12.1	6.9	26.7	7.7	16.7
Change Period (Y+Rc), s	4.5	5.0	4.5	5.0	4.5	5.0	4.5	5.0
Max Green Setting (Gmax), s	7.5	28.0	8.5	27.0	5.1	30.4	8.1	27.4
Max Q Clear Time (g_c+I1), s	9.2	6.1	8.2	6.0	3.6	18.8	4.3	9.9
Green Ext Time (p_c), s	0.0	1.5	0.0	0.6	0.0	2.7	0.0	1.7

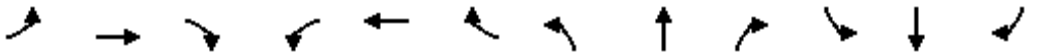
Intersection Summary	
HCM 6th Ctrl Delay	30.4
HCM 6th LOS	C



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	144	321	0	0	0	0	510	112	125	425	0
Future Volume (veh/h)	145	144	321	0	0	0	0	510	112	125	425	0
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	1730	1702	1758				0	1730	1730	1647	1772	0
Adj Flow Rate, veh/h	148	147	328				0	520	114	128	434	0
Peak Hour Factor	0.98	0.98	0.98				0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	5	7	3				0	5	5	4	2	0
Cap, veh/h	214	213	370				0	1247	272	158	2090	0
Arrive On Green	0.26	0.26	0.26				0.00	0.46	0.46	0.03	0.20	0.00
Sat Flow, veh/h	833	827	1442				0	2769	585	1569	3455	0
Grp Volume(v), veh/h	295	0	328				0	318	316	128	434	0
Grp Sat Flow(s),veh/h/ln	1660	0	1442				0	1643	1624	1569	1683	0
Q Serve(g_s), s	14.5	0.0	19.7				0.0	11.5	11.6	7.3	9.6	0.0
Cycle Q Clear(g_c), s	14.5	0.0	19.7				0.0	11.5	11.6	7.3	9.6	0.0
Prop In Lane	0.50		1.00				0.00		0.36	1.00		0.00
Lane Grp Cap(c), veh/h	426	0	370				0	764	755	158	2090	0
V/C Ratio(X)	0.69	0.00	0.89				0.00	0.42	0.42	0.81	0.21	0.00
Avail Cap(c_a), veh/h	470	0	409				0	764	755	261	2090	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.94	0.94	0.00
Uniform Delay (d), s/veh	30.2	0.0	32.2				0.0	16.0	16.0	42.7	17.4	0.0
Incr Delay (d2), s/veh	3.8	0.0	18.9				0.0	1.7	1.7	9.0	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	0.0	8.6				0.0	4.4	4.4	3.3	4.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.0	0.0	51.1				0.0	17.6	17.7	51.7	17.6	0.0
LnGrp LOS	C	A	D				A	B	B	D	B	A
Approach Vol, veh/h		623						634			562	
Approach Delay, s/veh		43.0						17.7			25.4	
Approach LOS		D						B			C	

Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		61.4			14.0	47.3		28.6				
Change Period (Y+Rc), s		5.5			5.0	5.5		5.5				
Max Green Setting (Gmax), s		53.5			15.0	33.5		25.5				
Max Q Clear Time (g_c+I1), s		11.6			9.3	13.6		21.7				
Green Ext Time (p_c), s		3.1			0.1	3.7		1.4				

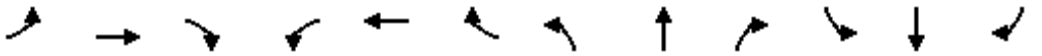
Intersection Summary			
HCM 6th Ctrl Delay		28.7	
HCM 6th LOS		C	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	291	84	40	524	6	88	2	26	20	7	55
Future Volume (veh/h)	35	291	84	40	524	6	88	2	26	20	7	55
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		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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1772	1730	1786	1673	1772	1772	1758	1772	1660	1772	1772	1772
Adj Flow Rate, veh/h	38	331	95	45	595	7	100	2	30	22	8	60
Peak Hour Factor	0.92	0.88	0.88	0.88	0.88	0.92	0.88	0.92	0.88	0.92	0.92	0.92
Percent Heavy Veh, %	2	5	1	2	2	2	3	2	10	2	2	2
Cap, veh/h	400	1014	466	149	1722	20	429	23	95	159	82	298
Arrive On Green	0.31	0.31	0.31	0.09	0.51	0.51	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow, veh/h	817	3287	1511	1594	3408	40	1019	79	323	228	280	1016
Grp Volume(v), veh/h	38	331	95	45	294	308	132	0	0	90	0	0
Grp Sat Flow(s),veh/h/ln	817	1643	1511	1594	1683	1765	1422	0	0	1524	0	0
Q Serve(g_s), s	1.6	3.8	2.3	1.3	5.1	5.1	1.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	1.6	3.8	2.3	1.3	5.1	5.1	3.1	0.0	0.0	2.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.02	0.76		0.23	0.24		0.67
Lane Grp Cap(c), veh/h	400	1014	466	149	850	891	547	0	0	539	0	0
V/C Ratio(X)	0.09	0.33	0.20	0.30	0.35	0.35	0.24	0.00	0.00	0.17	0.00	0.00
Avail Cap(c_a), veh/h	715	2279	1048	393	1756	1841	695	0	0	700	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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	0.00
Uniform Delay (d), s/veh	12.2	12.9	12.4	20.5	7.2	7.2	13.2	0.0	0.0	12.9	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.2	0.2	1.1	0.2	0.2	0.2	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	1.2	0.7	0.5	1.3	1.4	0.9	0.0	0.0	0.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.3	13.1	12.6	21.7	7.5	7.4	13.4	0.0	0.0	13.0	0.0	0.0
LnGrp LOS	B	B	B	C	A	A	B	A	A	B	A	A
Approach Vol, veh/h		464			647			132			90	
Approach Delay, s/veh		12.9			8.4			13.4			13.0	
Approach LOS		B			A			B			B	

Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	9.6	20.3		18.8		29.9		18.8				
Change Period (Y+Rc), s	5.0	5.3		4.5		5.3		4.5				
Max Green Setting (Gmax), s	12.0	33.7		19.5		50.7		19.5				
Max Q Clear Time (g_c+I1), s	3.3	5.8		4.1		7.1		5.1				
Green Ext Time (p_c), s	0.0	2.7		0.3		3.9		0.5				

Intersection Summary												
HCM 6th Ctrl Delay			10.8									
HCM 6th LOS			B									



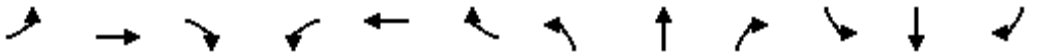
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	237	45	191	426	26	45	174	94	26	295	74
Future Volume (veh/h)	42	237	45	191	426	26	45	174	94	26	295	74
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1687	1744	1758	1687	1772	1688	1786	1786	1716	1758	1786	1772
Adj Flow Rate, veh/h	46	258	49	208	463	28	49	189	102	28	321	80
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	4	3	1	2	8	1	1	6	3	1	2
Cap, veh/h	71	407	76	255	842	51	70	214	682	62	439	705
Arrive On Green	0.04	0.15	0.15	0.16	0.26	0.26	0.47	0.47	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1606	2786	521	1606	3226	195	0	455	1454	0	935	1502
Grp Volume(v), veh/h	46	152	155	208	241	250	238	0	102	349	0	80
Grp Sat Flow(s),veh/h/ln	1606	1657	1650	1606	1683	1737	455	0	1454	935	0	1502
Q Serve(g_s), s	1.8	5.4	5.5	7.8	7.7	7.8	0.0	0.0	2.5	0.0	0.0	1.9
Cycle Q Clear(g_c), s	1.8	5.4	5.5	7.8	7.7	7.8	29.3	0.0	2.5	29.3	0.0	1.9
Prop In Lane	1.00		0.32	1.00		0.11	0.21		1.00	0.08		1.00
Lane Grp Cap(c), veh/h	71	242	241	255	439	453	283	0	682	501	0	705
V/C Ratio(X)	0.65	0.63	0.64	0.82	0.55	0.55	0.84	0.00	0.15	0.70	0.00	0.11
Avail Cap(c_a), veh/h	165	724	722	497	1084	1118	283	0	682	501	0	705
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	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.4	25.1	25.1	25.4	19.9	19.9	16.1	0.0	9.5	14.3	0.0	9.3
Incr Delay (d2), s/veh	9.7	2.7	2.9	6.3	1.1	1.0	19.7	0.0	0.1	4.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	2.1	2.2	3.2	2.9	3.0	3.4	0.0	0.7	3.5	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.1	27.7	28.0	31.7	21.0	21.0	35.8	0.0	9.6	18.5	0.0	9.4
LnGrp LOS	D	C	C	C	C	C	D	A	A	B	A	A
Approach Vol, veh/h		353			699			340			429	
Approach Delay, s/veh		29.3			24.2			27.9			16.8	
Approach LOS		C			C			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	14.6	13.8		34.0	7.4	21.0		34.0				
Change Period (Y+Rc), s	* 4.7	* 4.7		* 4.7	* 4.7	* 4.7		* 4.7				
Max Green Setting (Gmax), s	* 19	* 27		* 29	* 6.4	* 40		* 29				
Max Q Clear Time (g_c+I1), s	9.8	7.5		31.3	3.8	9.8		31.3				
Green Ext Time (p_c), s	0.4	1.6		0.0	0.0	3.0		0.0				

Intersection Summary	
HCM 6th Ctrl Delay	24.1
HCM 6th LOS	C

Notes

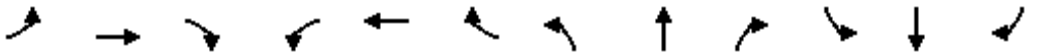
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	767	404	150	443	116	301	314	264	88	85	19
Future Volume (veh/h)	81	767	404	150	443	116	301	314	264	88	85	19
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.99
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	1673	1772	1772	1673	1772	1772	1673	1772	1744	1673	1758	1772
Adj Flow Rate, veh/h	84	791	416	155	457	120	310	324	272	91	88	20
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	4	2	3	2
Cap, veh/h	104	1150	509	141	494	130	228	425	353	113	295	249
Arrive On Green	0.06	0.34	0.34	0.09	0.37	0.37	0.14	0.24	0.24	0.07	0.17	0.17
Sat Flow, veh/h	1594	3367	1491	1594	1351	355	1594	1772	1472	1594	1758	1488
Grp Volume(v), veh/h	84	791	416	155	0	577	310	324	272	91	88	20
Grp Sat Flow(s),veh/h/ln	1594	1683	1491	1594	0	1706	1594	1772	1472	1594	1758	1488
Q Serve(g_s), s	3.8	14.8	18.7	6.5	0.0	23.8	10.5	12.5	12.6	4.1	3.2	0.8
Cycle Q Clear(g_c), s	3.8	14.8	18.7	6.5	0.0	23.8	10.5	12.5	12.6	4.1	3.2	0.8
Prop In Lane	1.00		1.00	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	104	1150	509	141	0	623	228	425	353	113	295	249
V/C Ratio(X)	0.81	0.69	0.82	1.10	0.00	0.93	1.36	0.76	0.77	0.80	0.30	0.08
Avail Cap(c_a), veh/h	109	1239	549	141	0	663	228	655	544	226	647	548
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	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	33.9	20.8	22.0	33.4	0.0	22.3	31.4	26.0	26.0	33.6	26.8	25.8
Incr Delay (d2), s/veh	34.3	1.5	8.8	104.3	0.0	18.5	187.3	2.9	3.6	12.2	0.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	5.4	7.2	6.5	0.0	11.8	15.7	5.2	4.5	1.9	1.3	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	68.2	22.3	30.9	137.8	0.0	40.8	218.8	28.8	29.6	45.8	27.3	25.9
LnGrp LOS	E	C	C	F	A	D	F	C	C	D	C	C
Approach Vol, veh/h		1291			732			906			199	
Approach Delay, s/veh		28.0			61.3			94.1			35.6	
Approach LOS		C			E			F			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.0	30.1	15.0	17.3	9.3	31.8	9.7	22.6
Change Period (Y+Rc), s	4.5	5.0	4.5	5.0	4.5	5.0	4.5	5.0
Max Green Setting (Gmax), s	6.5	27.0	10.5	27.0	5.0	28.5	10.4	27.1
Max Q Clear Time (g_c+I1), s	8.5	20.7	12.5	5.2	5.8	25.8	6.1	14.6
Green Ext Time (p_c), s	0.0	3.4	0.0	0.4	0.0	1.0	0.1	2.3

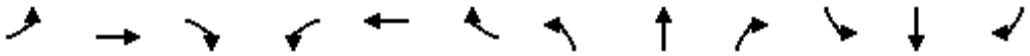
Intersection Summary	
HCM 6th Ctrl Delay	55.4
HCM 6th LOS	E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	337	348	354	0	0	0	0	621	149	239	410	0
Future Volume (veh/h)	337	348	354	0	0	0	0	621	149	239	410	0
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	1758	1772	1772				0	1772	1772	1673	1758	0
Adj Flow Rate, veh/h	355	366	373				0	654	157	252	432	0
Peak Hour Factor	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	2	2				0	2	2	2	3	0
Cap, veh/h	334	356	385				0	853	205	283	1837	0
Arrive On Green	0.33	0.33	0.33				0.00	0.32	0.32	0.06	0.18	0.00
Sat Flow, veh/h	1020	1086	1176				0	2782	646	1594	3428	0
Grp Volume(v), veh/h	599	0	495				0	408	403	252	432	0
Grp Sat Flow(s),veh/h/ln	1721	0	1560				0	1683	1656	1594	1670	0
Q Serve(g_s), s	29.5	0.0	28.1				0.0	19.7	19.8	14.1	10.0	0.0
Cycle Q Clear(g_c), s	29.5	0.0	28.1				0.0	19.7	19.8	14.1	10.0	0.0
Prop In Lane	0.59		0.75				0.00		0.39	1.00		0.00
Lane Grp Cap(c), veh/h	564	0	511				0	533	524	283	1837	0
V/C Ratio(X)	1.06	0.00	0.97				0.00	0.77	0.77	0.89	0.24	0.00
Avail Cap(c_a), veh/h	564	0	511				0	533	524	283	1837	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	0.33	0.33	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.91	0.91	0.00
Uniform Delay (d), s/veh	30.3	0.0	29.8				0.0	27.7	27.8	41.5	20.6	0.0
Incr Delay (d2), s/veh	55.4	0.0	31.6				0.0	10.1	10.3	25.4	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.4	0.0	14.6				0.0	9.0	8.9	8.0	4.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	85.7	0.0	61.4				0.0	37.8	38.1	66.9	20.9	0.0
LnGrp LOS	F	A	E				A	D	D	E	C	A
Approach Vol, veh/h		1094						811			684	
Approach Delay, s/veh		74.7						38.0			37.9	
Approach LOS		E						D			D	

Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		55.0			21.0	34.0		35.0				
Change Period (Y+Rc), s		5.5			5.0	5.5		5.5				
Max Green Setting (Gmax), s		49.5			16.0	28.5		29.5				
Max Q Clear Time (g_c+I1), s		12.0			16.1	21.8		31.5				
Green Ext Time (p_c), s		3.0			0.0	2.7		0.0				

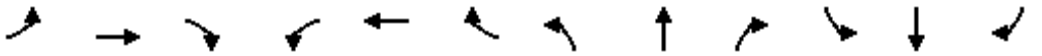
Intersection Summary			
HCM 6th Ctrl Delay		53.5	
HCM 6th LOS		D	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	116	936	162	40	495	22	169	7	58	13	4	34
Future Volume (veh/h)	116	936	162	40	495	22	169	7	58	13	4	34
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		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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1772	1772	1758	1660	1772	1772	1772	1772	1772	1772	1772	1772
Adj Flow Rate, veh/h	126	1029	178	44	544	24	186	8	64	14	4	37
Peak Hour Factor	0.92	0.91	0.91	0.91	0.91	0.92	0.91	0.92	0.91	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	3	3	2	2	2	2	2	2	2	2
Cap, veh/h	476	1429	631	136	1948	86	346	22	88	139	63	262
Arrive On Green	0.42	0.42	0.42	0.09	0.59	0.59	0.25	0.25	0.25	0.25	0.25	0.25
Sat Flow, veh/h	843	3367	1486	1581	3284	145	993	90	357	263	256	1067
Grp Volume(v), veh/h	126	1029	178	44	278	290	258	0	0	55	0	0
Grp Sat Flow(s),veh/h/ln	843	1683	1486	1581	1683	1746	1441	0	0	1586	0	0
Q Serve(g_s), s	6.1	15.4	4.8	1.6	4.9	4.9	8.2	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	6.1	15.4	4.8	1.6	4.9	4.9	9.9	0.0	0.0	1.7	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.08	0.72		0.25	0.25		0.67
Lane Grp Cap(c), veh/h	476	1429	631	136	998	1035	456	0	0	464	0	0
V/C Ratio(X)	0.26	0.72	0.28	0.32	0.28	0.28	0.57	0.00	0.00	0.12	0.00	0.00
Avail Cap(c_a), veh/h	614	1979	874	260	1405	1457	562	0	0	575	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	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	0.00
Uniform Delay (d), s/veh	11.8	14.5	11.4	26.1	6.0	6.0	20.9	0.0	0.0	17.9	0.0	0.0
Incr Delay (d2), s/veh	0.3	0.8	0.2	1.4	0.2	0.1	1.1	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	5.0	1.4	0.6	1.3	1.4	3.1	0.0	0.0	0.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.1	15.3	11.7	27.4	6.2	6.2	22.0	0.0	0.0	18.0	0.0	0.0
LnGrp LOS	B	B	B	C	A	A	C	A	A	B	A	A
Approach Vol, veh/h		1333			612			258			55	
Approach Delay, s/veh		14.5			7.7			22.0			18.0	
Approach LOS		B			A			C			B	

Timer - Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	10.2	31.1		19.4		41.3		19.4				
Change Period (Y+Rc), s	5.0	5.3		4.5		5.3		4.5				
Max Green Setting (Gmax), s	10.0	35.7		19.5		50.7		19.5				
Max Q Clear Time (g_c+I1), s	3.6	17.4		3.7		6.9		11.9				
Green Ext Time (p_c), s	0.0	8.4		0.2		3.7		0.8				

Intersection Summary												
HCM 6th Ctrl Delay			13.6									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	72	779	93	86	401	14	105	259	143	20	222	40
Future Volume (veh/h)	72	779	93	86	401	14	105	259	143	20	222	40
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		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	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1687	1786	1786	1673	1772	1786	1786	1786	1786	1786	1786	1786
Adj Flow Rate, veh/h	76	820	98	91	422	15	111	273	151	21	234	42
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	2	2	1	1	1	1	1	1	1
Cap, veh/h	95	992	118	113	1117	40	58	97	648	49	383	648
Arrive On Green	0.06	0.32	0.32	0.07	0.34	0.34	0.43	0.43	0.43	0.43	0.43	0.43
Sat Flow, veh/h	1606	3052	365	1594	3316	118	0	227	1514	0	895	1514
Grp Volume(v), veh/h	76	456	462	91	214	223	384	0	151	255	0	42
Grp Sat Flow(s),veh/h/ln	1606	1697	1720	1594	1683	1751	227	0	1514	895	0	1514
Q Serve(g_s), s	3.7	19.9	19.9	4.5	7.7	7.8	0.0	0.0	5.1	0.0	0.0	1.3
Cycle Q Clear(g_c), s	3.7	19.9	19.9	4.5	7.7	7.8	34.3	0.0	5.1	34.3	0.0	1.3
Prop In Lane	1.00		0.21	1.00		0.07	0.29		1.00	0.08		1.00
Lane Grp Cap(c), veh/h	95	551	559	113	567	590	155	0	648	432	0	648
V/C Ratio(X)	0.80	0.83	0.83	0.80	0.38	0.38	2.48	0.00	0.23	0.59	0.00	0.06
Avail Cap(c_a), veh/h	201	684	694	185	664	691	155	0	648	432	0	648
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	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.2	25.0	25.0	36.7	20.2	20.2	19.9	0.0	14.5	18.3	0.0	13.5
Incr Delay (d2), s/veh	14.4	6.8	6.8	12.4	0.4	0.4	684.4	0.0	0.2	2.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	8.5	8.6	2.1	2.9	3.0	31.0	0.0	1.6	3.2	0.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	51.6	31.8	31.7	49.1	20.6	20.6	704.4	0.0	14.7	20.5	0.0	13.5
LnGrp LOS	D	C	C	D	C	C	F	A	B	C	A	B
Approach Vol, veh/h		994			528			535			297	
Approach Delay, s/veh		33.3			25.5			509.7			19.5	
Approach LOS		C			C			F			B	

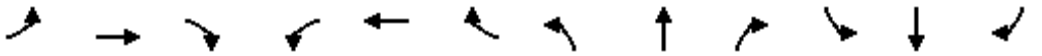
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.4	30.7		39.0	9.4	31.7		39.0				
Change Period (Y+Rc), s	* 4.7	* 4.7		* 4.7	* 4.7	* 4.7		* 4.7				
Max Green Setting (Gmax), s	* 9.3	* 32		* 34	* 10	* 32		* 34				
Max Q Clear Time (g_c+I1), s	6.5	21.9		36.3	5.7	9.8		36.3				
Green Ext Time (p_c), s	0.0	4.2		0.0	0.0	2.4		0.0				

Intersection Summary		
HCM 6th Ctrl Delay		138.1
HCM 6th LOS		F

Notes

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

Attachment 5 – Improvements Synchro Worksheets



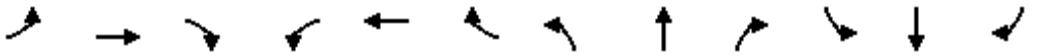
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	64	786	404	153	453	118	301	309	268	90	83	10
Future Volume (veh/h)	64	786	404	153	453	118	301	309	268	90	83	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.99
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	1673	1772	1772	1673	1772	1772	1673	1772	1744	1673	1758	1772
Adj Flow Rate, veh/h	66	810	416	158	467	122	310	319	276	93	86	10
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	4	2	3	2
Cap, veh/h	81	1102	488	189	535	140	334	424	353	116	181	152
Arrive On Green	0.05	0.33	0.33	0.12	0.40	0.40	0.21	0.24	0.24	0.07	0.10	0.10
Sat Flow, veh/h	1594	3367	1491	1594	1353	354	1594	1772	1472	1594	1758	1480
Grp Volume(v), veh/h	66	810	416	158	0	589	310	319	276	93	86	10
Grp Sat Flow(s),veh/h/ln	1594	1683	1491	1594	0	1707	1594	1772	1472	1594	1758	1480
Q Serve(g_s), s	3.2	16.8	20.5	7.6	0.0	25.1	15.0	13.1	13.8	4.5	3.6	0.5
Cycle Q Clear(g_c), s	3.2	16.8	20.5	7.6	0.0	25.1	15.0	13.1	13.8	4.5	3.6	0.5
Prop In Lane	1.00		1.00	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	81	1102	488	189	0	675	334	424	353	116	181	152
V/C Ratio(X)	0.82	0.73	0.85	0.84	0.00	0.87	0.93	0.75	0.78	0.80	0.48	0.07
Avail Cap(c_a), veh/h	101	1198	531	192	0	705	334	685	569	265	603	508
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	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.0	23.4	24.7	33.9	0.0	22.0	30.5	27.7	28.0	35.9	33.3	31.9
Incr Delay (d2), s/veh	32.3	2.2	11.9	25.9	0.0	11.4	31.2	2.7	3.8	11.8	1.9	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	1.9	6.4	8.3	4.2	0.0	11.2	8.3	5.6	5.0	2.1	1.6	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.3	25.6	36.6	59.8	0.0	33.3	61.7	30.5	31.8	47.6	35.2	32.1
LnGrp LOS	E	C	D	E	A	C	E	C	C	D	D	C
Approach Vol, veh/h		1292			747			905			189	
Approach Delay, s/veh		31.4			38.9			41.6			41.2	
Approach LOS		C			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.8	30.8	21.0	13.1	8.5	36.1	10.2	23.8
Change Period (Y+Rc), s	4.5	5.0	4.5	5.0	4.5	5.0	4.5	5.0
Max Green Setting (Gmax), s	9.5	28.0	16.5	27.0	5.0	32.5	13.1	30.4
Max Q Clear Time (g_c+I1), s	9.6	22.5	17.0	5.6	5.2	27.1	6.5	15.8
Green Ext Time (p_c), s	0.0	3.1	0.0	0.4	0.0	1.8	0.1	2.5

Intersection Summary	
HCM 6th Ctrl Delay	36.7
HCM 6th LOS	D

HCM 6th Signalized Intersection Summary
4: Tennessee St & Lugonia Ave

06/21/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	767	404	150	443	116	301	314	264	88	85	19
Future Volume (veh/h)	81	767	404	150	443	116	301	314	264	88	85	19
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		0.98
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	1673	1772	1772	1673	1772	1772	1673	1772	1744	1673	1758	1772
Adj Flow Rate, veh/h	84	791	416	155	457	120	310	324	272	91	88	20
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	4	2	3	2
Cap, veh/h	104	1112	493	176	508	133	345	427	355	114	169	142
Arrive On Green	0.07	0.33	0.33	0.11	0.38	0.38	0.22	0.24	0.24	0.07	0.10	0.10
Sat Flow, veh/h	1594	3367	1491	1594	1351	355	1594	1772	1472	1594	1758	1478
Grp Volume(v), veh/h	84	791	416	155	0	577	310	324	272	91	88	20
Grp Sat Flow(s),veh/h/ln	1594	1683	1491	1594	0	1706	1594	1772	1472	1594	1758	1478
Q Serve(g_s), s	4.0	15.8	20.0	7.4	0.0	24.6	14.6	13.1	13.2	4.3	3.7	1.0
Cycle Q Clear(g_c), s	4.0	15.8	20.0	7.4	0.0	24.6	14.6	13.1	13.2	4.3	3.7	1.0
Prop In Lane	1.00		1.00	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	104	1112	493	176	0	641	345	427	355	114	169	142
V/C Ratio(X)	0.81	0.71	0.84	0.88	0.00	0.90	0.90	0.76	0.77	0.80	0.52	0.14
Avail Cap(c_a), veh/h	114	1224	542	176	0	687	362	727	604	267	616	518
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	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.5	22.6	23.9	33.8	0.0	22.7	29.4	27.1	27.2	35.2	33.1	31.9
Incr Delay (d2), s/veh	31.8	1.8	10.9	36.7	0.0	14.4	23.7	2.8	3.5	12.0	2.5	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	2.4	5.9	8.0	4.5	0.0	11.5	7.5	5.5	4.7	2.0	1.6	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	67.3	24.3	34.9	70.4	0.0	37.0	53.1	29.9	30.7	47.2	35.6	32.3
LnGrp LOS	E	C	C	E	A	D	D	C	C	D	D	C
Approach Vol, veh/h		1291			732			906			199	
Approach Delay, s/veh		30.5			44.1			38.1			40.6	
Approach LOS		C			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.0	30.5	21.2	12.4	9.5	33.9	10.0	23.6
Change Period (Y+Rc), s	4.5	5.0	4.5	5.0	4.5	5.0	4.5	5.0
Max Green Setting (Gmax), s	8.5	28.0	17.5	27.0	5.5	31.0	12.9	31.6
Max Q Clear Time (g_c+I1), s	9.4	22.0	16.6	5.7	6.0	26.6	6.3	15.2
Green Ext Time (p_c), s	0.0	3.3	0.1	0.4	0.0	1.5	0.1	2.6

Intersection Summary	
HCM 6th Ctrl Delay	36.5
HCM 6th LOS	D