Appendix G

Traffic Operations Analysis

Michael Baker INTERNATIONAL

February 19, 2019

Jerry Gonzalez
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City of Temecula
4100 Main Street
Temecula, CA 92590

Subject: Wabash Lane and Park & Ride Traffic Operations Analysis

Introduction

Michael Baker International (Michael Baker) has completed an evaluation of the proposed traffic signal located at Temecula Parkway and Wabash Lane. The purpose of this study was to determine the traffic signal operations and lane configuration requirements for the proposed signal as well as the queuing storage requirements for vehicles entering and exiting the project access.

The project proposes to construct a new traffic signal at the intersection of Temecula Parkway and Wabash Lane as well as adding the north leg of the intersection to provide access to the existing Park & Ride facility located east of La Paz Road and north of Temecula Parkway. In addition, the existing median on Temecula Parkway will be reconfigured to provide a left turn bay serving from eastbound Temecula Parkway onto the proposed access road. The existing median on Wabash Lane will also be reconfigured to accommodate traffic flow through the proposed signalized intersection. Once the proposed Park & Ride access road on Temecula Parkway is complete and the traffic signal is operational, the existing Park & Ride driveway on Vallejo Avenue will be closed.

A Focused Traffic Impact Analysis was completed by Michael Baker in July 2017 for the Park and Ride Site assuming access off of Vallejo Avenue. This study documents the expected distribution of traffic that uses the Park & Ride facility.

Existing Conditions

Near the project site, Temecula Parkway is a six-lane divided roadway with a raised median, trending in an east-west direction providing access to the I-15 freeway. It is functionally classified as an Urban Arterial adjacent to the project site according to the *City of Temecula General Plan Circulation Element Roadway Plan.* On street parking is prohibited and the posted speed limit near the project site is 50 MPH.

Wabash Lane is a 2-lane divided roadway providing access to approximately 140 homes south of Temecula Parkway in the California Sunset subdivision. Within the residential community, the speed limit is 25 MPH. There is currently a westbound left-turn-lane from Temecula Parkway onto Wabash Lane with approximately 250 feet of storage. For vehicles at the northbound Wabash Lane approach turning left onto westbound Temecula Parkway, a 225 feet acceleration lane is provided to facilitate the left-turn movement and allow vehicles to merge into the westbound traffic flow.

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Existing traffic counts were obtained on Tuesday, January 2018 for the morning and evening peak periods. The highest peak hour during the morning period was 7:30-8:30 AM. The highest peak hour during the evening period was 4:30-5:30 PM. **Exhibit 1** shows the existing AM/PM peak hour volumes. Detailed count data is contained in **Attachment A**.

Proposed Traffic Signal

As part of the signalization of the intersection of Temecula Parkway and Wabash Lane, the project will construct a 42-foot (curb-to-curb) access road connection to service the existing Park & Ride facility. In addition, the existing westbound acceleration lane will be converted into a eastbound left-turn-lane.

The proposed trips to be generated by the Park & Ride are not new trips to the community, but rather redirected existing traffic which consists mostly of pass-by trips. The estimated trip distribution for the current Park & Ride with access on Vallejo Avenue was redistributed to the new access location on Temecula Parkway. **Exhibit 2** shows the revised distribution and **Exhibit 3** shows the AM/PM peak hour trip assignment for the Park & Ride at the new Temecula Parkway access location at Wabash Lane.

Currently, residents of the neighborhood south of Temecula Parkway travelling toward the I-15 freeway must turn left from northbound Wabash Lane, cross 3 lanes of heavy, fast moving traffic into a refuge/acceleration lane, and then merge into westbound traffic flow on Temecula Parkway. Based on observations, many of the residents who are less aggressive drivers either turn right onto Temecula Parkway and U-turn at Pechenga Parkway, or exit the neighborhood at Cupeno Lane, U-turn at Rainbow Canyon Road, and turn left onto westbound Temecula Parkway. The proposed signal would provide these residents with a more direct and protected access to the I-15 freeway via Temecula Parkway. In order to account for this, the existing traffic volumes for the northbound right, northbound left, and westbound through movements were adjusted to reflect the expected change in driver behavior.

The Park & Ride trip assignment was layered over the modified existing volumes to determine the Existing With Park & Ride Signal AM/PM peak hour volumes. Refer to **Exhibit 4**.

Exhibit 5 shows the recommended lane configuration based on the following factors:

- Lane alignment for the northbound Wabash Lane through movement
- Lane alignment for the southbound Park & Ride access road through movement
- Conversion of westbound acceleration lane into eastbound left-turn-lane
- Minimized queuing
- Median configurations on Temecula Parkway and Wabash Lane

In order to assess the operations of the proposed signal, Synchro (v. 10) was utilized to implement HCM 6 methodology to determine the Level of Service (LOS) of the intersection. **Table 1** shows the results of the LOS analysis and queuing assessment (95th percentile) based on the volumes shown in **Exhibit 4** and the lane configurations shown in **Exhibit 5**. The analysis assumes permissive phasing for the northbound and southbound movements. Detailed analysis worksheets are contained in **Attachment B**.

As shown in **Table 1**, the proposed signalized intersection is projected to operate at acceptable levels of service during both the AM and PM peak hours. The minimum required southbound left-turn-lane storage length is based on the PM peak hour 95th percentile queue which is 66 feet.

Table 1

LOS & Queuing Summary

Existing With Park & Ride		AM	PM
Delay (seconds)		9.3	30.8
Level of Service		A	C
95th Percentile Queue (feet)	NBL	51	31
	SBL	8	66
	EBL	26	40
	WBL	38	41

Conclusion

Based on the results of the traffic operations analysis for the proposed signalization of the intersection of Wabash Lane and Temecula Parkway, Michael Baker provides the following recommendations:

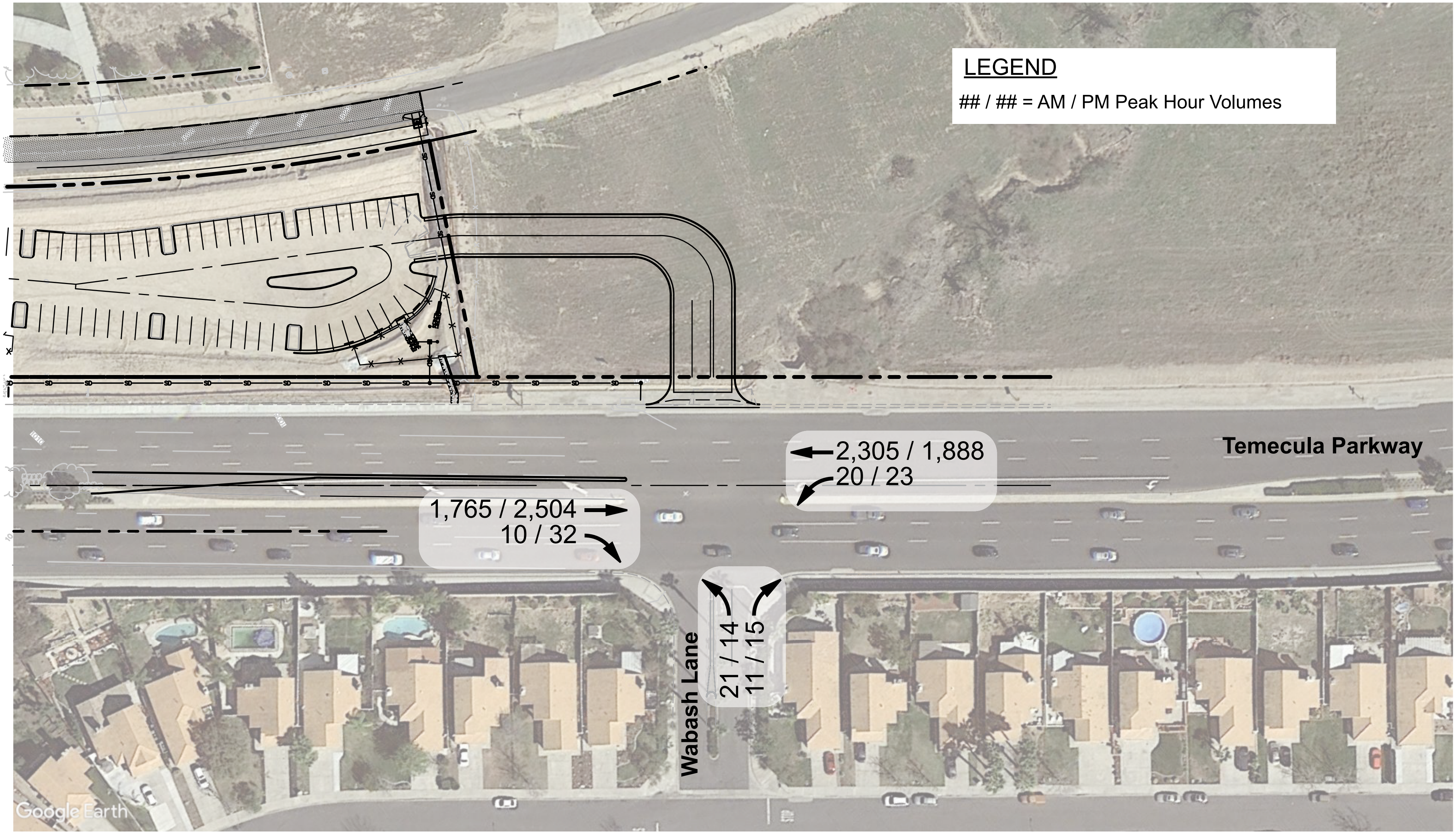
- Convert existing westbound acceleration lane to eastbound left-turn-lane (230-feet of storage)
- Construct Project Access Road (42-foot curb-to-curb width)
    - One shared through/left-turn-lane
    - One dedicated right-turn-lane
    - Minimum 66' foot southbound left-turn storage pocket)
- Wabash Lane Configuration:
    - One shared through/left-turn-lane
    - One dedicated right-turn-lane
- Permissive signal phasing for northbound & southbound movements
- Protected signal phasing for eastbound & westbound left-turn movements

If you have any questions pertaining to the analysis results summarized in this memo, please call me at (760) 603-6244.

Sincerely,

Robert A Davis

Robert Davis,
Senior Associate
Transportation Services



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Existing AM/PM Peak Hour Volumes

Exhibit 1

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Park & Ride Trip Distribution and Pass-By Assumptions

Exhibit 2

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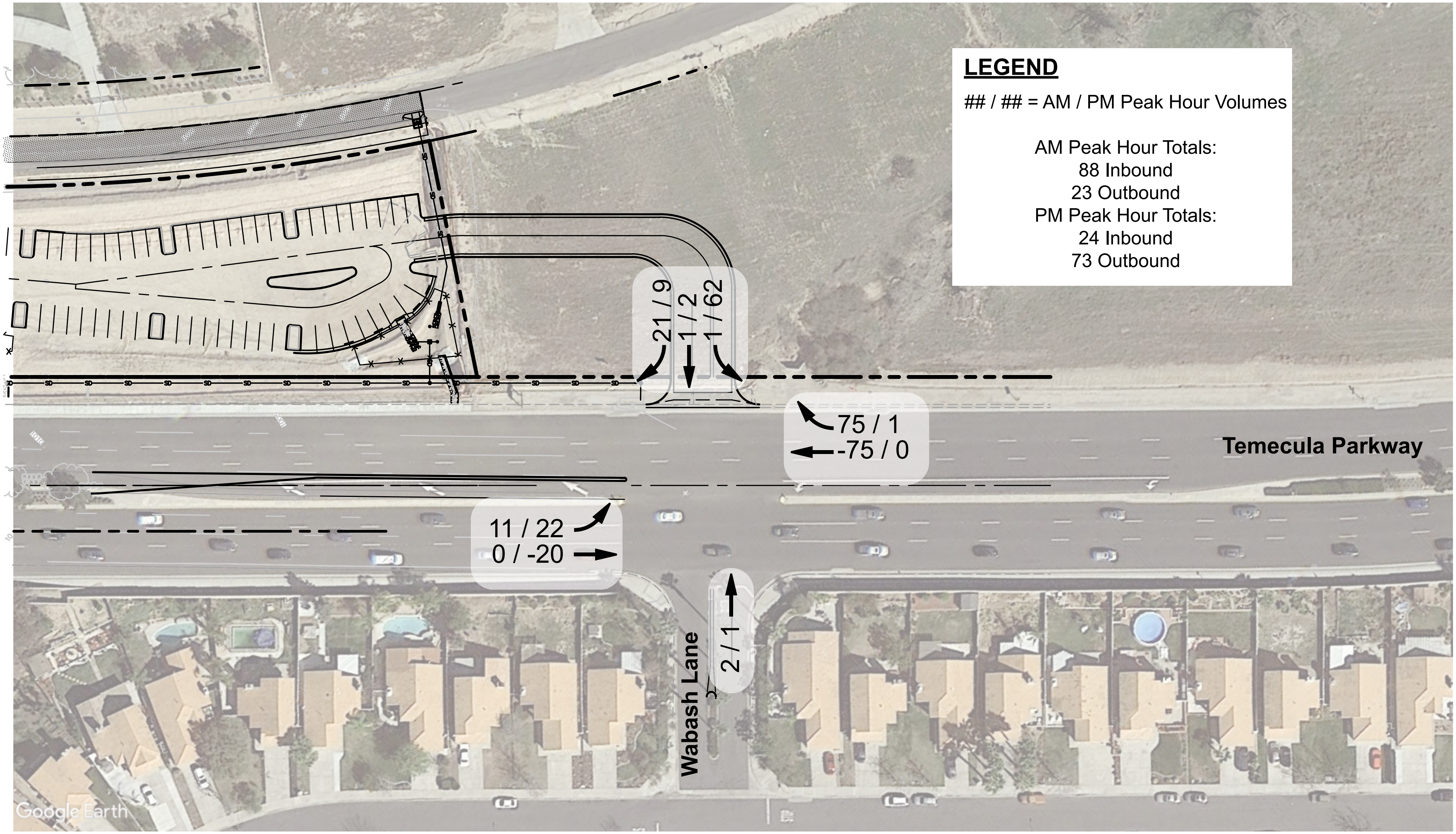

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Park & Ride AM/PM Peak Hour Trip Assignment

Exhibit 3

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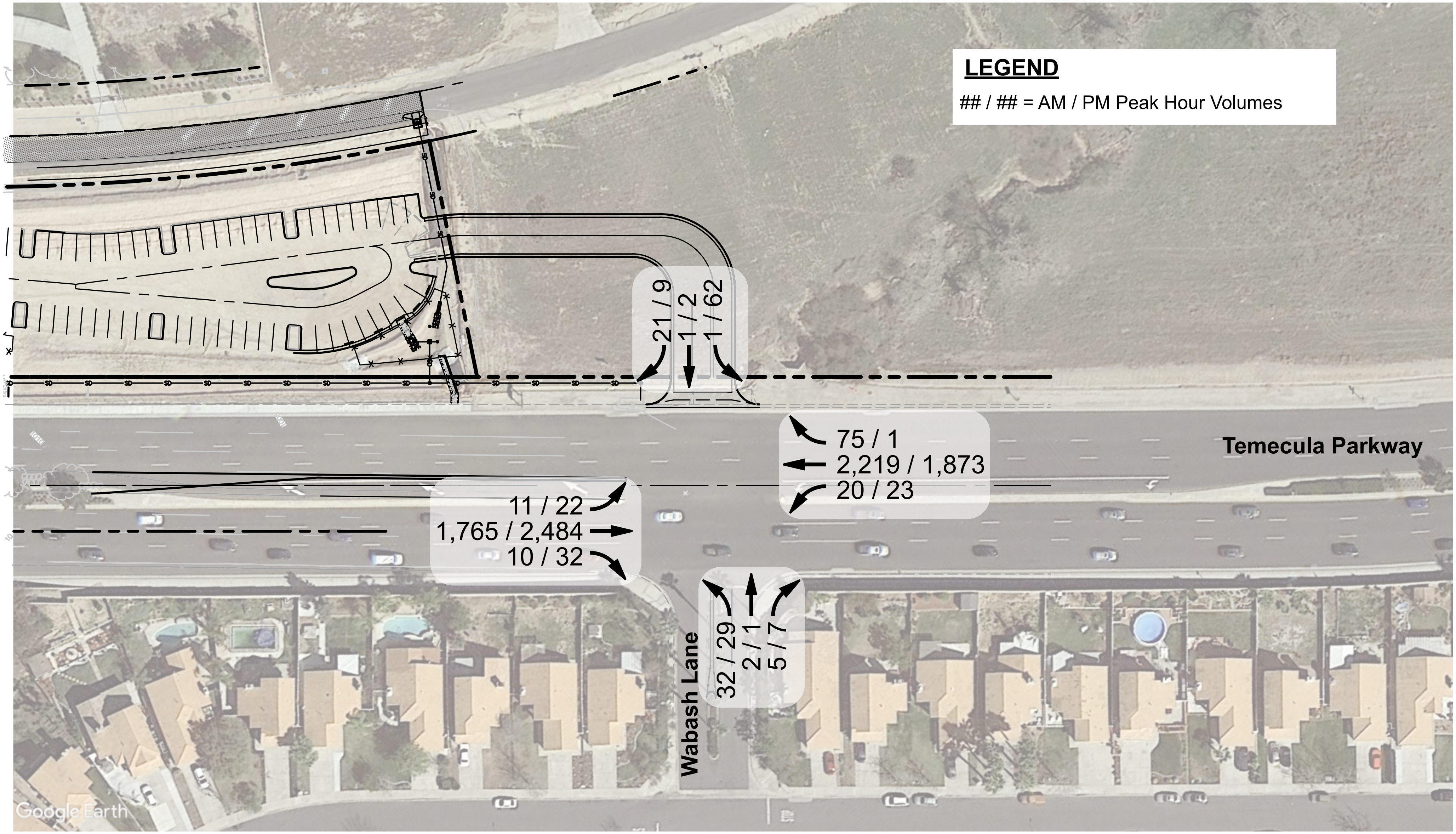

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Existing With Park & Ride AM/PM Peak Hour Volumes

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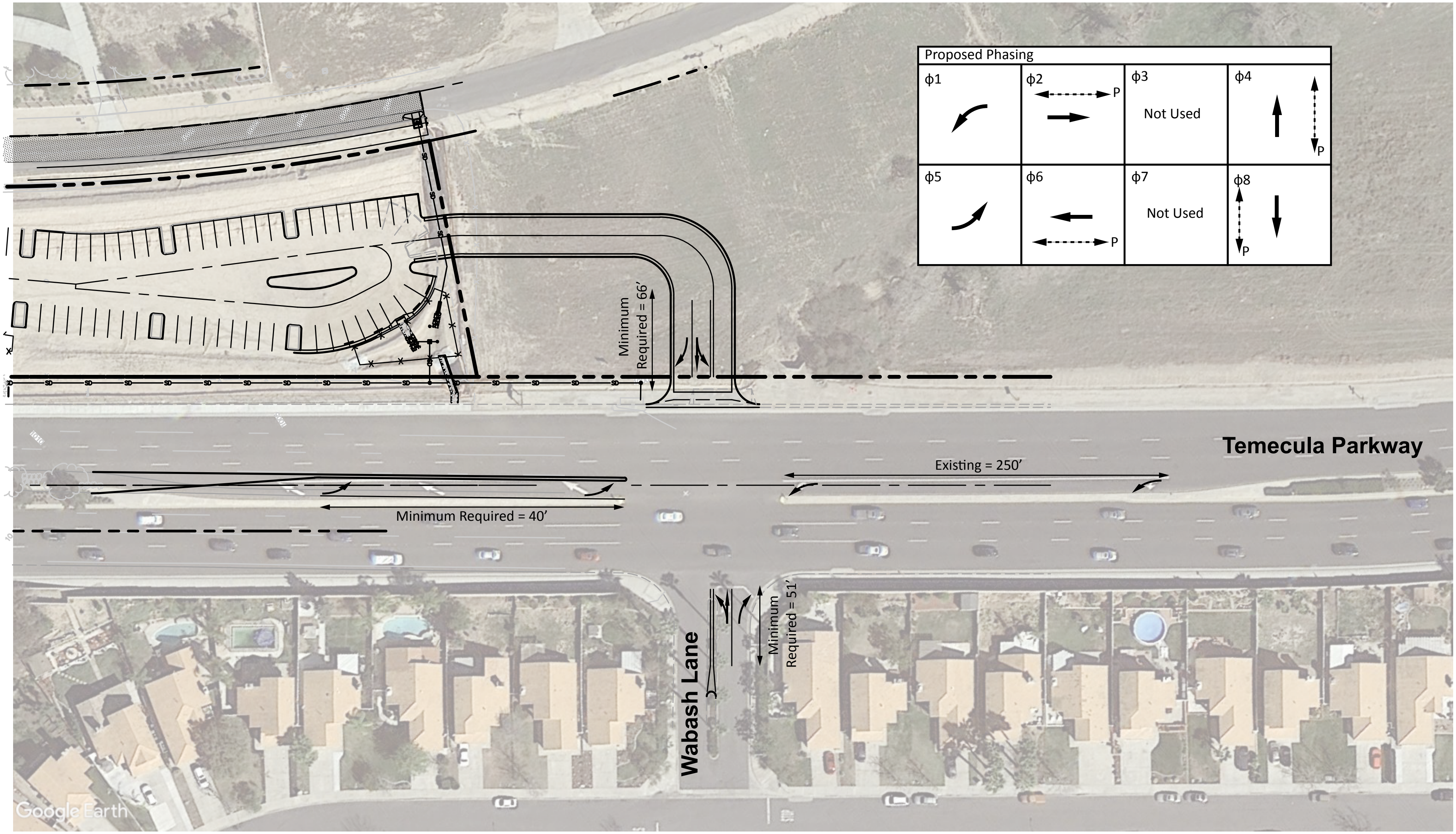
Exhibit 4



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Proposed Lane Configurations

Exhibit 5

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Attachment A

Intersection Analysis Worksheets

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	12	1898	11	22	2494	47	7	2	23
v/c Ratio	0.12	0.55	0.01	0.18	0.64	0.27	0.03	0.01	0.10
Control Delay	47.5	8.9	0.0	47.5	6.6	45.5	0.2	40.0	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.5	8.9	0.0	47.5	6.6	45.5	0.2	40.0	0.8
Queue Length 50th (ft)	7	200	0	13	186	28	0	1	0
Queue Length 95th (ft)	26	235	0	38	364	51	0	8	0
Internal Link Dist (ft)		1274			1538	528		477	
Turn Bay Length (ft)	210		60	250					110
Base Capacity (vph)	132	3457	1094	123	3897	171	241	195	241
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.55	0.01	0.18	0.64	0.27	0.03	0.01	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	1765	10	20	2219	75	32	2	5	1	1	21
Future Volume (veh/h)	11	1765	10	20	2219	75	32	2	5	1	1	21
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	1870	1870	1870	1870	1870	1870	1870	1945	1870	1870	1945	1870
Adj Flow Rate, veh/h	12	1898	11	22	2412	82	44	3	7	1	1	23
Peak Hour Factor	0.93	0.93	0.93	0.92	0.92	0.92	0.73	0.73	0.73	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	25	3472	1078	125	3758	127	70	3	174	54	38	174
Arrive On Green	0.01	0.68	0.68	0.07	0.74	0.74	0.11	0.11	0.11	0.11	0.11	0.11
Sat Flow, veh/h	1781	5106	1585	1781	5072	171	0	24	1585	0	346	1585
Grp Volume(v), veh/h	12	1898	11	22	1614	880	47	0	7	2	0	23
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1839	24	0	1585	346	0	1585
Q Serve(g_s), s	0.7	18.9	0.2	1.2	23.4	23.8	0.0	0.0	0.4	0.0	0.0	1.3
Cycle Q Clear(g_c), s	0.7	18.9	0.2	1.2	23.4	23.8	11.0	0.0	0.4	11.0	0.0	1.3
Prop In Lane	1.00		1.00	1.00		0.09	0.94		1.00	0.50		1.00
Lane Grp Cap(c), veh/h	25	3472	1078	125	2522	1363	72	0	174	92	0	174
V/C Ratio(X)	0.48	0.55	0.01	0.18	0.64	0.65	0.65	0.00	0.04	0.02	0.00	0.13
Avail Cap(c_a), veh/h	134	3472	1078	125	2522	1363	72	0	174	92	0	174
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	48.9	8.1	5.2	43.8	6.4	6.4	49.4	0.0	39.8	40.1	0.0	40.2
Incr Delay (d2), s/veh	5.1	0.6	0.0	3.1	0.6	1.2	37.3	0.0	0.4	0.4	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	5.1	0.1	0.6	5.1	5.9	1.9	0.0	0.2	0.1	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	54.0	8.8	5.2	46.9	7.0	7.7	86.7	0.0	40.2	40.5	0.0	41.8
LnGrp LOS	D	A	A	D	A	A	F	A	D	D	A	D
Approach Vol, veh/h		1921			2516			54			25	
Approach Delay, s/veh		9.0			7.6			80.7			41.6	
Approach LOS		A			A			F			D	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		15.0	11.0	74.0		15.0	4.9	80.1				
Change Period (Y+Rc), s		4.0	4.0	6.0		4.0	3.5	6.0				
Max Green Setting (Gmax), s		11.0	7.0	68.0		11.0	7.5	68.0				
Max Q Clear Time (g_c+I1), s		13.0	3.2	20.9		13.0	2.7	25.8				
Green Ext Time (p_c), s		0.0	0.0	22.1		0.0	0.0	29.3				

Intersection Summary			
HCM 6th Ctrl Delay			9.3
HCM 6th LOS			A

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	23	2561	33	24	1932	60	14	69	10
v/c Ratio	0.22	0.87	0.04	0.23	0.66	0.14	0.03	0.16	0.02
Control Delay	50.1	23.4	2.8	50.5	16.5	26.1	0.1	26.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.1	23.4	2.8	50.5	16.5	26.1	0.1	26.4	0.1
Queue Length 50th (ft)	14	426	0	15	257	27	0	32	0
Queue Length 95th (ft)	40	#699	11	41	391	31	0	66	0
Internal Link Dist (ft)		616			600	428		84	
Turn Bay Length (ft)	210		60	250					60
Base Capacity (vph)	106	2934	932	106	2934	429	524	426	524
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.87	0.04	0.23	0.66	0.14	0.03	0.16	0.02

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	2484	32	23	1873	1	29	1	7	62	2	9
Future Volume (veh/h)	22	2484	32	23	1873	1	29	1	7	62	2	9
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	23	2561	33	24	1931	1	58	2	14	67	2	10
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.50	0.50	0.50	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	42	2653	823	43	2742	1	71	1	549	71	1	549
Arrive On Green	0.02	0.52	0.52	0.02	0.52	0.52	0.35	0.35	0.35	0.35	0.35	0.35
Sat Flow, veh/h	1781	5106	1585	1781	5271	3	0	4	1585	0	3	1585
Grp Volume(v), veh/h	23	2561	33	24	1247	685	60	0	14	69	0	10
Grp Sat Flow(s),veh/h/ln	1781	1702	1585	1781	1702	1870	4	0	1585	3	0	1585
Q Serve(g_s), s	1.3	48.3	1.0	1.3	27.7	27.7	0.0	0.0	0.6	0.0	0.0	0.4
Cycle Q Clear(g_c), s	1.3	48.3	1.0	1.3	27.7	27.7	34.6	0.0	0.6	34.6	0.0	0.4
Prop In Lane	1.00		1.00	1.00		0.00	0.97		1.00	0.97		1.00
Lane Grp Cap(c), veh/h	42	2653	823	43	1771	973	72	0	549	72	0	549
V/C Ratio(X)	0.55	0.97	0.04	0.55	0.70	0.70	0.83	0.00	0.03	0.96	0.00	0.02
Avail Cap(c_a), veh/h	107	2655	824	107	1771	973	72	0	549	72	0	549
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	48.3	23.2	11.8	48.2	18.2	18.2	49.3	0.0	21.6	49.4	0.0	21.5
Incr Delay (d2), s/veh	10.6	10.6	0.0	10.6	1.3	2.3	66.1	0.0	0.1	94.6	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	0.7	20.5	0.4	0.7	10.6	11.9	2.8	0.0	0.2	3.6	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.9	33.8	11.8	58.8	19.4	20.5	115.3	0.0	21.7	144.0	0.0	21.6
LnGrp LOS	E	C	B	E	B	C	F	A	C	F	A	C
Approach Vol, veh/h		2617			1956			74			79	
Approach Delay, s/veh		33.7			20.3			97.6			128.5	
Approach LOS		C			C			F			F	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		38.1	5.9	56.0		38.1	5.9	56.0				
Change Period (Y+Rc), s		3.5	3.5	4.0		3.5	3.5	4.0				
Max Green Setting (Gmax), s		31.0	6.0	52.0		31.0	6.0	52.0				
Max Q Clear Time (g_c+I1), s		36.6	3.3	50.3		36.6	3.3	29.7				
Green Ext Time (p_c), s		0.0	0.0	1.6		0.0	0.0	15.0				
Intersection Summary												
HCM 6th Ctrl Delay			30.8									
HCM 6th LOS			C									