



## TECHNICAL MEMORANDUM

**Date:** September 22, 2023  
**To:** Brad Taylor, PE, TE City of Lathrop  
**CC:** Sean Asmus Hodgdon Group Realty, Inc.  
**From:** Renee Reavis, EIT TJKM  
 Steven Matthew Dauterman, PTOE, RSP<sub>1</sub> TJKM  
**Subject:** **Ashely Furniture – Lathrop Road Supplemental Analysis**

The purpose of this memorandum is to provide a brief supplemental analysis of the Lathrop Road & I-5 Ramp intersections. The *Ashley Furniture Traffic Impact Analysis Report* (TIA), dated August 9, 2023, utilized estimated 2022 Baseline conditions as the basis for identifying potential improvement measures to address increases in vehicular delay above City thresholds in conjunction with additional trips generated by the Ashley Furniture project. The 2022 Baseline Conditions were based on 2018 traffic volumes plus estimated background growth by the year 2022, which was initially the projected opening year of the project. The TIA determined that widening of the northbound ramp and retiming of the southbound ramp intersection would be required to mitigate project impacts. To verify whether this was the case under 2023 Conditions as discussed in a meeting with City staff, new traffic counts at the ramp intersections were collected on August 31, 2023. (The new traffic counts included peak hour factors, pedestrians and bicycles, and heavy vehicles.) Additionally, the intersections surrounding the Lathrop Road/I-5 interchange were recently retimed and coordinated, and this analysis utilizes these new timings.

Under 2023 Existing Conditions with new signal timings, the ramp intersections both operate at LOS D or better during both peak hours. With the addition of project traffic, both intersections continue to operate at LOS D or better, within jurisdictional standards for the City of Lathrop. **Table 1** summarizes these results. Based on these findings, it is determined that **improvements are no longer required** at either ramp intersection to mitigate project impacts.

Table 1 – Level of Service Results

Intersection Name	Peak Hour	2023 Existing Conditions		2023 Existing Plus Project Conditions		Change in Delay
		Delay	LOS	Delay	LOS	
I-5 NB Ramps & Lathrop Rd	AM	14.4	B	18.6	B	4.2
	PM	37.5	D	45.6	D	8.1
I-5 SB Ramps & Lathrop Rd	AM	32.0	C	34.2	C	2.2
	PM	37.4	D	39.5	D	2.1

In addition to the level of service analysis, the Synchro model was utilized for a SimTraffic analysis to identify potential queuing impacts at the northbound and southbound ramps under 2023 Existing plus Project conditions. Based on ten one-hour simulation runs, queuing on both ramps would be fully contained within the available storage and would not affect the freeway mainline. **Table 2** summarizes these results

**Table 2 – Queuing Results**

Intersection	Dir.	Lane Group	Peak	Storage	2023 plus Project	Required Storage
Lathrop Rd. & I-5 NB Ramps	NB	LTR	AM	1600	402	405
			PM		984	985
Lathrop Road/I-5 SB Ramps	SB	LTR	AM	1525	477	780
			PM		707	710

## Appendix

Level of Service Worksheets

Simulation Queueing Worksheets

HCM 6th Signalized Intersection Summary  
 3: I-5 NB Off Ramp/I-5 NB On Ramp & Lathrop Road

Existing Conditions  
 Timing Plan: A.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑			↑↑			↕				
Traffic Volume (veh/h)	133	821	0	0	852	280	84	2	214	0	0	0
Future Volume (veh/h)	133	821	0	0	852	280	84	2	214	0	0	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		0.95	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			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1811	1841	0	0	1870	1870	1767	1767	1767			
Adj Flow Rate, veh/h	141	873	0	0	906	298	89	2	228			
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94			
Percent Heavy Veh, %	6	4	0	0	2	2	9	9	9			
Cap, veh/h	162	2424	0	0	1471	482	96	2	245			
Arrive On Green	0.19	1.00	0.00	0.00	1.00	1.00	0.22	0.22	0.22			
Sat Flow, veh/h	1725	3589	0	0	2682	848	428	10	1097			
Grp Volume(v), veh/h	141	873	0	0	621	583	319	0	0			
Grp Sat Flow(s),veh/h/ln	1725	1749	0	0	1777	1660	1535	0	0			
Q Serve(g_s), s	10.3	0.0	0.0	0.0	0.0	0.0	26.5	0.0	0.0			
Cycle Q Clear(g_c), s	10.3	0.0	0.0	0.0	0.0	0.0	26.5	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		0.51	0.28		0.71			
Lane Grp Cap(c), veh/h	162	2424	0	0	1010	943	342	0	0			
V/C Ratio(X)	0.87	0.36	0.00	0.00	0.61	0.62	0.93	0.00	0.00			
Avail Cap(c_a), veh/h	172	2424	0	0	1010	943	463	0	0			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00			
Upstream Filter(I)	0.84	0.84	0.00	0.00	0.88	0.88	1.00	0.00	0.00			
Uniform Delay (d), s/veh	52.0	0.0	0.0	0.0	0.0	0.0	49.5	0.0	0.0			
Incr Delay (d2), s/veh	27.7	0.4	0.0	0.0	2.5	2.7	18.9	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.3	0.1	0.0	0.0	0.7	0.7	11.7	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	79.7	0.4	0.0	0.0	2.5	2.7	68.5	0.0	0.0			
LnGrp LOS	E	A	A	A	A	A	E	A	A			
Approach Vol, veh/h		1014			1204			319				
Approach Delay, s/veh		11.4			2.6			68.5				
Approach LOS		B			A			E				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		95.2			16.2	79.0		34.8				
Change Period (Y+Rc), s		5.1			4.0	5.1		5.8				
Max Green Setting (Gmax), s		79.9			13.0	62.9		39.2				
Max Q Clear Time (g_c+I1), s		2.0			12.3	2.0		28.5				
Green Ext Time (p_c), s		6.8			0.0	10.1		0.5				
<b>Intersection Summary</b>												
HCM 6th Ctrl Delay					14.4							
HCM 6th LOS					B							

HCM 6th Signalized Intersection Summary  
 4: I-5 SB On Ramp/I-5 SB Off Ramp & Spartan Way/Lathrop Road

Existing Conditions  
 Timing Plan: A.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑		↖	↑						↕	
Traffic Volume (veh/h)	0	703	87	290	646	0	0	0	0	247	3	115
Future Volume (veh/h)	0	703	87	290	646	0	0	0	0	247	3	115
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1856	1856	1841	1870	0				1796	1796	1796
Adj Flow Rate, veh/h	0	764	95	315	702	0				268	3	125
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3	4	2	0				7	7	7
Cap, veh/h	0	1153	142	654	1244	0				286	3	133
Arrive On Green	0.00	0.25	0.25	0.75	1.00	0.00				0.26	0.26	0.26
Sat Flow, veh/h	0	4722	562	1753	1870	0				1115	12	520
Grp Volume(v), veh/h	0	565	294	315	702	0				396	0	0
Grp Sat Flow(s),veh/h/ln	0	1689	1740	1753	1870	0				1647	0	0
Q Serve(g_s), s	0.0	19.5	19.8	9.3	0.0	0.0				30.6	0.0	0.0
Cycle Q Clear(g_c), s	0.0	19.5	19.8	9.3	0.0	0.0				30.6	0.0	0.0
Prop In Lane	0.00		0.32	1.00		0.00				0.68		0.32
Lane Grp Cap(c), veh/h	0	855	440	654	1244	0				422	0	0
V/C Ratio(X)	0.00	0.66	0.67	0.48	0.56	0.00				0.94	0.00	0.00
Avail Cap(c_a), veh/h	0	855	440	654	1244	0				556	0	0
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.75	0.75	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	43.5	43.6	11.5	0.0	0.0				47.3	0.0	0.0
Incr Delay (d2), s/veh	0.0	4.0	7.8	0.2	1.4	0.0				18.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.6	9.4	2.7	0.5	0.0				14.5	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	47.5	51.5	11.7	1.4	0.0				65.6	0.0	0.0
LnGrp LOS	A	D	D	B	A	A				E	A	A
Approach Vol, veh/h		859			1017						396	
Approach Delay, s/veh		48.9			4.6						65.6	
Approach LOS		D			A						E	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	53.6	38.0		38.4		91.6						
Change Period (Y+Rc), s	5.1	* 5.1		5.1		5.1						
Max Green Setting (Gmax), s	39.0	* 33		43.9		75.9						
Max Q Clear Time (g_c+I1), s	11.3	21.8		32.6		2.0						
Green Ext Time (p_c), s	0.1	3.9		0.7		5.2						

Intersection Summary

HCM 6th Ctrl Delay	32.0
HCM 6th LOS	C

Notes

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

HCM 6th Signalized Intersection Summary  
 3: I-5 NB Off Ramp/I-5 NB On Ramp & Lathrop Road

Existing Conditions  
 Timing Plan: P.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	771	0	0	718	248	110	6	543	0	0	0
Future Volume (veh/h)	46	771	0	0	718	248	110	6	543	0	0	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		0.97	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870	1870	1870	1870			
Adj Flow Rate, veh/h	48	803	0	0	748	258	115	6	566			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	126	1945	0	0	1156	399	102	5	503			
Arrive On Green	0.14	1.00	0.00	0.00	0.90	0.90	0.38	0.38	0.38			
Sat Flow, veh/h	1781	3647	0	0	2666	887	270	14	1330			
Grp Volume(v), veh/h	48	803	0	0	517	489	687	0	0			
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1682	1614	0	0			
Q Serve(g_s), s	3.6	0.0	0.0	0.0	10.3	10.3	55.2	0.0	0.0			
Cycle Q Clear(g_c), s	3.6	0.0	0.0	0.0	10.3	10.3	55.2	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		0.53	0.17		0.82			
Lane Grp Cap(c), veh/h	126	1945	0	0	799	756	610	0	0			
V/C Ratio(X)	0.38	0.41	0.00	0.00	0.65	0.65	1.13	0.00	0.00			
Avail Cap(c_a), veh/h	207	1945	0	0	799	756	610	0	0			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00			
Upstream Filter(I)	0.95	0.95	0.00	0.00	0.92	0.92	1.00	0.00	0.00			
Uniform Delay (d), s/veh	59.8	0.0	0.0	0.0	4.6	4.6	45.4	0.0	0.0			
Incr Delay (d2), s/veh	0.7	0.6	0.0	0.0	3.7	3.9	76.3	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.6	0.2	0.0	0.0	2.8	2.6	34.2	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	60.5	0.6	0.0	0.0	8.3	8.5	121.7	0.0	0.0			
LnGrp LOS	E	A	A	A	A	A	F	A	A			
Approach Vol, veh/h		851			1006			687				
Approach Delay, s/veh		4.0			8.4			121.7				
Approach LOS		A			A			F				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		85.0			14.3	70.7		61.0				
Change Period (Y+Rc), s		5.1			4.0	5.1		5.8				
Max Green Setting (Gmax), s		79.9			17.0	58.9		55.2				
Max Q Clear Time (g_c+I1), s		2.0			5.6	12.3		57.2				
Green Ext Time (p_c), s		6.0			0.0	7.4		0.0				
<b>Intersection Summary</b>												
HCM 6th Ctrl Delay					37.5							
HCM 6th LOS					D							

HCM 6th Signalized Intersection Summary  
 4: I-5 SB On Ramp/I-5 SB Off Ramp & Spartan Way/Lathrop Road

Existing Conditions  
 Timing Plan: P.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑		↖	↑						↕	
Traffic Volume (veh/h)	0	392	60	237	591	0	0	0	0	419	8	155
Future Volume (veh/h)	0	392	60	237	591	0	0	0	0	419	8	155
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1885	1885	1856	1870	0				1856	1856	1856
Adj Flow Rate, veh/h	0	426	65	258	642	0				455	9	168
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	1	1	3	2	0				3	3	3
Cap, veh/h	0	1170	174	449	1026	0				470	9	174
Arrive On Green	0.00	0.26	0.26	0.51	1.00	0.00				0.38	0.38	0.38
Sat Flow, veh/h	0	4677	671	1767	1870	0				1233	24	455
Grp Volume(v), veh/h	0	322	169	258	642	0				632	0	0
Grp Sat Flow(s),veh/h/ln	0	1716	1747	1767	1870	0				1712	0	0
Q Serve(g_s), s	0.0	11.2	11.6	14.8	0.0	0.0				52.8	0.0	0.0
Cycle Q Clear(g_c), s	0.0	11.2	11.6	14.8	0.0	0.0				52.8	0.0	0.0
Prop In Lane	0.00		0.38	1.00		0.00				0.72		0.27
Lane Grp Cap(c), veh/h	0	891	454	449	1026	0				653	0	0
V/C Ratio(X)	0.00	0.36	0.37	0.57	0.63	0.00				0.97	0.00	0.00
Avail Cap(c_a), veh/h	0	891	454	449	1026	0				702	0	0
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.74	0.74	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	44.2	44.3	30.4	0.0	0.0				44.3	0.0	0.0
Incr Delay (d2), s/veh	0.0	1.1	2.3	0.9	2.1	0.0				24.8	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
%ile BackOfQ(50%),veh/ln	0.0	4.9	5.3	5.2	0.6	0.0				26.5	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	45.3	46.7	31.3	2.1	0.0				69.1	0.0	0.0
LnGrp LOS	A	D	D	C	A	A				E	A	A
Approach Vol, veh/h		491			900						632	
Approach Delay, s/veh		45.8			10.5						69.1	
Approach LOS		D			B						E	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	42.2	43.0		60.8		85.2						
Change Period (Y+Rc), s	5.1	* 5.1		5.1		5.1						
Max Green Setting (Gmax), s	34.0	* 38		59.9		75.9						
Max Q Clear Time (g_c+I1), s	16.8	13.6		54.8		2.0						
Green Ext Time (p_c), s	0.1	2.9		0.9		4.5						

Intersection Summary

HCM 6th Ctrl Delay	37.4
HCM 6th LOS	D

Notes

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

# HCM 6th Signalized Intersection Summary

## 3: I-5 NB Off Ramp/I-5 NB On Ramp & Lathrop Road

Existing Plus Project Conditions  
Timing Plan: A.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	161	829	0	0	864	280	127	2	214	0	0	0
Future Volume (veh/h)	161	829	0	0	864	280	127	2	214	0	0	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		0.94	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			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1811	1841	0	0	1870	1870	1767	1767	1767			
Adj Flow Rate, veh/h	171	882	0	0	919	298	135	2	228			
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94			
Percent Heavy Veh, %	6	4	0	0	2	2	9	9	9			
Cap, veh/h	172	2331	0	0	1392	449	143	2	242			
Arrive On Green	0.20	1.00	0.00	0.00	1.00	1.00	0.25	0.25	0.25			
Sat Flow, veh/h	1725	3589	0	0	2692	838	575	9	970			
Grp Volume(v), veh/h	171	882	0	0	627	590	365	0	0			
Grp Sat Flow(s),veh/h/ln	1725	1749	0	0	1777	1660	1554	0	0			
Q Serve(g_s), s	12.9	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0			
Cycle Q Clear(g_c), s	12.9	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		0.51	0.37		0.62			
Lane Grp Cap(c), veh/h	172	2331	0	0	952	889	388	0	0			
V/C Ratio(X)	0.99	0.38	0.00	0.00	0.66	0.66	0.94	0.00	0.00			
Avail Cap(c_a), veh/h	172	2331	0	0	952	889	468	0	0			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00			
Upstream Filter(I)	0.76	0.76	0.00	0.00	0.87	0.87	1.00	0.00	0.00			
Uniform Delay (d), s/veh	51.9	0.0	0.0	0.0	0.0	0.0	47.8	0.0	0.0			
Incr Delay (d2), s/veh	57.1	0.4	0.0	0.0	3.1	3.4	23.4	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	7.6	0.1	0.0	0.0	0.8	0.8	13.7	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	109.1	0.4	0.0	0.0	3.1	3.4	71.3	0.0	0.0			
LnGrp LOS	F	A	A	A	A	A	E	A	A			
Approach Vol, veh/h		1053			1217			365				
Approach Delay, s/veh		18.0			3.2			71.3				
Approach LOS		B			A			E				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		91.8			17.0	74.8		38.2				
Change Period (Y+Rc), s		5.1			4.0	5.1		5.8				
Max Green Setting (Gmax), s		79.9			13.0	62.9		39.2				
Max Q Clear Time (g_c+I1), s		2.0			14.9	2.0		32.0				
Green Ext Time (p_c), s		6.9			0.0	10.3		0.5				
<b>Intersection Summary</b>												
HCM 6th Ctrl Delay					18.6							
HCM 6th LOS					B							



HCM 6th Signalized Intersection Summary

Existing Plus Project Conditions

4: I-5 SB On Ramp/I-5 SB Off Ramp & Spartan Way/Lathrop Road

Timing Plan: A.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑		↖	↑						↕	
Traffic Volume (veh/h)	0	739	114	290	701	0	0	0	0	247	3	158
Future Volume (veh/h)	0	739	114	290	701	0	0	0	0	247	3	158
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1856	1856	1841	1870	0				1796	1796	1796
Adj Flow Rate, veh/h	0	803	124	315	762	0				268	3	172
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3	4	2	0				7	7	7
Cap, veh/h	0	1118	171	601	1188	0				283	3	182
Arrive On Green	0.00	0.25	0.25	0.69	1.00	0.00				0.29	0.29	0.29
Sat Flow, veh/h	0	4583	677	1753	1870	0				988	11	634
Grp Volume(v), veh/h	0	613	314	315	762	0				443	0	0
Grp Sat Flow(s),veh/h/ln	0	1689	1716	1753	1870	0				1633	0	0
Q Serve(g_s), s	0.0	21.5	21.8	11.5	0.0	0.0				34.5	0.0	0.0
Cycle Q Clear(g_c), s	0.0	21.5	21.8	11.5	0.0	0.0				34.5	0.0	0.0
Prop In Lane	0.00		0.39	1.00		0.00				0.60		0.39
Lane Grp Cap(c), veh/h	0	855	434	601	1188	0				468	0	0
V/C Ratio(X)	0.00	0.72	0.72	0.52	0.64	0.00				0.95	0.00	0.00
Avail Cap(c_a), veh/h	0	855	434	601	1188	0				551	0	0
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.67	0.67	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	44.3	44.4	15.2	0.0	0.0				45.4	0.0	0.0
Incr Delay (d2), s/veh	0.0	5.1	10.1	0.3	1.8	0.0				22.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	9.5	10.4	3.4	0.6	0.0				16.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	49.4	54.5	15.5	1.8	0.0				68.0	0.0	0.0
LnGrp LOS	A	D	D	B	A	A				E	A	A
Approach Vol, veh/h		927			1077						443	
Approach Delay, s/veh		51.1			5.8						68.0	
Approach LOS		D			A						E	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	49.7	38.0		42.3		87.7						
Change Period (Y+Rc), s	5.1	* 5.1		5.1		5.1						
Max Green Setting (Gmax), s	39.0	* 33		43.9		75.9						
Max Q Clear Time (g_c+I1), s	13.5	23.8		36.5		2.0						
Green Ext Time (p_c), s	0.1	3.7		0.7		5.9						

Intersection Summary

HCM 6th Ctrl Delay	34.2
HCM 6th LOS	C

Notes

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

HCM 6th Signalized Intersection Summary  
 3: I-5 NB Off Ramp/I-5 NB On Ramp & Lathrop Road

Existing Plus Project Conditions

Timing Plan: P.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↑↑			↑↑			↕				
Traffic Volume (veh/h)	97	786	0	0	729	248	148	6	543	0	0	0
Future Volume (veh/h)	97	786	0	0	729	248	148	6	543	0	0	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		0.97	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1870	1870	1870	1870	1870			
Adj Flow Rate, veh/h	101	819	0	0	759	258	154	6	566			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	144	1945	0	0	1134	385	130	5	478			
Arrive On Green	0.16	1.00	0.00	0.00	0.88	0.88	0.38	0.38	0.38			
Sat Flow, veh/h	1781	3647	0	0	2677	878	344	13	1265			
Grp Volume(v), veh/h	101	819	0	0	522	495	726	0	0			
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1777	1684	1622	0	0			
Q Serve(g_s), s	7.8	0.0	0.0	0.0	12.7	12.7	55.2	0.0	0.0			
Cycle Q Clear(g_c), s	7.8	0.0	0.0	0.0	12.7	12.7	55.2	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		0.52	0.21		0.78			
Lane Grp Cap(c), veh/h	144	1945	0	0	780	739	613	0	0			
V/C Ratio(X)	0.70	0.42	0.00	0.00	0.67	0.67	1.18	0.00	0.00			
Avail Cap(c_a), veh/h	207	1945	0	0	780	739	613	0	0			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00			
Upstream Filter(I)	0.89	0.89	0.00	0.00	0.92	0.92	1.00	0.00	0.00			
Uniform Delay (d), s/veh	59.5	0.0	0.0	0.0	5.8	5.8	45.4	0.0	0.0			
Incr Delay (d2), s/veh	2.1	0.6	0.0	0.0	4.2	4.4	98.6	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	3.4	0.2	0.0	0.0	3.3	3.2	38.2	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	61.6	0.6	0.0	0.0	9.9	10.2	144.0	0.0	0.0			
LnGrp LOS	E	A	A	A	A	B	F	A	A			
Approach Vol, veh/h		920			1017			726				
Approach Delay, s/veh		7.3			10.1			144.0				
Approach LOS		A			B			F				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		85.0			15.8	69.2		61.0				
Change Period (Y+Rc), s		5.1			4.0	5.1		5.8				
Max Green Setting (Gmax), s		79.9			17.0	58.9		55.2				
Max Q Clear Time (g_c+I1), s		2.0			9.8	14.7		57.2				
Green Ext Time (p_c), s		6.2			0.0	7.5		0.0				
<b>Intersection Summary</b>												
HCM 6th Ctrl Delay					45.6							
HCM 6th LOS					D							

HCM 6th Signalized Intersection Summary

Existing Plus Project Conditions

4: I-5 SB On Ramp/I-5 SB Off Ramp & Spartan Way/Lathrop Road

Timing Plan: P.M. Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑		↖	↑						↕	
Traffic Volume (veh/h)	0	458	110	237	640	0	0	0	0	419	8	193
Future Volume (veh/h)	0	458	110	237	640	0	0	0	0	419	8	193
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1885	1885	1856	1870	0				1856	1856	1856
Adj Flow Rate, veh/h	0	498	120	258	696	0				455	9	210
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	1	1	3	2	0				3	3	3
Cap, veh/h	0	1076	252	407	982	0				466	9	215
Arrive On Green	0.00	0.26	0.26	0.46	1.00	0.00				0.41	0.41	0.41
Sat Flow, veh/h	0	4316	970	1767	1870	0				1149	23	530
Grp Volume(v), veh/h	0	409	209	258	696	0				674	0	0
Grp Sat Flow(s),veh/h/ln	0	1716	1686	1767	1870	0				1703	0	0
Q Serve(g_s), s	0.0	14.7	15.3	16.2	0.0	0.0				56.9	0.0	0.0
Cycle Q Clear(g_c), s	0.0	14.7	15.3	16.2	0.0	0.0				56.9	0.0	0.0
Prop In Lane	0.00		0.58	1.00		0.00				0.68		0.31
Lane Grp Cap(c), veh/h	0	891	438	407	982	0				690	0	0
V/C Ratio(X)	0.00	0.46	0.48	0.63	0.71	0.00				0.98	0.00	0.00
Avail Cap(c_a), veh/h	0	891	438	412	982	0				699	0	0
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.66	0.66	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	45.4	45.7	34.7	0.0	0.0				42.8	0.0	0.0
Incr Delay (d2), s/veh	0.0	1.7	3.7	1.6	2.9	0.0				28.0	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
%ile BackOfQ(50%),veh/ln	0.0	6.5	6.8	5.9	0.8	0.0				28.8	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	47.2	49.4	36.2	2.9	0.0				70.7	0.0	0.0
LnGrp LOS	A	D	D	D	A	A				E	A	A
Approach Vol, veh/h		618			954						674	
Approach Delay, s/veh		47.9			11.9						70.7	
Approach LOS		D			B						E	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	38.7	43.0		64.3		81.7						
Change Period (Y+Rc), s	5.1	* 5.1		5.1		5.1						
Max Green Setting (Gmax), s	34.0	* 38		59.9		75.9						
Max Q Clear Time (g_c+I1), s	18.2	17.3		58.9		2.0						
Green Ext Time (p_c), s	0.1	3.6		0.3		5.1						

Intersection Summary

HCM 6th Ctrl Delay	39.5
HCM 6th LOS	D

Notes

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

Intersection: 3: I-5 NB Off Ramp/I-5 NB On Ramp & Lathrop Road

Movement	EB	EB	EB	WB	WB	NB
Directions Served	L	T	T	T	TR	LTR
Maximum Queue (ft)	294	56	26	559	558	427
Average Queue (ft)	151	4	2	365	458	250
95th Queue (ft)	257	25	14	643	666	402
Link Distance (ft)	502	502	502	531	531	1653
Upstream Blk Time (%)				2	8	
Queuing Penalty (veh)				7	37	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: I-5 SB On Ramp/I-5 SB Off Ramp & Spartan Way/Lathrop Road

Movement	EB	EB	EB	B12	B12	B12	WB	WB	SB
Directions Served	T	T	TR	T	T	T	L	T	LTR
Maximum Queue (ft)	249	268	253	74	126	55	348	290	549
Average Queue (ft)	123	207	172	4	19	4	203	87	297
95th Queue (ft)	230	286	247	41	82	35	320	209	477
Link Distance (ft)	182	182	182	1011	1011	1011	502	502	901
Upstream Blk Time (%)	4	17	8						
Queuing Penalty (veh)	0	0	0						
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Zone Summary

Zone wide Queuing Penalty: 44

Intersection: 3: I-5 NB Off Ramp/I-5 NB On Ramp & Lathrop Road

Movement	EB	EB	EB	WB	WB	NB
Directions Served	L	T	T	T	TR	LTR
Maximum Queue (ft)	135	143	139	409	465	854
Average Queue (ft)	89	102	97	225	385	623
95th Queue (ft)	159	163	166	481	546	984
Link Distance (ft)	499	499	499	531	531	1728
Upstream Blk Time (%)				0	0	
Queuing Penalty (veh)				0	1	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: I-5 SB On Ramp/I-5 SB Off Ramp & Spartan Way/Lathrop Road

Movement	EB	EB	EB	B12	B12	WB	WB	SB
Directions Served	T	T	TR	T	T	L	T	LTR
Maximum Queue (ft)	101	220	193	15	3	208	187	580
Average Queue (ft)	45	164	153	3	1	140	117	475
95th Queue (ft)	121	237	211	25	7	247	209	707
Link Distance (ft)	182	182	182	1011	1011	499	499	901
Upstream Blk Time (%)		7	3					1
Queuing Penalty (veh)		0	0					0
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 2
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