APPENDIX IV

Alternative 2 LOS Worksheets

This page intentionally left blank.

Appendix A

Intersection Analysis

Appendix A Includes:

A1. Year 2020 Alternative 2 Intersection LOS Worksheets

A2. Year 2040 Alternative 2 Intersection LOS Worksheets

This page intentionally left blank.

Appendix A1

Year 2020 Alternative 2
Intersection Level of Service (LOS) Worksheets

This page intentionally left blank.

Queues
1: Carson St & I-605 SB Off Ramps

11/30/2012

Lane Group	EBT	WBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	1337	1409	76	722	436	353
v/c Ratio	0.55	0.72	0.05	0.41	0.28	0.47
Control Delay	24.4	18.9	0.1	16.5	14.7	18.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.4	18.9	0.1	16.5	14.7	18.6
Queue Length 50th (ft)	186	216	0	141	81	148
Queue Length 95th (ft)	204	226	0	203	126	256
Internal Link Dist (ft)	550	190			1136	
Turn Bay Length (ft)				300		300
Base Capacity (vph)	2750	2192	1611	1767	1539	748
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.64	0.05	0.41	0.28	0.47

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1207	63	0	1339	0	0	0	72	686	79	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9				4.0	5.4	5.4	5.4
Lane Util. Factor		0.86			0.91				1.00	0.97	0.91	0.91
Frt		0.99			1.00				0.86	1.00	0.88	0.85
Flt Protected		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (prot)		6360			5085				1611	3433	2978	1441
Flt Permitted		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (perm)		6360			5085				1611	3433	2978	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1271	66	0	1409	0	0	0	76	722	83	706
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	0	0	6	6
Lane Group Flow (vph)	0	1329	0	0	1409	0	0	0	76	722	430	347
Turn Type									Free	Split		Perm
Protected Phases		2			6					4	4	
Permitted Phases									Free			4
Actuated Green, G (s)		38.2			38.2				100.0	51.5	51.5	51.5
Effective Green, g (s)		38.2			38.2				100.0	51.5	51.5	51.5
Actuated g/C Ratio		0.38			0.38				1.00	0.52	0.52	0.52
Clearance Time (s)		4.9			4.9					5.4	5.4	5.4
Vehicle Extension (s)		5.0			5.0					2.5	2.5	2.5
Lane Grp Cap (vph)		2430			1942				1611	1768	1534	742
v/s Ratio Prot		0.21			c0.28					0.21	0.14	
v/s Ratio Perm									0.05			c0.24
v/c Ratio		0.55			0.73				0.05	0.41	0.28	0.47
Uniform Delay, d1		24.1			26.4				0.0	14.9	13.7	15.5
Progression Factor		1.00			0.65				1.00	1.00	1.00	1.00
Incremental Delay, d2		0.4			1.4				0.1	0.7	0.5	2.1
Delay (s)		24.6			18.5				0.1	15.6	14.2	17.6
Level of Service		C			B				A	B	B	B
Approach Delay (s)		24.6			18.5			0.1			15.7	
Approach LOS		C			B			A			B	

Intersection Summary			
HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	1776	1218	808	656	565
v/c Ratio	0.50	0.62	0.65	0.55	0.57
Control Delay	10.6	8.1	5.1	28.6	28.3
Queue Delay	0.0	0.9	2.4	0.0	0.0
Total Delay	10.6	9.0	7.5	28.6	28.3
Queue Length 50th (ft)	131	128	106	174	159
Queue Length 95th (ft)	159	m168	m140	230	220
Internal Link Dist (ft)	410	90			
Turn Bay Length (ft)				300	300
Base Capacity (vph)	3627	2003	1247	1195	987
Starvation Cap Reductn	0	467	300	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.49	0.79	0.85	0.55	0.57

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1687	0	0	1157	768	623	0	537	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4			5.4	5.4	4.0		4.0			
Lane Util. Factor		0.86			0.95	1.00	0.97		0.88			
Frt		1.00			1.00	0.85	1.00		0.85			
Flt Protected		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)		6408			3539	1583	3433		2787			
Flt Permitted		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)		6408			3539	1583	3433		2787			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1776	0	0	1218	808	656	0	565	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	357	0	0	17	0	0	0
Lane Group Flow (vph)	0	1776	0	0	1218	451	656	0	548	0	0	0
Turn Type						Perm	custom		custom			
Protected Phases		2			6							
Permitted Phases						6	8		8			
Actuated Green, G (s)		55.8			55.8	55.8	34.8		34.8			
Effective Green, g (s)		55.8			55.8	55.8	34.8		34.8			
Actuated g/C Ratio		0.56			0.56	0.56	0.35		0.35			
Clearance Time (s)		5.4			5.4	5.4	4.0		4.0			
Vehicle Extension (s)		5.0			5.0	5.0	3.0		3.0			
Lane Grp Cap (vph)		3576			1975	883	1195		970			
v/s Ratio Prot		0.28			c0.34							
v/s Ratio Perm						0.28	0.19		c0.20			
v/c Ratio		0.50			0.62	0.51	0.55		0.56			
Uniform Delay, d1		13.5			14.9	13.7	26.3		26.5			
Progression Factor		0.75			0.47	3.45	1.00		1.00			
Incremental Delay, d2		0.2			0.6	0.7	1.8		2.4			
Delay (s)		10.4			7.6	47.8	28.1		28.8			
Level of Service		B			A	D	C		C			
Approach Delay (s)		10.4			23.6			28.4			0.0	
Approach LOS		B			C			C			A	

Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.4
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	604	1222	5	1171	264	179	96	302	300
v/c Ratio	0.91	0.47	0.04	0.77	0.90	0.20	0.40	0.73	0.65
Control Delay	48.3	10.3	44.2	36.7	75.4	28.9	49.7	20.7	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.3	10.3	44.2	36.7	75.4	28.9	49.7	20.7	11.5
Queue Length 50th (ft)	191	83	3	245	167	47	30	38	0
Queue Length 95th (ft)	#297	99	15	#345	#315	72	57	130	77
Internal Link Dist (ft)		311		731		382		448	
Turn Bay Length (ft)	250		80		120		140		140
Base Capacity (vph)	663	2606	124	1521	292	997	240	473	517
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	0.91	0.47	0.04	0.77	0.90	0.18	0.40	0.64	0.58

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												
Volume (vph)	574	1055	105	5	1083	29	251	160	10	91	45	527
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Lane Util. Factor	0.97	0.91		1.00	0.91		1.00	0.95		0.97	0.95	0.95
Frt	1.00	0.99		1.00	1.00		1.00	0.99		1.00	0.87	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	5016		1770	5065		1770	3507		3433	1545	1504
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	5016		1770	5065		1770	3507		3433	1545	1504
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	604	1111	111	5	1140	31	264	168	11	96	47	555
RTOR Reduction (vph)	0	10	0	0	3	0	0	5	0	0	203	256
Lane Group Flow (vph)	604	1212	0	5	1168	0	264	174	0	96	99	44
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	23.2	46.9		1.4	25.1		16.5	25.5		5.6	14.6	14.6
Effective Green, g (s)	23.2	46.9		1.4	25.1		16.5	25.5		5.6	14.6	14.6
Actuated g/C Ratio	0.23	0.47		0.01	0.25		0.16	0.26		0.06	0.15	0.15
Clearance Time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	796	2353		25	1271		292	894		192	226	220
v/s Ratio Prot	c0.18	0.24		0.00	c0.23		c0.15	0.05		0.03	c0.06	
v/s Ratio Perm												0.03
v/c Ratio	0.76	0.52		0.20	0.92		0.90	0.19		0.50	0.44	0.20
Uniform Delay, d1	35.8	18.6		48.7	36.5		41.0	29.2		45.8	39.0	37.6
Progression Factor	0.76	0.59		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.9	0.7		5.3	12.1		29.6	0.1		2.8	1.8	0.6
Delay (s)	31.0	11.7		54.1	48.5		70.6	29.3		48.6	40.8	38.2
Level of Service	C	B		D	D		E	C		D	D	D
Approach Delay (s)		18.1			48.6			53.9			40.7	
Approach LOS		B			D			D			D	

Intersection Summary			
HCM Average Control Delay	34.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.6
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	1207	1359	799	854
v/c Ratio	0.39	0.64	0.78	0.54
Control Delay	11.4	15.3	37.1	1.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	11.4	15.3	37.1	1.3
Queue Length 50th (ft)	134	268	239	0
Queue Length 95th (ft)	200	413	274	0
Internal Link Dist (ft)	898	560	1261	
Turn Bay Length (ft)			230	900
Base Capacity (vph)	3076	2140	1744	1583
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	1	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.39	0.64	0.46	0.54

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1147	1291	0	759	811
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.3	5.3		4.2	4.0
Lane Util. Factor		0.91	0.95		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	3539		3433	1583
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	3539		3433	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1207	1359	0	799	854
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1207	1359	0	799	854
Turn Type						Free
Protected Phases		2	6		4	
Permitted Phases						Free
Actuated Green, G (s)		60.5	60.5		30.0	100.0
Effective Green, g (s)		60.5	60.5		30.0	100.0
Actuated g/C Ratio		0.60	0.60		0.30	1.00
Clearance Time (s)		5.3	5.3		4.2	
Vehicle Extension (s)		5.0	5.0		2.5	
Lane Grp Cap (vph)		3076	2141		1030	1583
v/s Ratio Prot		0.24	c0.38		c0.23	
v/s Ratio Perm						0.54
v/c Ratio		0.39	0.63		0.78	0.54
Uniform Delay, d1		10.2	12.7		31.9	0.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.4	1.4		3.6	1.3
Delay (s)		10.6	14.0		35.5	1.3
Level of Service		B	B		D	A
Approach Delay (s)		10.6	14.0		17.8	
Approach LOS		B	B		B	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.5
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT
Lane Group Flow (vph)	1811	551	209	1380
v/c Ratio	0.69	0.44	0.71	0.39
Control Delay	10.3	4.2	52.6	0.3
Queue Delay	0.4	0.0	0.0	0.0
Total Delay	10.7	4.2	52.6	0.3
Queue Length 50th (ft)	320	88	127	0
Queue Length 95th (ft)	477	192	196	0
Internal Link Dist (ft)	560			522
Turn Bay Length (ft)			260	
Base Capacity (vph)	2623	1251	372	3539
Starvation Cap Reductn	308	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.78	0.44	0.56	0.39

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1720	523	199	1311	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	4.0	5.3		
Lane Util. Factor	0.95	1.00	1.00	0.95		
Frt	1.00	0.85	1.00	1.00		
Flt Protected	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	3539	1583	1770	3539		
Flt Permitted	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	3539	1583	1770	3539		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1811	551	209	1380	0	0
RTOR Reduction (vph)	0	78	0	0	0	0
Lane Group Flow (vph)	1811	473	209	1380	0	0
Turn Type		Perm	Prot			
Protected Phases	2		1	6		
Permitted Phases		2				
Actuated Green, G (s)	74.1	74.1	16.6	100.0		
Effective Green, g (s)	74.1	74.1	16.6	100.0		
Actuated g/C Ratio	0.74	0.74	0.17	1.00		
Clearance Time (s)	5.3	5.3	4.0	5.3		
Vehicle Extension (s)	5.0	5.0	3.0	5.0		
Lane Grp Cap (vph)	2622	1173	294	3539		
v/s Ratio Prot	c0.51		c0.12	0.39		
v/s Ratio Perm		0.30				
v/c Ratio	0.69	0.40	0.71	0.39		
Uniform Delay, d1	6.9	4.8	39.4	0.0		
Progression Factor	1.15	1.31	1.00	1.00		
Incremental Delay, d2	1.4	1.0	7.9	0.3		
Delay (s)	9.4	7.2	47.3	0.3		
Level of Service	A	A	D	A		
Approach Delay (s)	8.9			6.5	0.0	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	7.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	344	0	0	632	0	563	805	0	756	592
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	362	0	0	665	0	593	847	0	796	623
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1120				
pX, platoon unblocked	0.98	0.98		0.98	0.98	0.98				0.98		
vC, conflicting volume	993	1388	265	858	1388	198	796			593		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	922	1325	265	784	1325	110	796			514		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	51	100	100	26	100			100		
cM capacity (veh/h)	58	151	733	141	151	903	822			1027		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	362	665	237	237	401	565	318	318	367	415
Volume Left	0	0	0	0	0	0	0	0	0	0
Volume Right	362	665	0	0	282	565	0	0	208	415
cSH	733	903	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.49	0.74	0.14	0.14	0.24	0.33	0.19	0.19	0.22	0.24
Queue Length 95th (ft)	69	170	0	0	0	0	0	0	0	0
Control Delay (s)	14.6	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	C								
Approach Delay (s)	14.6	19.2	0.0				0.0			
Approach LOS	B	C								

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	624	0	1294	792	335
Sign Control	Yield			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	657	0	1362	834	353
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked	0.90					
vC, conflicting volume	1174	278	834			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	665	278	834			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	9	100			
cM capacity (veh/h)	356	719	795			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	657	341	341	341	341	333	333	284	235
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	657	0	0	0	0	0	0	118	235
cSH	719	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.91	0.20	0.20	0.20	0.20	0.20	0.20	0.17	0.14
Queue Length 95th (ft)	307	0	0	0	0	0	0	0	0
Control Delay (s)	39.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	E								
Approach Delay (s)	39.8	0.0				0.0			
Approach LOS	E								

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	100	797	119	74	1075	233	246	1163	103	1372
v/c Ratio	0.55	0.52	0.16	0.40	0.75	0.41	0.84	0.54	0.32	0.87
Control Delay	49.4	24.0	9.8	43.8	28.3	5.7	62.5	22.2	37.6	30.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.4	24.0	9.8	43.8	28.3	5.7	62.5	22.2	37.6	30.0
Queue Length 50th (ft)	25	120	22	19	186	0	63	138	25	213
Queue Length 95th (ft)	#56	157	52	39	237	56	#130	167	50	#298
Internal Link Dist (ft)		578			652			1209		560
Turn Bay Length (ft)	175			150			180		150	
Base Capacity (vph)	183	1624	744	183	1531	594	293	2233	320	1648
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.49	0.16	0.40	0.70	0.39	0.84	0.52	0.32	0.83

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												
Volume (vph)	95	757	113	70	997	246	234	907	198	98	890	413
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Lane Util. Factor	0.97	0.91	1.00	0.97	0.86	0.86	0.97	0.86		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	5085	1583	3433	4788	1362	3433	6236		3433	4843	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	5085	1583	3433	4788	1362	3433	6236		3433	4843	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	100	797	119	74	1049	259	246	955	208	103	937	435
RTOR Reduction (vph)	0	0	25	0	3	165	0	48	0	0	103	0
Lane Group Flow (vph)	100	797	94	74	1072	68	246	1115	0	103	1269	0
Turn Type	Prot		pm+ov	Prot		Perm	Prot			Prot		
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	3.0	22.8	29.3	3.0	22.8	22.8	6.5	25.5		5.6	24.6	
Effective Green, g (s)	3.0	22.8	29.3	3.0	22.8	22.8	6.5	25.5		5.6	24.6	
Actuated g/C Ratio	0.04	0.29	0.37	0.04	0.29	0.29	0.08	0.32		0.07	0.31	
Clearance Time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	131	1477	700	131	1391	396	284	2026		245	1518	
v/s Ratio Prot	0.03	c0.16	0.01	0.02	c0.22		c0.07	0.18		0.03	c0.26	
v/s Ratio Perm			0.05			0.05						
v/c Ratio	0.76	0.54	0.13	0.56	0.77	0.17	0.87	0.55		0.42	0.84	
Uniform Delay, d1	37.4	23.4	16.2	37.1	25.5	20.8	35.6	21.8		34.9	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	22.8	0.4	0.1	5.5	2.7	0.2	23.0	0.3		1.2	4.2	
Delay (s)	60.2	23.8	16.3	42.6	28.2	21.0	58.6	22.1		36.1	29.2	
Level of Service	E	C	B	D	C	C	E	C		D	C	
Approach Delay (s)		26.5			27.7			28.5			29.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	78.5	Sum of lost time (s)	16.2
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	611	472	0	827	0	0	0	0	0	0	501
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	643	497	0	871	0	0	0	0	0	0	527
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		732										
pX, platoon unblocked				0.89			0.89	0.89	0.89	0.89	0.89	
vC, conflicting volume	871			1140			1182	1762	463	1085	2011	290
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	871			723			770	1422	0	661	1702	290
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	25
cM capacity (veh/h)	770			779			65	120	965	309	81	706

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	257	257	625	290	290	290	527
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	497	0	0	0	527
cSH	1700	1700	1700	1700	1700	1700	706
Volume to Capacity	0.15	0.15	0.37	0.17	0.17	0.17	0.75
Queue Length 95th (ft)	0	0	0	0	0	0	170
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	23.5
Lane LOS							C
Approach Delay (s)	0.0			0.0			23.5
Approach LOS							C

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	55	184	186	184	6	1431	423	1351
v/c Ratio	0.38	0.52	0.45	0.43	0.04	0.56	0.31	0.49
Control Delay	23.2	24.9	10.1	9.7	10.2	8.0	0.3	11.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.2	24.9	10.1	9.7	10.2	8.0	0.3	11.2
Queue Length 50th (ft)	7	62	17	15	1	78	0	115
Queue Length 95th (ft)	37	102	59	55	m2	m106	m0	188
Internal Link Dist (ft)	296		624			121		607
Turn Bay Length (ft)				470	120			
Base Capacity (vph)	143	532	553	566	153	2576	1362	2747
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.35	0.34	0.33	0.04	0.56	0.31	0.49

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	0	32	195	1	331	6	989	772	0	1277	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		5.0	5.0	5.0	5.0	5.0	4.0		5.0	
Lane Util. Factor		1.00		0.95	0.91	0.95	1.00	0.86	0.86		0.91	
Frt		0.92		1.00	0.87	0.85	1.00	0.96	0.85		1.00	
Flt Protected		0.98		0.95	0.99	1.00	0.95	1.00	1.00		1.00	
Satd. Flow (prot)		1675		1681	1463	1504	1770	4609	1362		5081	
Flt Permitted		0.98		0.95	0.99	1.00	0.15	1.00	1.00		1.00	
Satd. Flow (perm)		1675		1681	1463	1504	284	4609	1362		5081	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	0	34	205	1	348	6	1041	813	0	1344	7
RTOR Reduction (vph)	0	33	0	0	104	104	0	89	0	0	0	0
Lane Group Flow (vph)	0	22	0	184	82	80	6	1342	423	0	1351	0
Turn Type	Split			Split		Perm	Perm		Free			
Protected Phases	4	4		8	8			2			6	
Permitted Phases						8	2		Free			
Actuated Green, G (s)		2.4		12.8	12.8	12.8	30.8	30.8	60.0		30.8	
Effective Green, g (s)		2.4		12.8	12.8	12.8	30.8	30.8	60.0		30.8	
Actuated g/C Ratio		0.04		0.21	0.21	0.21	0.51	0.51	1.00		0.51	
Clearance Time (s)		4.0		5.0	5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		67		359	312	321	146	2366	1362		2608	
v/s Ratio Prot		0.01		c0.11	0.06			c0.29			0.27	
v/s Ratio Perm						0.05	0.02		c0.31			
v/c Ratio		0.33		0.51	0.26	0.25	0.04	0.57	0.31		0.52	
Uniform Delay, d1		28.0		20.8	19.7	19.6	7.3	10.0	0.0		9.7	
Progression Factor		1.00		1.00	1.00	1.00	0.90	0.81	1.00		1.00	
Incremental Delay, d2		2.9		1.2	0.5	0.4	0.3	0.6	0.3		0.7	
Delay (s)		31.0		22.1	20.1	20.0	6.9	8.7	0.3		10.4	
Level of Service		C		C	C	C	A	A	A		B	
Approach Delay (s)		31.0			20.7			6.8			10.4	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	68	698	268	2491	174	999	104	1007
v/c Ratio	0.92	0.40	0.78	1.01	0.98	0.77	0.88	0.90
Control Delay	141.5	30.6	63.0	29.1	101.1	29.2	101.1	53.2
Queue Delay	0.0	0.0	0.0	23.5	0.0	1.3	0.0	0.0
Total Delay	141.5	30.6	63.0	52.6	101.1	30.5	101.1	53.2
Queue Length 50th (ft)	54	144	176	~559	140	275	81	207
Queue Length 95th (ft)	#147	200	m183	#210	#289	113	#189	#303
Internal Link Dist (ft)		1129		409		285		200
Turn Bay Length (ft)	140		110		150		120	
Base Capacity (vph)	74	1726	457	2474	177	1290	118	1117
Starvation Cap Reductn	0	0	0	148	0	127	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.40	0.59	1.07	0.98	0.86	0.88	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	568	95	255	1743	623	165	931	18	99	845	112
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.91		1.00	0.91	
Frt	1.00	0.98		1.00	0.96		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4976		1770	4884		1770	5071		1770	4996	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4976		1770	4884		1770	5071		1770	4996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	598	100	268	1835	656	174	980	19	104	889	118
RTOR Reduction (vph)	0	18	0	0	53	0	0	1	0	0	14	0
Lane Group Flow (vph)	68	680	0	268	2438	0	174	998	0	104	993	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	5.0	41.2		23.3	59.5		12.0	30.5		8.0	26.5	
Effective Green, g (s)	5.0	41.2		23.3	59.5		12.0	30.5		8.0	26.5	
Actuated g/C Ratio	0.04	0.34		0.19	0.50		0.10	0.25		0.07	0.22	
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	74	1708		344	2422		177	1289		118	1103	
v/s Ratio Prot	0.04	0.14		c0.15	c0.50		c0.10	0.20		0.06	c0.20	
v/s Ratio Perm												
v/c Ratio	0.92	0.40		0.78	1.01		0.98	0.77		0.88	0.90	
Uniform Delay, d1	57.3	30.0		45.9	30.2		53.9	41.5		55.5	45.5	
Progression Factor	1.00	1.00		1.22	0.47		0.76	0.61		0.86	0.95	
Incremental Delay, d2	76.3	0.2		5.1	13.9		56.7	3.9		44.7	10.7	
Delay (s)	133.6	30.1		61.3	28.2		97.8	29.1		92.5	53.7	
Level of Service	F	C		E	C		F	C		F	D	
Approach Delay (s)		39.3			31.4			39.3			57.3	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM Average Control Delay	39.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	305	1054	305	152	588	14	906	227	1151
v/c Ratio	0.66	0.74	0.57	0.68	0.70	0.09	0.55	0.26	0.50
Control Delay	47.3	37.0	15.1	61.5	37.3	24.2	26.0	3.8	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total Delay	47.3	37.0	15.1	61.5	37.3	24.2	26.0	3.8	8.5
Queue Length 50th (ft)	216	280	80	126	136	6	264	0	76
Queue Length 95th (ft)	316	270	124	197	169	23	367	49	m84
Internal Link Dist (ft)		339			174		323		285
Turn Bay Length (ft)	200			175		175			
Base Capacity (vph)	521	1605	584	280	1038	149	1653	860	2322
Starvation Cap Reductn	0	0	0	0	0	0	0	0	292
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	0.59	0.66	0.52	0.54	0.57	0.09	0.55	0.26	0.57

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	852	439	144	559	0	13	861	216	0	594	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor	1.00	0.86	0.86	1.00	0.91		1.00	0.95	1.00		0.91	
Frt	1.00	0.98	0.85	1.00	1.00		1.00	1.00	0.85		0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)	1770	4699	1362	1770	5085		1770	3539	1583		4737	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.17	1.00	1.00		1.00	
Satd. Flow (perm)	1770	4699	1362	1770	5085		319	3539	1583		4737	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	305	897	462	152	588	0	14	906	227	0	625	526
RTOR Reduction (vph)	0	20	131	0	0	0	0	0	121	0	111	0
Lane Group Flow (vph)	305	1034	174	152	588	0	14	906	106	0	1040	0
Turn Type	Prot		Perm	Prot			Perm		Perm			
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2		2			
Actuated Green, G (s)	31.3	35.9	35.9	15.1	19.7		56.0	56.0	56.0		56.0	
Effective Green, g (s)	31.3	35.9	35.9	15.1	19.7		56.0	56.0	56.0		56.0	
Actuated g/C Ratio	0.26	0.30	0.30	0.13	0.16		0.47	0.47	0.47		0.47	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	462	1406	407	223	835		149	1652	739		2211	
v/s Ratio Prot	c0.17	c0.22		0.09	0.12			c0.26			0.22	
v/s Ratio Perm			0.13				0.04		0.07			
v/c Ratio	0.66	0.74	0.43	0.68	0.70		0.09	0.55	0.14		0.47	
Uniform Delay, d1	39.6	37.8	33.8	50.2	47.4		17.8	22.9	18.3		21.9	
Progression Factor	1.04	0.93	0.89	0.99	0.71		1.00	1.00	1.00		0.42	
Incremental Delay, d2	3.2	1.8	0.7	6.5	2.1		1.2	1.3	0.4		0.4	
Delay (s)	44.3	36.9	30.8	56.0	35.8		19.1	24.3	18.7		9.6	
Level of Service	D	D	C	E	D		B	C	B		A	
Approach Delay (s)		37.1			40.0			23.1			9.6	
Approach LOS		D			D			C			A	

Intersection Summary			
HCM Average Control Delay	27.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	178	1019	0	0	1203
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	187	1073	0	0	1266
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						629
pX, platoon unblocked						
vC, conflicting volume	1495	358			1073	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1495	358			1073	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	71			100	
cM capacity (veh/h)	114	639			646	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	187	358	358	358	422	422	422
Volume Left	0	0	0	0	0	0	0
Volume Right	187	0	0	0	0	0	0
cSH	639	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.29	0.21	0.21	0.21	0.25	0.25	0.25
Queue Length 95th (ft)	30	0	0	0	0	0	0
Control Delay (s)	13.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	13.0	0.0			0.0		
Approach LOS	B						

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	37.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	1249	821	719
v/c Ratio	0.43	0.28	0.70
Control Delay	8.6	5.2	20.6
Queue Delay	0.0	0.0	0.0
Total Delay	8.6	5.2	20.6
Queue Length 50th (ft)	82	60	106
Queue Length 95th (ft)	137	91	137
Internal Link Dist (ft)	736	218	493
Turn Bay Length (ft)			
Base Capacity (vph)	2900	2900	1389
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.43	0.28	0.52

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1187	780	0	533	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5		4.0	
Lane Util. Factor		0.91	0.91		0.97	
Frt		1.00	1.00		0.97	
Flt Protected		1.00	1.00		0.96	
Satd. Flow (prot)		5085	5085		3363	
Flt Permitted		1.00	1.00		0.96	
Satd. Flow (perm)		5085	5085		3363	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1249	821	0	561	158
RTOR Reduction (vph)	0	0	0	0	53	0
Lane Group Flow (vph)	0	1249	821	0	666	0
Turn Type						
Protected Phases		4	8		6	
Permitted Phases						
Actuated Green, G (s)		34.2	34.2		17.3	
Effective Green, g (s)		34.2	34.2		17.3	
Actuated g/C Ratio		0.57	0.57		0.29	
Clearance Time (s)		4.5	4.5		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2898	2898		970	
v/s Ratio Prot		c0.25	0.16		c0.20	
v/s Ratio Perm						
v/c Ratio		0.43	0.28		0.69	
Uniform Delay, d1		7.4	6.6		18.9	
Progression Factor		1.00	0.71		1.00	
Incremental Delay, d2		0.5	0.2		2.0	
Delay (s)		7.8	4.9		21.0	
Level of Service		A	A		C	
Approach Delay (s)		7.8	4.9		21.0	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.5
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	82	680	340	2733	100	562	441	91	789
v/c Ratio	0.92	0.33	0.82	0.90	0.10	0.64	0.61	0.81	0.63
Control Delay	136.9	10.2	58.6	26.9	4.6	61.8	32.6	88.9	38.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	136.9	10.2	58.6	26.9	4.6	61.8	32.6	88.9	38.0
Queue Length 50th (ft)	67	53	250	642	11	238	238	67	177
Queue Length 95th (ft)	m#159	m64	329	725	34	299	292	#166	224
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	89	2077	546	3021	967	876	724	113	1254
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	0.92	0.33	0.62	0.90	0.10	0.64	0.61	0.81	0.63

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	78	646	0	323	2596	95	0	534	419	86	460	290
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00		0.95	1.00	1.00	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085		1770	5085	1583		3539	1583	1770	4790	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.24	1.00	
Satd. Flow (perm)	1770	5085		1770	5085	1583		3539	1583	455	4790	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	82	680	0	340	2733	100	0	562	441	91	484	305
RTOR Reduction (vph)	0	0	0	0	0	26	0	0	332	0	68	0
Lane Group Flow (vph)	82	680	0	340	2733	74	0	562	109	91	721	0
Turn Type	Prot		Perm	Prot		Perm			Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8			2	6		
Actuated Green, G (s)	6.0	49.0		28.3	71.3	71.3		29.7	29.7	29.7	29.7	
Effective Green, g (s)	6.0	49.0		28.3	71.3	71.3		29.7	29.7	29.7	29.7	
Actuated g/C Ratio	0.05	0.41		0.24	0.59	0.59		0.25	0.25	0.25	0.25	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	89	2076		417	3021	941		876	392	113	1186	
v/s Ratio Prot	0.05	0.13		c0.19	c0.54			0.16			0.15	
v/s Ratio Perm						0.05			0.07	c0.20		
v/c Ratio	0.92	0.33		0.82	0.90	0.08		0.64	0.28	0.81	0.61	
Uniform Delay, d1	56.8	24.2		43.4	21.4	10.4		40.4	36.5	42.4	40.0	
Progression Factor	1.18	0.39		1.00	1.00	1.00		1.44	8.24	1.00	1.00	
Incremental Delay, d2	65.5	0.4		11.6	5.1	0.2		3.0	1.5	43.9	2.3	
Delay (s)	132.8	9.7		55.0	26.4	10.5		61.3	302.2	86.3	42.3	
Level of Service	F	A		E	C	B		E	F	F	D	
Approach Delay (s)		23.0			29.0			167.2			46.9	
Approach LOS		C			C			F			D	

Intersection Summary			
HCM Average Control Delay	54.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	185	1628	111	2839	638	148	32	46	834	293
v/c Ratio	1.57	0.93	0.83	1.56	1.88	0.11	0.05	0.40	1.01	0.62
Control Delay	329.0	46.7	98.6	284.7	436.5	25.9	8.8	63.6	79.6	29.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	329.0	46.7	98.6	284.7	436.5	25.9	8.8	63.6	79.6	29.1
Queue Length 50th (ft)	~203	433	86	~1149	~755	40	0	35	~347	113
Queue Length 95th (ft)	#351	#532	#191	#1238	#982	65	22	74	#485	211
Internal Link Dist (ft)		631		1090		191			644	
Turn Bay Length (ft)	200		180		140		60	120		120
Base Capacity (vph)	118	1760	133	1819	339	1329	614	133	826	469
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.57	0.93	0.83	1.56	1.88	0.11	0.05	0.35	1.01	0.62

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	176	1299	248	105	2667	30	606	141	30	44	792	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4963		1770	5077		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4963		1770	5077		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	185	1367	261	111	2807	32	638	148	32	46	834	293
RTOR Reduction (vph)	0	23	0	0	1	0	0	0	20	0	0	99
Lane Group Flow (vph)	185	1605	0	111	2838	0	638	148	12	46	834	194
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	8.0	42.0		9.0	43.0		23.0	45.1	45.1	6.7	28.8	28.8
Effective Green, g (s)	8.0	42.0		9.0	43.0		23.0	45.1	45.1	6.7	28.8	28.8
Actuated g/C Ratio	0.07	0.35		0.07	0.36		0.19	0.37	0.37	0.06	0.24	0.24
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	117	1726		132	1807		337	1321	591	98	844	377
v/s Ratio Prot	c0.10	0.32		0.06	c0.56		c0.36	0.04		0.03	c0.24	
v/s Ratio Perm									0.01			0.12
v/c Ratio	1.58	0.93		0.84	1.57		1.89	0.11	0.02	0.47	0.99	0.51
Uniform Delay, d1	56.4	38.0		55.2	38.9		48.9	24.8	23.9	55.3	45.8	39.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	298.2	9.3		35.8	259.6		412.9	0.0	0.0	3.5	27.7	1.2
Delay (s)	354.6	47.3		91.0	298.5		461.8	24.8	23.9	58.8	73.6	41.1
Level of Service	F	D		F	F		F	C	C	E	E	D
Approach Delay (s)		78.6			290.6			365.6			64.9	
Approach LOS		E			F			F			E	

Intersection Summary			
HCM Average Control Delay	203.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	120.8	Sum of lost time (s)	13.0
Intersection Capacity Utilization	132.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations										
Volume (veh/h)	0	176	0	657	0	0	783	435	0	0
Sign Control	Yield			Free			Free		Yield	
Grade	0%			0%			0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	185	0	692	0	0	824	458	0	0
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type				None			None			
Median storage veh)										
Upstream signal (ft)							271			
pX, platoon unblocked	0.76		0.76						0.76	0.76
vC, conflicting volume	1974	346	1282			692			1355	1516
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	2123	346	1213			692			1310	1521
tC, single (s)	6.5	6.9	4.1			4.1			7.5	6.5
tC, 2 stage (s)										
tF (s)	4.0	3.3	2.2			2.2			3.5	4.0
p0 queue free %	100	72	100			100			100	100
cM capacity (veh/h)	38	650	434			899			63	89

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	185	346	346	824	458
Volume Left	0	0	0	0	0
Volume Right	185	0	0	0	458
cSH	650	1700	1700	1700	1700
Volume to Capacity	0.28	0.20	0.20	0.48	0.27
Queue Length 95th (ft)	29	0	0	0	0
Control Delay (s)	12.7	0.0	0.0	0.0	0.0
Lane LOS	B				
Approach Delay (s)	12.7	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	759	0	0	0	0	0	0	657	116	0
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	799	0	0	0	0	0	0	692	122	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											795	
pX, platoon unblocked												
vC, conflicting volume	1505	1505	122	2304	1505	0	122			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1505	1505	122	2304	1505	0	122			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	14	100	100	100	100			57		
cM capacity (veh/h)	66	70	929	3	70	1085	1465			1623		

Direction, Lane #	EB 1	SB 1	SB 2
Volume Total	799	692	122
Volume Left	0	692	0
Volume Right	799	0	0
cSH	929	1623	1700
Volume to Capacity	0.86	0.43	0.07
Queue Length 95th (ft)	275	55	0
Control Delay (s)	27.3	8.9	0.0
Lane LOS	D	A	
Approach Delay (s)	27.3	7.5	
Approach LOS	D		

Intersection Summary			
Average Delay	17.3		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	459	233	98	788	156	1212
v/c Ratio	0.86	0.39	0.57	0.39	0.16	0.60
Control Delay	40.8	8.2	27.4	9.4	2.5	11.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.8	8.2	27.4	9.4	2.5	11.8
Queue Length 50th (ft)	179	20	20	87	6	172
Queue Length 95th (ft)	#327	68	m#74	149	m17	232
Internal Link Dist (ft)		1190		300		620
Turn Bay Length (ft)	600		90			
Base Capacity (vph)	569	634	172	2018	970	2017
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	45
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.37	0.57	0.39	0.16	0.61

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	436	31	190	93	749	148	0	1146	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor				1.00	1.00		1.00	0.95	1.00		0.95	
Frt				1.00	0.87		1.00	1.00	0.85		1.00	
Flt Protected				0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)				1770	1623		1770	3539	1583		3537	
Flt Permitted				0.95	1.00		0.16	1.00	1.00		1.00	
Satd. Flow (perm)				1770	1623		302	3539	1583		3537	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	459	33	200	98	788	156	0	1206	6
RTOR Reduction (vph)	0	0	0	0	116	0	0	0	67	0	0	0
Lane Group Flow (vph)	0	0	0	459	117	0	98	788	89	0	1212	0
Turn Type				Split			Perm		Perm			
Protected Phases				8	8			2			6	
Permitted Phases							2		2			
Actuated Green, G (s)				21.1	21.1		39.9	39.9	39.9		39.9	
Effective Green, g (s)				21.1	21.1		39.9	39.9	39.9		39.9	
Actuated g/C Ratio				0.30	0.30		0.57	0.57	0.57		0.57	
Clearance Time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)				3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)				534	489		172	2017	902		2016	
v/s Ratio Prot				c0.26	0.07			0.22			c0.34	
v/s Ratio Perm							0.32		0.06			
v/c Ratio				0.86	0.24		0.57	0.39	0.10		0.60	
Uniform Delay, d1				23.1	18.4		9.6	8.3	6.9		9.8	
Progression Factor				1.00	1.00		1.06	1.01	1.38		1.00	
Incremental Delay, d2				13.0	0.3		11.7	0.5	0.2		1.3	
Delay (s)				36.1	18.7		21.9	9.0	9.7		11.2	
Level of Service				D	B		C	A	A		B	
Approach Delay (s)		0.0			30.2			10.3			11.2	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBT	SBT
Lane Group Flow (vph)	400	403	689	1689
v/c Ratio	0.79	0.86	0.33	0.80
Control Delay	34.9	41.7	2.3	9.5
Queue Delay	0.0	0.0	0.0	0.3
Total Delay	34.9	41.7	2.3	9.8
Queue Length 50th (ft)	151	149	23	170
Queue Length 95th (ft)	#257	#290	36	201
Internal Link Dist (ft)	434		320	300
Turn Bay Length (ft)				
Base Capacity (vph)	556	511	2116	2116
Starvation Cap Reductn	0	0	0	7
Spillback Cap Reductn	0	0	0	78
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.72	0.79	0.33	0.83

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	380	383	0	655	1605	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1770	1583		3539	3539	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1770	1583		3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	400	403	0	689	1689	0
RTOR Reduction (vph)	0	14	0	0	0	0
Lane Group Flow (vph)	400	389	0	689	1689	0
Turn Type		custom				
Protected Phases				2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	20.1	20.1		41.9	41.9	
Effective Green, g (s)	20.1	20.1		41.9	41.9	
Actuated g/C Ratio	0.29	0.29		0.60	0.60	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	508	455		2118	2118	
v/s Ratio Prot				0.19	c0.48	
v/s Ratio Perm	0.23	c0.25				
v/c Ratio	0.79	0.86		0.33	0.80	
Uniform Delay, d1	23.0	23.6		7.0	10.8	
Progression Factor	1.00	1.00		0.26	0.58	
Incremental Delay, d2	7.9	14.6		0.4	2.5	
Delay (s)	30.9	38.2		2.2	8.7	
Level of Service	C	D		A	A	
Approach Delay (s)	34.5			2.2	8.7	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	174	378	137	46	284	74	149	389	112	183	1535	383
v/c Ratio	0.83	0.51	0.31	0.28	0.38	0.19	0.84	0.27	0.16	0.48	0.83	0.42
Control Delay	59.1	26.8	6.8	27.4	25.0	7.5	70.9	15.0	3.9	25.1	11.8	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Total Delay	59.1	26.8	6.8	27.4	25.0	7.5	70.9	15.0	3.9	25.1	13.1	2.4
Queue Length 50th (ft)	70	74	0	16	54	0	64	59	0	81	112	7
Queue Length 95th (ft)	#168	113	40	44	86	30	#161	90	28	m92	#307	m23
Internal Link Dist (ft)		612			420			572			320	
Turn Bay Length (ft)	90			80			130			120		
Base Capacity (vph)	229	809	468	180	809	419	177	1435	708	379	1840	917
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	140	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.47	0.29	0.26	0.35	0.18	0.84	0.27	0.16	0.48	0.90	0.42

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	165	359	130	44	270	70	142	370	106	174	1458	364
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.54	1.00	1.00	0.42	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1001	3539	1583	789	3539	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	174	378	137	46	284	74	149	389	112	183	1535	383
RTOR Reduction (vph)	0	0	108	0	0	59	0	0	67	0	0	94
Lane Group Flow (vph)	174	378	29	46	284	15	149	389	45	183	1535	289
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	14.6	14.6	14.6	14.6	14.6	14.6	7.0	28.4	28.4	15.0	36.4	36.4
Effective Green, g (s)	14.6	14.6	14.6	14.6	14.6	14.6	7.0	28.4	28.4	15.0	36.4	36.4
Actuated g/C Ratio	0.21	0.21	0.21	0.21	0.21	0.21	0.10	0.41	0.41	0.21	0.52	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	209	738	330	165	738	330	177	1436	642	379	1840	823
v/s Ratio Prot		0.11			0.08		c0.08	0.11		0.10	c0.43	
v/s Ratio Perm	c0.17		0.02	0.06		0.01			0.03			0.18
v/c Ratio	0.83	0.51	0.09	0.28	0.38	0.05	0.84	0.27	0.07	0.48	0.83	0.35
Uniform Delay, d1	26.5	24.5	22.3	23.3	23.8	22.1	31.0	13.9	12.7	24.1	14.2	9.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.55	0.30
Incremental Delay, d2	23.7	0.6	0.1	0.9	0.3	0.1	28.7	0.5	0.2	0.6	2.8	0.7
Delay (s)	50.2	25.1	22.4	24.2	24.2	22.2	59.7	14.4	12.9	22.5	10.6	3.7
Level of Service	D	C	C	C	C	C	E	B	B	C	B	A
Approach Delay (s)		30.9			23.8			24.5			10.4	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	161	433	0	415	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	169	456	0	437	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	500					
pX, platoon unblocked						
vC, conflicting volume			625		388	85
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			625		388	85
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			952		588	957

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2
Volume Total	113	208	304	218	218
Volume Left	0	0	0	0	0
Volume Right	0	152	304	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.07	0.12	0.18	0.13	0.13
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					
Approach Delay (s)	0.0			0.0	
Approach LOS					

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	98	1140	1548	272
v/c Ratio	0.42	0.32	0.57	0.21
Control Delay	25.7	0.2	4.8	0.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	25.7	0.2	4.8	0.9
Queue Length 50th (ft)	34	0	111	1
Queue Length 95th (ft)	68	0	162	16
Internal Link Dist (ft)		370	263	
Turn Bay Length (ft)	100			70
Base Capacity (vph)	266	3539	2738	1284
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.37	0.32	0.57	0.21

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	93	1083	1471	258
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.5	4.5	4.5
Lane Util. Factor			1.00	0.95	0.95	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			1770	3539	3539	1583
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			1770	3539	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	98	1140	1548	272
RTOR Reduction (vph)	0	0	0	0	0	67
Lane Group Flow (vph)	0	0	98	1140	1548	205
Turn Type			Prot			Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			6.8	60.0	44.7	44.7
Effective Green, g (s)			6.8	60.0	44.7	44.7
Actuated g/C Ratio			0.11	1.00	0.75	0.75
Clearance Time (s)			4.0	4.5	4.5	4.5
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			201	3539	2637	1179
v/s Ratio Prot			0.06	c0.32	c0.44	
v/s Ratio Perm						0.13
v/c Ratio			0.49	0.32	0.59	0.17
Uniform Delay, d1			25.0	0.0	3.5	2.2
Progression Factor			0.85	1.00	1.00	1.00
Incremental Delay, d2			1.8	0.2	1.0	0.3
Delay (s)			23.1	0.2	4.4	2.6
Level of Service			C	A	A	A
Approach Delay (s)	0.0			2.0	4.2	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	3.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	4.5
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	188	228	0	1014	1474	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	198	240	0	1067	1552	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				382	450	
pX, platoon unblocked	0.84	0.77	0.77			
vC, conflicting volume	2085	776	1552			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1207	114	1121			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	66	100			
cM capacity (veh/h)	147	707	477			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	132	306	534	534	776	776
Volume Left	132	66	0	0	0	0
Volume Right	0	240	0	0	0	0
cSH	147	388	1700	1700	1700	1700
Volume to Capacity	0.90	0.79	0.31	0.31	0.46	0.46
Queue Length 95th (ft)	154	169	0	0	0	0
Control Delay (s)	108.5	41.2	0.0	0.0	0.0	0.0
Lane LOS	F	E				
Approach Delay (s)	61.5		0.0		0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	8.8		
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	126	122	36	86	173	916	8	1136	492
v/c Ratio	0.53	0.19	0.16	0.14	0.46	0.37	0.02	0.55	0.47
Control Delay	29.3	6.9	20.3	13.4	9.1	6.4	3.8	8.9	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	6.9	20.3	13.4	9.1	6.4	3.8	8.9	2.6
Queue Length 50th (ft)	42	3	11	8	17	58	1	80	6
Queue Length 95th (ft)	79	19	29	22	55	166	m1	207	16
Internal Link Dist (ft)		646		699		573		302	
Turn Bay Length (ft)	120		220		200		260		70
Base Capacity (vph)	347	901	335	914	379	2486	474	2054	1058
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	0.36	0.14	0.11	0.09	0.46	0.37	0.02	0.55	0.47

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	19	97	34	51	30	164	864	7	8	1079	467
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.87		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3095		1770	3342		1770	3535		1770	3539	1583
Flt Permitted	0.70	1.00		0.67	1.00		0.16	1.00		0.31	1.00	1.00
Satd. Flow (perm)	1301	3095		1257	3342		290	3535		580	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	126	20	102	36	54	32	173	909	7	8	1136	492
RTOR Reduction (vph)	0	85	0	0	27	0	0	1	0	0	0	152
Lane Group Flow (vph)	126	37	0	36	59	0	173	915	0	8	1136	340
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	9.8	9.8		9.8	9.8		42.2	37.4		33.2	32.4	32.4
Effective Green, g (s)	9.8	9.8		9.8	9.8		42.2	37.4		33.2	32.4	32.4
Actuated g/C Ratio	0.16	0.16		0.16	0.16		0.70	0.62		0.55	0.54	0.54
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	212	506		205	546		347	2203		337	1911	855
v/s Ratio Prot		0.01			0.02		c0.05	0.26		0.00	c0.32	
v/s Ratio Perm	c0.10			0.03			0.30			0.01		0.21
v/c Ratio	0.59	0.07		0.18	0.11		0.50	0.42		0.02	0.59	0.40
Uniform Delay, d1	23.3	21.3		21.6	21.4		5.4	5.7		6.0	9.3	8.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.80	0.70	0.32
Incremental Delay, d2	4.4	0.1		0.4	0.1		1.1	0.6		0.0	1.2	1.2
Delay (s)	27.7	21.3		22.0	21.5		6.6	6.3		4.9	7.7	3.8
Level of Service	C	C		C	C		A	A		A	A	A
Approach Delay (s)		24.5			21.6			6.4			6.5	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	643	208	647	123	93	835
v/c Ratio	0.72	0.37	0.41	0.16	0.43	0.39
Control Delay	25.3	5.1	9.2	1.4	31.4	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.3	5.1	9.2	1.4	31.4	7.3
Queue Length 50th (ft)	104	0	92	0	31	77
Queue Length 95th (ft)	154	41	101	14	#81	111
Internal Link Dist (ft)	720		1803			515
Turn Bay Length (ft)	240	240		150	215	
Base Capacity (vph)	973	598	1636	798	221	2123
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.35	0.40	0.15	0.42	0.39

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	611	198	615	117	88	793
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	643	208	647	123	93	835
RTOR Reduction (vph)	0	154	0	70	0	0
Lane Group Flow (vph)	643	54	647	53	93	835
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.5	15.5	25.7	25.7	6.3	36.0
Effective Green, g (s)	15.5	15.5	25.7	25.7	6.3	36.0
Actuated g/C Ratio	0.26	0.26	0.43	0.43	0.10	0.60
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	887	409	1516	678	186	2123
v/s Ratio Prot	c0.19		c0.18		0.05	c0.24
v/s Ratio Perm		0.03		0.03		
v/c Ratio	0.72	0.13	0.43	0.08	0.50	0.39
Uniform Delay, d1	20.3	17.1	12.0	10.1	25.4	6.3
Progression Factor	1.00	1.00	0.66	0.48	1.00	1.00
Incremental Delay, d2	3.0	0.1	0.9	0.2	2.1	0.5
Delay (s)	23.3	17.2	8.8	5.1	27.5	6.8
Level of Service	C	B	A	A	C	A
Approach Delay (s)	21.8		8.2			8.9
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.5
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	60	144	728	1353	228	1248
v/c Ratio	0.26	0.60	0.29	1.02	1.10	0.41
Control Delay	54.9	19.1	6.8	39.1	136.7	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.9	19.1	6.8	39.1	136.7	1.8
Queue Length 50th (ft)	23	0	94	~771	~204	32
Queue Length 95th (ft)	44	62	139	#1212	#368	55
Internal Link Dist (ft)	1134		595			1803
Turn Bay Length (ft)	75	50			235	
Base Capacity (vph)	629	408	2519	1331	207	3050
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.35	0.29	1.02	1.10	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	57	137	692	1285	217	1186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	144	728	1353	228	1248
RTOR Reduction (vph)	0	134	0	204	0	0
Lane Group Flow (vph)	60	10	728	1149	228	1248
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	8.1	8.1	85.4	85.4	14.0	103.4
Effective Green, g (s)	8.1	8.1	85.4	85.4	14.0	103.4
Actuated g/C Ratio	0.07	0.07	0.71	0.71	0.12	0.86
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	232	107	2519	1127	207	3049
v/s Ratio Prot	c0.02		0.21		c0.13	0.35
v/s Ratio Perm		0.01		c0.73		
v/c Ratio	0.26	0.09	0.29	1.02	1.10	0.41
Uniform Delay, d1	53.1	52.5	6.3	17.3	53.0	1.8
Progression Factor	1.00	1.00	1.00	1.00	0.99	0.73
Incremental Delay, d2	0.6	0.4	0.3	31.9	88.3	0.4
Delay (s)	53.7	52.9	6.6	49.2	140.6	1.7
Level of Service	D	D	A	D	F	A
Approach Delay (s)	53.1		34.3			23.1
Approach LOS	D		C			C

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	98.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	176	148	740	65	37	0
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	185	156	779	68	39	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						800
pX, platoon unblocked						
vC, conflicting volume	891	813			779	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	891	813			779	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	38	59			95	
cM capacity (veh/h)	298	378			838	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	185	156	847	39	0
Volume Left	185	0	0	39	0
Volume Right	0	156	68	0	0
cSH	298	378	1700	838	1700
Volume to Capacity	0.62	0.41	0.50	0.05	0.00
Queue Length 95th (ft)	97	49	0	4	0
Control Delay (s)	35.0	21.0	0.0	9.5	0.0
Lane LOS	D	C		A	
Approach Delay (s)	28.6		0.0	9.5	
Approach LOS	D				

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2396	1578	552	111	1059	525	594
v/c Ratio	1.04	0.97	0.50	0.50	0.95	0.78	0.40
Control Delay	63.6	45.4	5.2	43.2	60.7	58.7	38.1
Queue Delay	545.7	356.3	7.9	0.0	3.4	0.0	0.0
Total Delay	609.3	401.7	13.1	43.2	64.1	58.7	38.1
Queue Length 50th (ft)	~794	740	116	94	347	218	147
Queue Length 95th (ft)	#886	m707	m77	155	#427	283	185
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2312	1620	1103	222	1110	673	1475
Starvation Cap Reductn	0	746	503	0	0	0	0
Spillback Cap Reductn	1251	0	0	0	28	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	2.26	1.81	0.92	0.50	0.98	0.78	0.40

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	2143	133	0	1499	524	105	948	58	499	563	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5041			3539	1583	1770	5041		3433	5084	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5041			3539	1583	1770	5041		3433	5084	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	2256	140	0	1578	552	111	998	61	525	593	1
RTOR Reduction (vph)	0	5	0	0	0	1	0	5	0	0	0	0
Lane Group Flow (vph)	0	2391	0	0	1578	551	111	1054	0	525	594	0
Turn Type						pm+ov	Prot			Prot		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		59.5			59.5	85.0	16.3	28.5		25.5	37.7	
Effective Green, g (s)		59.5			59.5	85.0	16.3	28.5		25.5	37.7	
Actuated g/C Ratio		0.46			0.46	0.65	0.13	0.22		0.20	0.29	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2307			1620	1102	222	1105		673	1474	
v/s Ratio Prot		c0.47			0.45	0.10	0.06	c0.21		c0.15	0.12	
v/s Ratio Perm						0.25						
v/c Ratio		1.04			0.97	0.50	0.50	0.95		0.78	0.40	
Uniform Delay, d1		35.2			34.5	11.6	53.0	50.1		49.6	37.1	
Progression Factor		1.00			1.13	0.50	0.68	0.88		1.00	1.00	
Incremental Delay, d2		28.9			6.3	0.1	7.0	16.5		5.8	0.8	
Delay (s)		64.1			45.2	5.9	42.8	60.7		55.4	37.9	
Level of Service		E			D	A	D	E		E	D	
Approach Delay (s)		64.1			35.0			59.0			46.1	
Approach LOS		E			D			E			D	

Intersection Summary			
HCM Average Control Delay	51.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	92.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	477	2320	33	2145	739	128	223	448	393
v/c Ratio	1.11	0.73	0.38	1.08	1.08	0.44	1.13	0.54	0.58
Control Delay	97.5	31.2	86.2	95.3	116.4	33.5	156.0	46.4	7.7
Queue Delay	188.8	206.8	0.0	346.1	0.0	0.5	599.8	0.0	0.9
Total Delay	286.3	238.0	86.2	441.4	116.4	34.1	755.8	46.4	8.6
Queue Length 50th (ft)	~473	626	28	~719	~258	44	~111	175	0
Queue Length 95th (ft)	m#491	m635	m36	#813	#348	99	#196	231	87
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		160
Base Capacity (vph)	429	3173	91	1987	685	291	198	830	672
Starvation Cap Reductn	120	1582	0	9	0	0	0	0	0
Spillback Cap Reductn	0	491	0	830	0	31	198	0	97
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.54	1.46	0.36	1.85	1.08	0.49	223.00	0.54	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	453	2189	15	31	1685	352	0	702	122	212	426	373
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.97			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5080		1770	4953			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5080		1770	4953			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	477	2304	16	33	1774	371	0	739	128	223	448	393
RTOR Reduction (vph)	0	0	0	0	25	0	0	0	78	0	0	301
Lane Group Flow (vph)	477	2320	0	33	2120	0	0	739	50	223	448	92
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	31.5	79.0		4.0	51.5			17.5	17.5	7.5	30.5	30.5
Effective Green, g (s)	31.5	79.0		4.0	51.5			17.5	17.5	7.5	30.5	30.5
Actuated g/C Ratio	0.24	0.61		0.03	0.40			0.13	0.13	0.06	0.23	0.23
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	429	3087		54	1962			685	213	198	830	371
v/s Ratio Prot	c0.27	0.46		0.02	c0.43			c0.15		c0.06	0.13	
v/s Ratio Perm									0.03			0.06
v/c Ratio	1.11	0.75		0.61	1.08			1.08	0.24	1.13	0.54	0.25
Uniform Delay, d1	49.2	18.4		62.2	39.2			56.2	50.3	61.2	43.6	40.4
Progression Factor	0.81	1.72		1.31	1.50			1.19	1.60	1.00	1.00	1.00
Incremental Delay, d2	59.2	0.4		12.1	42.8			55.5	2.2	102.0	2.5	1.6
Delay (s)	99.3	32.1		93.4	101.5			122.3	82.5	163.2	46.1	42.0
Level of Service	F	C		F	F			F	F	F	D	D
Approach Delay (s)		43.5			101.4			116.4			69.2	
Approach LOS		D			F			F			E	

Intersection Summary			
HCM Average Control Delay	74.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	103.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	33	649	44	1076	451	67	444	167	327	13
v/c Ratio	0.25	0.32	0.17	0.52	0.50	0.17	0.56	0.45	0.29	0.03
Control Delay	37.5	32.5	27.1	30.4	4.3	41.8	46.2	78.4	72.6	48.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.5	32.5	27.1	30.4	4.3	41.8	46.2	78.4	72.6	48.9
Queue Length 50th (ft)	25	182	24	248	0	46	170	173	113	5
Queue Length 95th (ft)	m54	m213	53	293	65	88	226	m260	150	m17
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	132	2049	261	2054	908	402	796	369	1135	393
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.32	0.17	0.52	0.50	0.17	0.56	0.45	0.29	0.03

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	31	604	12	42	1022	428	64	362	60	317	152	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (prot)	1770	5070		1770	5085	1583	1770	3464		1522	4686	1583
Flt Permitted	0.18	1.00		0.35	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (perm)	326	5070		646	5085	1583	1770	3464		1522	4686	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	33	636	13	44	1076	451	67	381	63	334	160	13
RTOR Reduction (vph)	0	2	0	0	0	269	0	10	0	0	0	10
Lane Group Flow (vph)	33	647	0	44	1076	182	67	434	0	167	327	3
Turn Type	Perm			Perm		Perm	Split			Split		Perm
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	52.5	52.5		52.5	52.5	52.5	29.5	29.5		31.5	31.5	31.5
Effective Green, g (s)	52.5	52.5		52.5	52.5	52.5	29.5	29.5		31.5	31.5	31.5
Actuated g/C Ratio	0.40	0.40		0.40	0.40	0.40	0.23	0.23		0.24	0.24	0.24
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	132	2048		261	2054	639	402	786		369	1135	384
v/s Ratio Prot		0.13			c0.21		0.04	c0.13		c0.11	0.07	
v/s Ratio Perm	0.10			0.07		0.12						0.00
v/c Ratio	0.25	0.32		0.17	0.52	0.29	0.17	0.55		0.45	0.29	0.01
Uniform Delay, d1	25.7	26.5		24.8	29.3	26.1	40.4	44.4		41.9	40.1	37.4
Progression Factor	1.22	1.21		1.00	1.00	1.00	1.00	1.00		1.76	1.79	2.89
Incremental Delay, d2	3.9	0.3		1.4	1.0	1.1	0.9	2.8		3.4	0.6	0.0
Delay (s)	35.1	32.5		26.2	30.3	27.2	41.3	47.2		77.2	72.2	108.0
Level of Service	D	C		C	C	C	D	D		E	E	F
Approach Delay (s)		32.6			29.3			46.4			74.8	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM Average Control Delay	39.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	100	2499	36	127	2495	91	87	162	45	17	34
v/c Ratio	0.68	0.79	0.04	0.72	0.78	0.65	0.47	0.53	0.24	0.06	0.13
Control Delay	77.6	40.5	15.5	50.5	0.5	77.3	62.7	14.7	47.5	44.9	14.8
Queue Delay	0.0	25.7	0.0	0.0	0.8	499.8	0.0	0.0	0.0	0.0	1.1
Total Delay	77.6	66.3	15.5	50.5	1.3	577.2	62.7	14.7	47.5	44.9	15.9
Queue Length 50th (ft)	74	766	13	114	12	75	70	0	32	12	0
Queue Length 95th (ft)	m107	m806	m22	m105	m11	133	123	67	67	34	30
Internal Link Dist (ft)		585			1015		352			692	
Turn Bay Length (ft)	270		180								
Base Capacity (vph)	159	3165	993	189	3190	171	229	314	184	344	320
Starvation Cap Reductn	0	784	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	367	127	0	0	0	0	181
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	1.05	0.04	0.67	0.88	2.07	0.38	0.52	0.24	0.05	0.24

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	2374	34	121	1982	389	86	83	154	43	16	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	1770	4960		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.75	1.00	1.00	0.52	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	1770	4960		1390	1863	1583	964	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	100	2499	36	127	2086	409	91	87	162	45	17	34
RTOR Reduction (vph)	0	0	8	0	21	0	0	0	146	0	0	29
Lane Group Flow (vph)	100	2499	28	127	2474	0	91	87	16	45	17	5
Turn Type	Prot		Perm	Prot			Perm		Over	pm+pt		Perm
Protected Phases	7	4		3	8			2	3	1	6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	10.8	80.1	80.1	13.0	82.3		13.0	13.0	13.0	20.4	20.4	20.4
Effective Green, g (s)	10.8	80.1	80.1	13.0	82.3		13.0	13.0	13.0	20.4	20.4	20.4
Actuated g/C Ratio	0.08	0.62	0.62	0.10	0.63		0.10	0.10	0.10	0.16	0.16	0.16
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	147	3133	975	177	3140		139	186	158	172	292	248
v/s Ratio Prot	0.06	0.49		c0.07	c0.50			0.05	0.01	c0.01	0.01	
v/s Ratio Perm			0.02				c0.07			0.03		0.00
v/c Ratio	0.68	0.80	0.03	0.72	0.79		0.65	0.47	0.10	0.26	0.06	0.02
Uniform Delay, d1	57.9	18.8	9.7	56.7	17.5		56.3	55.2	53.2	47.5	46.6	46.4
Progression Factor	1.08	1.99	2.41	0.84	0.02		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.0	1.4	0.0	1.3	0.2		10.6	1.9	0.3	0.8	0.1	0.0
Delay (s)	70.3	38.9	23.5	49.1	0.5		66.9	57.1	53.5	48.3	46.7	46.4
Level of Service	E	D	C	D	A		E	E	D	D	D	D
Approach Delay (s)		39.9			2.8			58.0			47.3	
Approach LOS		D			A			E			D	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	95	2518	3233	148
v/c Ratio	0.38	0.76	1.11	0.27
Control Delay	32.1	9.5	74.0	32.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	32.1	9.5	74.0	32.3
Queue Length 50th (ft)	70	173	~1123	35
Queue Length 95th (ft)	m80	307	m#366	70
Internal Link Dist (ft)		1015	1000	632
Turn Bay Length (ft)				150
Base Capacity (vph)	456	3325	2900	551
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.76	1.11	0.27

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	90	2392	2524	547	87	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5		5.5	
Lane Util. Factor	1.00	0.91	0.91		0.97	
Frt	1.00	1.00	0.97		0.94	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	5085	4949		3306	
Flt Permitted	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	5085	4949		3306	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	2518	2657	576	92	56
RTOR Reduction (vph)	0	0	26	0	47	0
Lane Group Flow (vph)	95	2518	3207	0	101	0
Turn Type	Prot					
Protected Phases	7 9	4	8		6	
Permitted Phases						
Actuated Green, G (s)	18.2	85.0	75.5		19.8	
Effective Green, g (s)	18.2	85.0	75.5		19.8	
Actuated g/C Ratio	0.14	0.65	0.58		0.15	
Clearance Time (s)		5.5	5.5		5.5	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)	248	3325	2874		504	
v/s Ratio Prot	c0.05	c0.50	c0.65		c0.03	
v/s Ratio Perm						
v/c Ratio	0.38	0.76	1.12		0.20	
Uniform Delay, d1	50.8	15.4	27.2		48.2	
Progression Factor	0.58	0.54	0.76		1.00	
Incremental Delay, d2	0.6	1.0	52.6		0.9	
Delay (s)	30.3	9.4	73.3		49.1	
Level of Service	C	A	E		D	
Approach Delay (s)		10.2	73.3		49.1	
Approach LOS		B	E		D	

Intersection Summary			
HCM Average Control Delay	45.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	144	2392	65	44	3585	173	48	113
v/c Ratio	1.01	0.68	0.06	0.41	1.08	1.08	0.28	0.37
Control Delay	102.1	1.4	0.1	69.7	65.2	146.1	55.4	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	102.1	1.4	0.1	69.7	65.2	146.1	55.4	16.9
Queue Length 50th (ft)	~118	25	0	36	~1235	~162	37	12
Queue Length 95th (ft)	m#207	29	m0	77	#1305	#313	78	69
Internal Link Dist (ft)		1000			893	425		590
Turn Bay Length (ft)	150			300				
Base Capacity (vph)	143	3531	1119	124	3320	160	173	302
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.68	0.06	0.35	1.08	1.08	0.28	0.37

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	137	2272	62	42	3202	203	117	36	11	46	15	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91			1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99			0.99		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.97		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5040			1782		1770	1623	
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.63		0.69	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5040			1172		1286	1623	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	144	2392	65	44	3371	214	123	38	12	48	16	97
RTOR Reduction (vph)	0	0	20	0	6	0	0	2	0	0	84	0
Lane Group Flow (vph)	144	2392	45	44	3579	0	0	171	0	48	29	0
Turn Type	Prot		Perm	Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2			6		
Actuated Green, G (s)	11.6	89.2	89.2	6.8	84.4			17.5		17.5	17.5	
Effective Green, g (s)	11.6	89.2	89.2	6.8	84.4			17.5		17.5	17.5	
Actuated g/C Ratio	0.09	0.69	0.69	0.05	0.65			0.13		0.13	0.13	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	158	3489	1086	93	3272			158		173	218	
v/s Ratio Prot	c0.08	0.47		0.02	c0.71						0.02	
v/s Ratio Perm			0.03					c0.15		0.04		
v/c Ratio	0.91	0.69	0.04	0.47	1.09			1.08		0.28	0.13	
Uniform Delay, d1	58.7	12.1	6.6	59.9	22.8			56.2		50.6	49.6	
Progression Factor	0.60	0.06	0.00	1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	34.9	0.7	0.0	3.8	47.9			95.8		0.9	0.3	
Delay (s)	70.4	1.4	0.0	63.6	70.7			152.0		51.4	49.8	
Level of Service	E	A	A	E	E			F		D	D	
Approach Delay (s)		5.2			70.6			152.0			50.3	
Approach LOS		A			E			F			D	

Intersection Summary			
HCM Average Control Delay	46.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	103.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
3: 7th St & Park Ave

2/20/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	16	1121	74	1274	72	168	494	53	125	87
v/c Ratio	0.12	0.75	0.30	0.71	0.17	0.27	0.78	0.13	0.20	0.16
Control Delay	17.5	20.9	11.6	15.4	16.1	16.8	22.2	15.7	16.1	11.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.5	20.9	11.6	15.4	16.1	16.8	22.2	15.7	16.1	11.2
Queue Length 50th (ft)	4	191	12	183	21	50	124	15	36	16
Queue Length 95th (ft)	19	319	37	318	47	91	232	37	70	43
Internal Link Dist (ft)		588		707		495			498	
Turn Bay Length (ft)	70		180		30		30	100		90
Base Capacity (vph)	154	1797	245	2223	666	985	910	634	985	851
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.62	0.30	0.57	0.11	0.17	0.54	0.08	0.13	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	1004	61	70	1199	11	68	160	469	50	119	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3509		1770	3534		1770	1863	1583	1770	1863	1583
Flt Permitted	0.16	1.00		0.14	1.00		0.68	1.00	1.00	0.64	1.00	1.00
Satd. Flow (perm)	301	3509		258	3534		1261	1863	1583	1201	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	1057	64	74	1262	12	72	168	494	53	125	87
RTOR Reduction (vph)	0	6	0	0	1	0	0	0	104	0	0	21
Lane Group Flow (vph)	16	1115	0	74	1273	0	72	168	390	53	125	66
Turn Type	Perm			pm+pt			Perm		Perm	Perm		Perm
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	25.9	25.9		31.8	31.8		20.6	20.6	20.6	20.6	20.6	20.6
Effective Green, g (s)	25.9	25.9		31.8	31.8		20.6	20.6	20.6	20.6	20.6	20.6
Actuated g/C Ratio	0.42	0.42		0.52	0.52		0.34	0.34	0.34	0.34	0.34	0.34
Clearance Time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	127	1480		205	1830		423	625	531	403	625	531
v/s Ratio Prot		0.32		0.02	c0.36			0.09			0.07	
v/s Ratio Perm	0.05			0.17			0.06		c0.25	0.04		0.04
v/c Ratio	0.13	0.75		0.36	0.70		0.17	0.27	0.74	0.13	0.20	0.13
Uniform Delay, d1	10.8	15.0		9.7	11.2		14.4	14.9	18.0	14.2	14.5	14.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	2.2		1.1	1.2		0.2	0.2	5.2	0.1	0.2	0.1
Delay (s)	11.3	17.3		10.7	12.3		14.6	15.1	23.2	14.3	14.7	14.3
Level of Service	B	B		B	B		B	B	C	B	B	B
Approach Delay (s)		17.2			12.2			20.5			14.5	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	61.4	Sum of lost time (s)	9.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
25: I-405 SB Off Ramp & Studebaker Rd

11/21/2012

Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	438	1067	1552
v/c Ratio	0.62	0.46	0.67
Control Delay	23.4	5.7	8.3
Queue Delay	0.0	0.1	0.5
Total Delay	23.4	5.8	8.8
Queue Length 50th (ft)	68	125	206
Queue Length 95th (ft)	101	42	337
Internal Link Dist (ft)	342	302	370
Turn Bay Length (ft)	170		
Base Capacity (vph)	889	2323	2323
Starvation Cap Reductn	0	321	341
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.49	0.53	0.78

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	188	228	0	1014	1474	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.92			1.00	1.00	
Flt Protected	0.98			1.00	1.00	
Satd. Flow (prot)	3243			3539	3539	
Flt Permitted	0.98			1.00	1.00	
Satd. Flow (perm)	3243			3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	198	240	0	1067	1552	0
RTOR Reduction (vph)	26	0	0	0	0	0
Lane Group Flow (vph)	412	0	0	1067	1552	0
Turn Type						
Protected Phases	4			2	6	
Permitted Phases						
Actuated Green, G (s)	12.6			39.4	39.4	
Effective Green, g (s)	12.6			39.4	39.4	
Actuated g/C Ratio	0.21			0.66	0.66	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	681			2324	2324	
v/s Ratio Prot	c0.13			0.30	c0.44	
v/s Ratio Perm						
v/c Ratio	0.60			0.46	0.67	
Uniform Delay, d1	21.4			5.1	6.3	
Progression Factor	1.00			0.90	0.99	
Incremental Delay, d2	1.5			0.6	1.3	
Delay (s)	23.0			5.2	7.5	
Level of Service	C			A	A	
Approach Delay (s)	23.0			5.2	7.5	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Queues
29: College Park Dr & SR-22 Ramps

11/21/2012

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	185	156	847	39	293
v/c Ratio	0.55	0.36	0.75	0.23	0.23
Control Delay	27.4	6.4	18.5	31.1	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	27.4	6.4	18.5	31.1	4.2
Queue Length 50th (ft)	61	0	145	14	41
Queue Length 95th (ft)	105	37	#521	32	68
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	472	537	1132	171	1258
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.39	0.29	0.75	0.23	0.23

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	176	148	740	65	37	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1843		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	1843		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	185	156	779	68	39	293
RTOR Reduction (vph)	0	126	4	0	0	0
Lane Group Flow (vph)	185	30	843	0	39	293
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	11.5	11.5	34.3		2.2	40.5
Effective Green, g (s)	11.5	11.5	34.3		2.2	40.5
Actuated g/C Ratio	0.19	0.19	0.57		0.04	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	339	303	1054		65	1258
v/s Ratio Prot	c0.10		c0.46		c0.02	0.16
v/s Ratio Perm		0.02				
v/c Ratio	0.55	0.10	0.80		0.60	0.23
Uniform Delay, d1	21.9	20.0	10.1		28.5	3.8
Progression Factor	1.00	1.00	1.00		1.10	0.88
Incremental Delay, d2	1.8	0.1	6.4		13.9	0.4
Delay (s)	23.7	20.1	16.5		45.1	3.7
Level of Service	C	C	B		D	A
Approach Delay (s)	22.1		16.5			8.6
Approach LOS	C		B			A

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Carson St & I-605 SB Off Ramps

11/30/2012

Lane Group	EBT	WBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	2032	1400	542	993	568	261
v/c Ratio	0.74	0.64	0.34	0.61	0.38	0.38
Control Delay	27.5	16.7	0.6	23.8	19.2	19.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.5	16.7	0.6	23.8	19.2	19.8
Queue Length 50th (ft)	327	224	0	267	136	121
Queue Length 95th (ft)	371	251	0	335	183	195
Internal Link Dist (ft)	550	190			1136	
Turn Bay Length (ft)				300		300
Base Capacity (vph)	2835	2270	1611	1627	1508	691
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.62	0.34	0.61	0.38	0.38

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1754	177	0	1330	0	0	0	515	943	302	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9				4.0	5.4	5.4	5.4
Lane Util. Factor		0.86			0.91				1.00	0.97	0.91	0.91
Frt		0.99			1.00				0.86	1.00	0.93	0.85
Flt Protected		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (prot)		6320			5085				1611	3433	3166	1441
Flt Permitted		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (perm)		6320			5085				1611	3433	3166	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1846	186	0	1400	0	0	0	542	993	318	511
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	0	0	8	8
Lane Group Flow (vph)	0	2017	0	0	1400	0	0	0	542	993	560	253
Turn Type									Free	Split		Perm
Protected Phases		2			6					4	4	
Permitted Phases									Free			4
Actuated Green, G (s)		47.6			47.6				110.0	52.1	52.1	52.1
Effective Green, g (s)		47.6			47.6				110.0	52.1	52.1	52.1
Actuated g/C Ratio		0.43			0.43				1.00	0.47	0.47	0.47
Clearance Time (s)		4.9			4.9					5.4	5.4	5.4
Vehicle Extension (s)		5.0			5.0					2.5	2.5	2.5
Lane Grp Cap (vph)		2735			2200				1611	1626	1500	683
v/s Ratio Prot		c0.32			0.28					c0.29	0.18	
v/s Ratio Perm									0.34			0.18
v/c Ratio		0.74			0.64				0.34	0.61	0.37	0.37
Uniform Delay, d1		26.0			24.4				0.0	21.4	18.5	18.5
Progression Factor		1.00			0.64				1.00	1.00	1.00	1.00
Incremental Delay, d2		1.3			0.7				0.6	1.7	0.7	1.5
Delay (s)		27.3			16.3				0.6	23.2	19.2	20.0
Level of Service		C			B				A	C	B	C
Approach Delay (s)		27.3			16.3			0.6			21.5	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	3114	1188	721	692	341
v/c Ratio	0.79	0.55	0.58	0.67	0.41
Control Delay	12.4	6.0	3.2	37.6	32.4
Queue Delay	0.0	0.7	1.7	0.0	0.0
Total Delay	12.5	6.8	4.9	37.6	32.4
Queue Length 50th (ft)	285	103	54	220	108
Queue Length 95th (ft)	304	160	m71	285	155
Internal Link Dist (ft)	410	90			
Turn Bay Length (ft)				300	300
Base Capacity (vph)	3938	2175	1251	1030	837
Starvation Cap Reductn	27	601	346	0	0
Spillback Cap Reductn	13	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.80	0.75	0.80	0.67	0.41

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	2958	0	0	1129	685	657	0	324	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4			5.4	5.4	4.0		4.0			
Lane Util. Factor		0.86			0.95	1.00	0.97		0.88			
Frt		1.00			1.00	0.85	1.00		0.85			
Flt Protected		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)		6408			3539	1583	3433		2787			
Flt Permitted		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)		6408			3539	1583	3433		2787			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	3114	0	0	1188	721	692	0	341	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	278	0	0	1	0	0	0
Lane Group Flow (vph)	0	3114	0	0	1188	443	692	0	340	0	0	0
Turn Type						Perm	custom		custom			
Protected Phases		2			6							
Permitted Phases						6	8		8			
Actuated Green, G (s)		67.6			67.6	67.6	33.0		33.0			
Effective Green, g (s)		67.6			67.6	67.6	33.0		33.0			
Actuated g/C Ratio		0.61			0.61	0.61	0.30		0.30			
Clearance Time (s)		5.4			5.4	5.4	4.0		4.0			
Vehicle Extension (s)		5.0			5.0	5.0	3.0		3.0			
Lane Grp Cap (vph)		3938			2175	973	1030		836			
v/s Ratio Prot		c0.49			0.34							
v/s Ratio Perm						0.28	c0.20		0.12			
v/c Ratio		0.79			0.55	0.46	0.67		0.41			
Uniform Delay, d1		15.9			12.3	11.3	33.8		30.7			
Progression Factor		0.68			0.43	2.34	1.00		1.00			
Incremental Delay, d2		1.1			0.3	0.5	3.5		1.5			
Delay (s)		12.0			5.6	27.1	37.2		32.2			
Level of Service		B			A	C	D		C			
Approach Delay (s)		12.0			13.7			35.6			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	9.4
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	761	2119	5	1057	247	103	145	314	310
v/c Ratio	0.89	0.79	0.04	0.79	0.85	0.31	0.21	0.80	0.66
Control Delay	37.0	11.0	49.4	42.3	71.9	45.2	36.8	31.1	12.0
Queue Delay	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.0	11.3	49.4	42.3	71.9	45.2	36.8	31.1	12.0
Queue Length 50th (ft)	273	80	3	255	173	33	43	70	0
Queue Length 95th (ft)	#372	#113	16	310	#332	60	72	#183	85
Internal Link Dist (ft)		311		731		382		448	
Turn Bay Length (ft)	250		80		120		140		140
Base Capacity (vph)	852	2696	113	1343	290	784	702	430	505
Starvation Cap Reductn	0	147	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	0.89	0.83	0.04	0.79	0.85	0.13	0.21	0.73	0.61

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												
Volume (vph)	723	1801	212	5	915	89	235	89	9	138	47	546
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Lane Util. Factor	0.97	0.91		1.00	0.91		1.00	0.95		0.97	0.95	0.95
Frt	1.00	0.98		1.00	0.99		1.00	0.99		1.00	0.87	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	5005		1770	5017		1770	3493		3433	1546	1504
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	5005		1770	5017		1770	3493		3433	1546	1504
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	761	1896	223	5	963	94	247	94	9	145	49	575
RTOR Reduction (vph)	0	11	0	0	11	0	0	7	0	0	183	268
Lane Group Flow (vph)	761	2108	0	5	1046	0	247	96	0	145	131	42
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	31.2	55.1		1.4	25.3		18.0	10.4		22.5	14.9	14.9
Effective Green, g (s)	31.2	55.1		1.4	25.3		18.0	10.4		22.5	14.9	14.9
Actuated g/C Ratio	0.28	0.50		0.01	0.23		0.16	0.09		0.20	0.14	0.14
Clearance Time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	974	2507		23	1154		290	330		702	209	204
v/s Ratio Prot	0.22	c0.42		0.00	c0.21		c0.14	0.03		c0.04	c0.08	
v/s Ratio Perm												0.03
v/c Ratio	0.78	0.84		0.22	0.91		0.85	0.29		0.21	0.63	0.21
Uniform Delay, d1	36.3	23.7		53.8	41.2		44.7	46.4		36.3	44.9	42.3
Progression Factor	0.67	0.40		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	2.3		6.4	11.8		21.3	0.7		0.2	6.5	0.7
Delay (s)	27.0	11.7		60.2	53.0		66.0	47.0		36.5	51.4	43.0
Level of Service	C	B		E	D		E	D		D	D	D
Approach Delay (s)		15.8			53.1			60.4			45.2	
Approach LOS		B			D			E			D	

Intersection Summary			
HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.6
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	1856	1231	601	908
v/c Ratio	0.60	0.57	0.70	0.57
Control Delay	9.8	10.0	28.0	1.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	9.8	10.0	28.0	1.5
Queue Length 50th (ft)	156	145	121	0
Queue Length 95th (ft)	242	242	155	0
Internal Link Dist (ft)	898	560	1261	
Turn Bay Length (ft)			230	900
Base Capacity (vph)	3119	2171	1658	1583
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.60	0.57	0.36	0.57

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1763	1169	0	571	863
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.3	5.3		4.2	4.0
Lane Util. Factor		0.91	0.95		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	3539		3433	1583
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	3539		3433	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1856	1231	0	601	908
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1856	1231	0	601	908
Turn Type						Free
Protected Phases		2	6		4	
Permitted Phases						Free
Actuated Green, G (s)		42.9	42.9		17.6	70.0
Effective Green, g (s)		42.9	42.9		17.6	70.0
Actuated g/C Ratio		0.61	0.61		0.25	1.00
Clearance Time (s)		5.3	5.3		4.2	
Vehicle Extension (s)		5.0	5.0		2.5	
Lane Grp Cap (vph)		3116	2169		863	1583
v/s Ratio Prot		0.36	0.35		0.18	
v/s Ratio Perm						c0.57
v/c Ratio		0.60	0.57		0.70	0.57
Uniform Delay, d1		8.3	8.0		23.8	0.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.8	1.0		2.3	1.5
Delay (s)		9.1	9.1		26.0	1.5
Level of Service		A	A		C	A
Approach Delay (s)		9.1	9.1		11.3	
Approach LOS		A	A		B	

Intersection Summary			
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT
Lane Group Flow (vph)	1951	936	155	1206
v/c Ratio	0.74	0.76	0.70	0.34
Control Delay	8.8	9.9	48.6	0.3
Queue Delay	0.1	0.1	0.0	0.0
Total Delay	8.9	9.9	48.6	0.3
Queue Length 50th (ft)	290	226	65	0
Queue Length 95th (ft)	396	411	#145	0
Internal Link Dist (ft)	560			522
Turn Bay Length (ft)			260	
Base Capacity (vph)	2630	1235	228	3539
Starvation Cap Reductn	99	13	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.77	0.77	0.68	0.34

Intersection Summary

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

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1853	889	147	1146	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	4.0	5.3		
Lane Util. Factor	0.95	1.00	1.00	0.95		
Frt	1.00	0.85	1.00	1.00		
Flt Protected	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	3539	1583	1770	3539		
Flt Permitted	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	3539	1583	1770	3539		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1951	936	155	1206	0	0
RTOR Reduction (vph)	0	58	0	0	0	0
Lane Group Flow (vph)	1951	878	155	1206	0	0
Turn Type		Perm	Prot			
Protected Phases	2		1	6		
Permitted Phases		2				
Actuated Green, G (s)	52.0	52.0	8.7	70.0		
Effective Green, g (s)	52.0	52.0	8.7	70.0		
Actuated g/C Ratio	0.74	0.74	0.12	1.00		
Clearance Time (s)	5.3	5.3	4.0	5.3		
Vehicle Extension (s)	5.0	5.0	3.0	5.0		
Lane Grp Cap (vph)	2629	1176	220	3539		
v/s Ratio Prot	0.55		c0.09	0.34		
v/s Ratio Perm		c0.55				
v/c Ratio	0.74	0.75	0.70	0.34		
Uniform Delay, d1	5.2	5.2	29.4	0.0		
Progression Factor	1.27	1.30	1.00	1.00		
Incremental Delay, d2	1.8	3.9	9.8	0.3		
Delay (s)	8.3	10.7	39.2	0.3		
Level of Service	A	B	D	A		
Approach Delay (s)	9.1			4.7	0.0	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	349	0	0	624	0	734	611	0	692	298
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	367	0	0	657	0	773	643	0	728	314
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1120				
pX, platoon unblocked	0.91	0.91		0.91	0.91	0.91				0.91		
vC, conflicting volume	986	1501	243	1015	1501	258	728			773		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	642	1208	243	674	1208	0	728			408		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	52	100	100	33	100			100		
cM capacity (veh/h)	109	166	758	160	166	988	871			1045		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	367	657	309	309	369	429	291	291	250	209
Volume Left	0	0	0	0	0	0	0	0	0	0
Volume Right	367	657	0	0	214	429	0	0	105	209
cSH	758	988	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.48	0.67	0.18	0.18	0.22	0.25	0.17	0.17	0.15	0.12
Queue Length 95th (ft)	67	132	0	0	0	0	0	0	0	0
Control Delay (s)	14.1	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	C								
Approach Delay (s)	14.1	15.6	0.0				0.0			
Approach LOS	B	C								

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	701	0	1230	586	370
Sign Control	Yield			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	738	0	1295	617	389
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked	0.89					
vC, conflicting volume	941	206	617			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	297	206	617			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	8	100			
cM capacity (veh/h)	594	801	959			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	738	324	324	324	324	247	247	253	260
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	738	0	0	0	0	0	0	130	260
cSH	801	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.92	0.19	0.19	0.19	0.19	0.15	0.15	0.15	0.15
Queue Length 95th (ft)	329	0	0	0	0	0	0	0	0
Control Delay (s)	38.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	E								
Approach Delay (s)	38.5	0.0				0.0			
Approach LOS	E								

Intersection Summary			
Average Delay	9.3		
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	136	2072	272	220	929	228	212	1036	180	1088
v/c Ratio	0.49	1.03	0.33	0.91	0.50	0.34	0.88	0.70	0.62	0.88
Control Delay	50.4	57.3	14.8	86.8	24.4	4.4	81.1	36.2	55.7	44.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.4	57.3	14.8	86.8	24.4	4.4	81.1	36.2	55.7	44.6
Queue Length 50th (ft)	43	~520	93	73	172	0	70	168	58	239
Queue Length 95th (ft)	74	#616	148	#143	215	54	#137	201	#119	#301
Internal Link Dist (ft)		578			652			1209		560
Turn Bay Length (ft)	175			150			180		150	
Base Capacity (vph)	286	2021	830	241	1858	667	241	1634	290	1260
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	1.03	0.33	0.91	0.50	0.34	0.88	0.63	0.62	0.86

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	129	1968	258	209	859	240	201	835	149	171	917	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Lane Util. Factor	0.97	0.91	1.00	0.97	0.86	0.86	0.97	0.86		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	5085	1583	3433	4786	1362	3433	6262		3433	4999	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	5085	1583	3433	4786	1362	3433	6262		3433	4999	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	2072	272	220	904	253	212	879	157	180	965	123
RTOR Reduction (vph)	0	0	4	0	2	140	0	33	0	0	16	0
Lane Group Flow (vph)	136	2072	268	220	927	88	212	1003	0	180	1072	0
Turn Type	Prot		pm+ov	Prot		Perm	Prot			Prot		
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	8.0	39.6	46.6	7.0	38.6	38.6	7.0	23.0		8.5	24.5	
Effective Green, g (s)	8.0	39.6	46.6	7.0	38.6	38.6	7.0	23.0		8.5	24.5	
Actuated g/C Ratio	0.08	0.40	0.47	0.07	0.39	0.39	0.07	0.23		0.09	0.25	
Clearance Time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	275	2020	826	241	1853	527	241	1445		293	1228	
v/s Ratio Prot	0.04	c0.41	0.02	c0.06	0.19		0.06	c0.16		0.05	c0.21	
v/s Ratio Perm			0.15			0.06						
v/c Ratio	0.49	1.03	0.32	0.91	0.50	0.17	0.88	0.69		0.61	0.87	
Uniform Delay, d1	43.9	30.1	16.7	46.0	23.2	20.0	45.9	35.1		44.0	36.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4	26.9	0.2	35.3	0.2	0.2	28.4	1.5		3.8	7.1	
Delay (s)	45.3	56.9	16.9	81.3	23.4	20.2	74.3	36.6		47.8	43.2	
Level of Service	D	E	B	F	C	C	E	D		D	D	
Approach Delay (s)		51.9			32.1			43.0			43.9	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM Average Control Delay	44.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	99.7	Sum of lost time (s)	16.2
Intersection Capacity Utilization	88.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1712	638	0	735	0	0	0	0	0	0	677
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	1802	672	0	774	0	0	0	0	0	0	713
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		732										
pX, platoon unblocked				0.62			0.62	0.62	0.62	0.62	0.62	
vC, conflicting volume	774			2474			2396	2912	936	1374	3247	258
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	774			1231			1105	1937	0	0	2479	258
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	4
cM capacity (veh/h)	838			348			4	40	672	634	18	741

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	721	721	1032	258	258	258	713
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	672	0	0	0	713
cSH	1700	1700	1700	1700	1700	1700	741
Volume to Capacity	0.42	0.42	0.61	0.15	0.15	0.15	0.96
Queue Length 95th (ft)	0	0	0	0	0	0	367
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	47.9
Lane LOS							E
Approach Delay (s)	0.0			0.0			47.9
Approach LOS							E

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	45	168	218	208	18	1654	473	1782
v/c Ratio	0.41	0.64	0.72	0.69	0.15	0.51	0.35	0.52
Control Delay	44.0	53.9	40.5	37.8	3.7	2.8	0.4	10.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.0	53.9	40.5	37.8	3.7	2.8	0.4	10.4
Queue Length 50th (ft)	17	118	103	90	2	57	0	217
Queue Length 95th (ft)	55	181	182	165	m2	m59	m0	308
Internal Link Dist (ft)	296		624			121		607
Turn Bay Length (ft)				470	120			
Base Capacity (vph)	112	367	391	391	120	3249	1362	3455
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.46	0.56	0.53	0.15	0.51	0.35	0.52

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	0	19	178	40	347	17	1486	535	0	1674	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		5.0	5.0	5.0	5.0	5.0	4.0		5.0	
Lane Util. Factor		1.00		0.95	0.91	0.95	1.00	0.86	0.86		0.91	
Frt		0.94		1.00	0.89	0.85	1.00	0.99	0.85		1.00	
Flt Protected		0.97		0.95	1.00	1.00	0.95	1.00	1.00		1.00	
Satd. Flow (prot)		1704		1681	1505	1504	1770	4767	1362		5077	
Flt Permitted		0.97		0.95	1.00	1.00	0.09	1.00	1.00		1.00	
Satd. Flow (perm)		1704		1681	1505	1504	177	4767	1362		5077	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	25	0	20	187	42	365	18	1564	563	0	1762	20
RTOR Reduction (vph)	0	19	0	0	67	67	0	4	0	0	1	0
Lane Group Flow (vph)	0	26	0	168	151	141	18	1650	473	0	1781	0
Turn Type	Split			Split		Perm	Perm		Free			
Protected Phases	4	4		8	8			2			6	
Permitted Phases						8	2		Free			
Actuated Green, G (s)		4.8		17.2	17.2	17.2	74.0	74.0	110.0		74.0	
Effective Green, g (s)		4.8		17.2	17.2	17.2	74.0	74.0	110.0		74.0	
Actuated g/C Ratio		0.04		0.16	0.16	0.16	0.67	0.67	1.00		0.67	
Clearance Time (s)		4.0		5.0	5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		74		263	235	235	119	3207	1362		3415	
v/s Ratio Prot		0.02		0.10	c0.10			0.35			c0.35	
v/s Ratio Perm						0.09	0.10		c0.35			
v/c Ratio		0.35		0.64	0.64	0.60	0.15	0.51	0.35		0.52	
Uniform Delay, d1		51.1		43.5	43.5	43.2	6.6	9.0	0.0		9.1	
Progression Factor		1.00		1.00	1.00	1.00	0.31	0.27	1.00		1.00	
Incremental Delay, d2		2.8		5.0	5.8	4.1	0.6	0.1	0.2		0.6	
Delay (s)		53.9		48.5	49.3	47.2	2.6	2.6	0.2		9.6	
Level of Service		D		D	D	D	A	A	A		A	
Approach Delay (s)		53.9			48.4			2.0			9.6	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	101	1910	215	1109	128	1988	146	1538
v/c Ratio	0.56	1.32	1.11	0.70	0.72	1.07	1.01	0.87
Control Delay	59.9	181.9	139.0	8.6	32.2	48.0	135.1	31.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	79.4	0.0	0.3
Total Delay	59.9	181.9	139.0	8.6	32.2	127.4	135.1	31.5
Queue Length 50th (ft)	68	~642	~159	32	81	~244	~102	316
Queue Length 95th (ft)	126	#740	#311	37	m79	m#153	#246	227
Internal Link Dist (ft)		1129		409		285		200
Turn Bay Length (ft)	140		110		150		120	
Base Capacity (vph)	192	1448	193	1632	177	1866	145	1773
Starvation Cap Reductn	0	0	0	0	0	272	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	31
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	1.32	1.11	0.68	0.72	1.25	1.01	0.88

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	1664	150	204	781	273	122	1811	78	139	1403	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.91		1.00	0.91	
Frt	1.00	0.99		1.00	0.96		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5022		1770	4888		1770	5054		1770	5055	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5022		1770	4888		1770	5054		1770	5055	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	101	1752	158	215	822	287	128	1906	82	146	1477	61
RTOR Reduction (vph)	0	9	0	0	56	0	0	4	0	0	4	0
Lane Group Flow (vph)	101	1901	0	215	1053	0	128	1984	0	146	1534	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.7	32.3		12.0	34.6		11.0	39.7		9.0	37.7	
Effective Green, g (s)	9.7	32.3		12.0	34.6		11.0	39.7		9.0	37.7	
Actuated g/C Ratio	0.09	0.29		0.11	0.31		0.10	0.36		0.08	0.34	
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	156	1475		193	1537		177	1824		145	1732	
v/s Ratio Prot	0.06	c0.38		c0.12	0.22		0.07	c0.39		0.08	c0.30	
v/s Ratio Perm												
v/c Ratio	0.65	1.29		1.11	0.69		0.72	1.09		1.01	0.89	
Uniform Delay, d1	48.5	38.9		49.0	32.9		48.0	35.1		50.5	34.1	
Progression Factor	1.00	1.00		1.06	0.21		0.58	0.43		1.29	0.77	
Incremental Delay, d2	8.9	135.1		91.2	1.0		1.3	40.4		71.8	6.3	
Delay (s)	57.4	174.0		143.3	7.9		29.3	55.4		136.9	32.4	
Level of Service	E	F		F	A		C	E		F	C	
Approach Delay (s)		168.1			29.9			53.8			41.5	
Approach LOS		F			C			D			D	

Intersection Summary			
HCM Average Control Delay	78.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	105.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	441	1198	321	268	673	25	1681	516	1850
v/c Ratio	1.03	0.92	0.80	0.98	0.71	0.37	1.04	0.55	0.81
Control Delay	95.6	47.3	43.9	71.9	33.4	38.7	65.4	7.8	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	1.2
Total Delay	95.6	47.3	43.9	71.9	33.4	38.7	70.2	7.8	8.6
Queue Length 50th (ft)	~339	329	227	204	124	11	~679	54	88
Queue Length 95th (ft)	#583	#414	#384	m207	m96	43	#818	147	m93
Internal Link Dist (ft)		339			174		323		285
Turn Bay Length (ft)	200			175		175			
Base Capacity (vph)	427	1307	403	274	1109	68	1609	930	2278
Starvation Cap Reductn	0	0	0	0	0	0	0	0	216
Spillback Cap Reductn	0	0	0	0	0	0	19	12	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.03	0.92	0.80	0.98	0.61	0.37	1.06	0.56	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	419	1104	339	255	635	5	24	1597	490	0	1242	516
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor	1.00	0.86	0.86	1.00	0.91		1.00	0.95	1.00		0.91	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)	1770	4784	1362	1770	5080		1770	3539	1583		4861	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.08	1.00	1.00		1.00	
Satd. Flow (perm)	1770	4784	1362	1770	5080		149	3539	1583		4861	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	441	1162	357	268	668	5	25	1681	516	0	1307	543
RTOR Reduction (vph)	0	3	32	0	1	0	0	0	210	0	68	0
Lane Group Flow (vph)	441	1195	289	268	672	0	25	1681	306	0	1782	0
Turn Type	Prot		Perm	Prot			Perm		Perm			
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2		2			
Actuated Green, G (s)	26.6	30.0	30.0	17.0	20.4		50.0	50.0	50.0		50.0	
Effective Green, g (s)	26.6	30.0	30.0	17.0	20.4		50.0	50.0	50.0		50.0	
Actuated g/C Ratio	0.24	0.27	0.27	0.15	0.19		0.45	0.45	0.45		0.45	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	428	1305	371	274	942		68	1609	720		2210	
v/s Ratio Prot	c0.25	c0.25		0.15	0.13			c0.47			0.37	
v/s Ratio Perm			0.21				0.17		0.19			
v/c Ratio	1.03	0.92	0.78	0.98	0.71		0.37	1.04	0.42		0.81	
Uniform Delay, d1	41.7	38.8	36.9	46.3	42.1		19.6	30.0	20.3		25.8	
Progression Factor	1.08	0.93	0.90	0.99	0.77		1.00	1.00	1.00		0.26	
Incremental Delay, d2	50.2	9.6	9.4	24.2	0.8		14.6	35.1	1.8		1.2	
Delay (s)	95.2	45.6	42.4	70.1	33.1		34.3	65.1	22.1		7.8	
Level of Service	F	D	D	E	C		C	E	C		A	
Approach Delay (s)		56.2			43.6			54.8			7.8	
Approach LOS		E			D			D			A	

Intersection Summary			
HCM Average Control Delay	41.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	93.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	368	1788	0	0	1816
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	387	1882	0	0	1912
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						629
pX, platoon unblocked	0.74					
vC, conflicting volume	2519	627			1882	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1811	627			1882	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	9			100	
cM capacity (veh/h)	51	426			315	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	387	627	627	627	637	637	637
Volume Left	0	0	0	0	0	0	0
Volume Right	387	0	0	0	0	0	0
cSH	426	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.91	0.37	0.37	0.37	0.37	0.37	0.37
Queue Length 95th (ft)	247	0	0	0	0	0	0
Control Delay (s)	55.2	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	F						
Approach Delay (s)	55.2	0.0			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	1299	1038	661
v/c Ratio	0.38	0.30	0.78
Control Delay	8.6	3.3	43.8
Queue Delay	0.0	0.0	0.0
Total Delay	8.6	3.3	43.8
Queue Length 50th (ft)	130	42	218
Queue Length 95th (ft)	191	110	260
Internal Link Dist (ft)	736	218	493
Turn Bay Length (ft)			
Base Capacity (vph)	3444	3444	1368
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.38	0.30	0.48

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1234	986	0	533	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5		4.0	
Lane Util. Factor		0.91	0.91		0.97	
Frt		1.00	1.00		0.98	
Flt Protected		1.00	1.00		0.96	
Satd. Flow (prot)		5085	5085		3388	
Flt Permitted		1.00	1.00		0.96	
Satd. Flow (perm)		5085	5085		3388	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1299	1038	0	561	100
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	0	1299	1038	0	644	0
Turn Type						
Protected Phases		4	8		6	
Permitted Phases						
Actuated Green, G (s)		74.5	74.5		27.0	
Effective Green, g (s)		74.5	74.5		27.0	
Actuated g/C Ratio		0.68	0.68		0.25	
Clearance Time (s)		4.5	4.5		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		3444	3444		832	
v/s Ratio Prot		c0.26	0.20		c0.19	
v/s Ratio Perm						
v/c Ratio		0.38	0.30		0.77	
Uniform Delay, d1		7.7	7.2		38.7	
Progression Factor		1.00	0.40		1.00	
Incremental Delay, d2		0.3	0.2		4.5	
Delay (s)		8.0	3.1		43.2	
Level of Service		A	A		D	
Approach Delay (s)		8.0	3.1		43.2	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.5
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	155	1875	488	1229	292	683	781	235	566
v/c Ratio	0.69	1.14	1.59	0.66	0.44	0.50	0.90	1.18	0.29
Control Delay	29.3	85.9	314.5	31.0	16.0	38.0	40.9	151.8	21.3
Queue Delay	0.0	3.1	0.0	0.0	0.0	0.0	4.2	0.0	0.0
Total Delay	29.3	89.0	314.5	31.0	16.0	38.0	45.1	151.8	21.3
Queue Length 50th (ft)	73	~532	~494	261	79	248	434	~199	89
Queue Length 95th (ft)	m54	m115	#697	313	156	m272	m#513	#355	118
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	225	1641	306	1872	667	1367	866	200	1944
Starvation Cap Reductn	0	10	0	0	0	0	47	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	0.69	1.15	1.59	0.66	0.44	0.50	0.95	1.18	0.29

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	147	1781	0	464	1168	277	0	649	742	223	437	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00		0.95	1.00	1.00	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085		1770	5085	1583		3539	1583	1770	4942	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.28	1.00	
Satd. Flow (perm)	1770	5085		1770	5085	1583		3539	1583	518	4942	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	155	1875	0	488	1229	292	0	683	781	235	460	106
RTOR Reduction (vph)	0	0	0	0	0	84	0	0	255	0	34	0
Lane Group Flow (vph)	155	1875	0	488	1229	208	0	683	526	235	532	0
Turn Type	Prot		Perm	Prot		Perm			Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8			2	6		
Actuated Green, G (s)	14.0	35.5		19.0	40.5	40.5		42.5	42.5	42.5	42.5	
Effective Green, g (s)	14.0	35.5		19.0	40.5	40.5		42.5	42.5	42.5	42.5	
Actuated g/C Ratio	0.13	0.32		0.17	0.37	0.37		0.39	0.39	0.39	0.39	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	225	1641		306	1872	583		1367	612	200	1909	
v/s Ratio Prot	0.09	c0.37		c0.28	0.24			0.19			0.11	
v/s Ratio Perm						0.13			0.33	c0.45		
v/c Ratio	0.69	1.14		1.59	0.66	0.36		0.50	0.86	1.18	0.28	
Uniform Delay, d1	45.9	37.2		45.5	29.0	25.3		25.7	31.0	33.8	23.2	
Progression Factor	0.58	0.50		1.00	1.00	1.00		1.44	2.22	1.00	1.00	
Incremental Delay, d2	0.8	64.9		282.6	1.8	1.7		0.7	8.9	118.8	0.4	
Delay (s)	27.4	83.4		328.1	30.8	27.0		37.6	77.7	152.6	23.6	
Level of Service	C	F		F	C	C		D	E	F	C	
Approach Delay (s)		79.2			102.4			59.0			61.4	
Approach LOS		E			F			E			E	

Intersection Summary			
HCM Average Control Delay	79.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	105.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	339	1999	56	1264	320	235	6	14	409	200
v/c Ratio	0.99	0.94	0.74	0.97	0.99	0.17	0.01	0.18	0.65	0.45
Control Delay	88.0	35.4	96.3	54.7	89.8	19.7	11.7	50.8	40.9	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	88.0	35.4	96.3	54.7	89.8	19.7	11.7	50.8	40.9	8.3
Queue Length 50th (ft)	203	399	34	272	192	45	0	8	120	0
Queue Length 95th (ft)	#411	#581	#108	#411	#393	82	9	29	168	56
Internal Link Dist (ft)		631		1090		191			644	
Turn Bay Length (ft)	200		180		140		60	120		120
Base Capacity (vph)	341	2132	76	1301	322	1402	631	76	870	540
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.99	0.94	0.74	0.97	0.99	0.17	0.01	0.18	0.47	0.37

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												
Volume (vph)	322	1316	583	53	1158	43	304	223	6	13	389	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.95		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4851		1770	5058		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4851		1770	5058		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	339	1385	614	56	1219	45	320	235	6	14	409	200
RTOR Reduction (vph)	0	77	0	0	4	0	0	0	4	0	0	159
Lane Group Flow (vph)	339	1922	0	56	1260	0	320	235	2	14	409	41
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	18.0	39.8		3.2	25.0		17.0	36.1	36.1	0.8	19.9	19.9
Effective Green, g (s)	18.0	39.8		3.2	25.0		17.0	36.1	36.1	0.8	19.9	19.9
Actuated g/C Ratio	0.18	0.41		0.03	0.26		0.17	0.37	0.37	0.01	0.20	0.20
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	325	1972		58	1292		307	1305	584	14	719	322
v/s Ratio Prot	c0.19	c0.40		0.03	0.25		c0.18	0.07		0.01	c0.12	
v/s Ratio Perm									0.00			0.03
v/c Ratio	1.04	0.97		0.97	0.98		1.04	0.18	0.00	1.00	0.57	0.13
Uniform Delay, d1	40.0	28.6		47.3	36.1		40.5	20.9	19.5	48.6	35.1	31.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	61.6	14.7		104.9	19.2		62.8	0.1	0.0	240.5	1.0	0.2
Delay (s)	101.5	43.2		152.1	55.4		103.3	21.0	19.5	289.1	36.2	32.1
Level of Service	F	D		F	E		F	C	B	F	D	C
Approach Delay (s)		51.7			59.5			67.9			40.5	
Approach LOS		D			E			E			D	

Intersection Summary			
HCM Average Control Delay	54.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	97.9	Sum of lost time (s)	13.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations										
Volume (veh/h)	0	228	0	352	0	0	855	315	0	0
Sign Control	Yield			Free			Free		Yield	
Grade	0%			0%			0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	240	0	371	0	0	900	332	0	0
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type				None			None			
Median storage veh)										
Upstream signal (ft)							271			
pX, platoon unblocked	0.88		0.88						0.88	0.88
vC, conflicting volume	1602	185	1232			371			1325	1271
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	1616	185	1196			371			1302	1240
tC, single (s)	6.5	6.9	4.1			4.1			7.5	6.5
tC, 2 stage (s)										
tF (s)	4.0	3.3	2.2			2.2			3.5	4.0
p0 queue free %	100	71	100			100			100	100
cM capacity (veh/h)	91	825	511			1185			74	153

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	240	185	185	900	332
Volume Left	0	0	0	0	0
Volume Right	240	0	0	0	332
cSH	825	1700	1700	1700	1700
Volume to Capacity	0.29	0.11	0.11	0.53	0.20
Queue Length 95th (ft)	30	0	0	0	0
Control Delay (s)	11.1	0.0	0.0	0.0	0.0
Lane LOS	B				
Approach Delay (s)	11.1	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	692	0	0	0	0	0	0	392	449	0
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	728	0	0	0	0	0	0	413	473	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											795	
pX, platoon unblocked	0.96	0.96	0.96	0.96	0.96		0.96					
vC, conflicting volume	1298	1298	473	2026	1298	0	473			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1289	1289	428	2049	1289	0	428			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	0	0	100	100	100			75		
cM capacity (veh/h)	108	117	601	0	117	1085	1084			1623		

Direction, Lane #	EB 1	SB 1	SB 2
Volume Total	728	413	473
Volume Left	0	413	0
Volume Right	728	0	0
cSH	601	1623	1700
Volume to Capacity	1.21	0.25	0.28
Queue Length 95th (ft)	658	25	0
Control Delay (s)	133.4	8.0	0.0
Lane LOS	F	A	
Approach Delay (s)	133.4	3.7	
Approach LOS	F		

Intersection Summary			
Average Delay	62.2		
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	325	464	146	782	293	909
v/c Ratio	0.68	0.84	0.50	0.38	0.28	0.44
Control Delay	26.7	28.5	10.5	4.7	1.1	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.7	28.5	10.5	4.7	1.1	8.5
Queue Length 50th (ft)	98	95	18	50	3	95
Queue Length 95th (ft)	172	#236	m33	65	10	135
Internal Link Dist (ft)		1190		300		620
Turn Bay Length (ft)	600		90			
Base Capacity (vph)	546	604	294	2048	1040	2044
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.77	0.50	0.38	0.28	0.44

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	309	12	428	139	743	278	0	847	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor				1.00	1.00		1.00	0.95	1.00		0.95	
Frt				1.00	0.85		1.00	1.00	0.85		1.00	
Flt Protected				0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)				1770	1591		1770	3539	1583		3529	
Flt Permitted				0.95	1.00		0.27	1.00	1.00		1.00	
Satd. Flow (perm)				1770	1591		506	3539	1583		3529	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	325	13	451	146	782	293	0	892	17
RTOR Reduction (vph)	0	0	0	0	119	0	0	0	124	0	2	0
Lane Group Flow (vph)	0	0	0	325	345	0	146	782	169	0	907	0
Turn Type				Split			Perm		Perm			
Protected Phases				8	8			2			6	
Permitted Phases							2		2			
Actuated Green, G (s)				16.3	16.3		34.7	34.7	34.7		34.7	
Effective Green, g (s)				16.3	16.3		34.7	34.7	34.7		34.7	
Actuated g/C Ratio				0.27	0.27		0.58	0.58	0.58		0.58	
Clearance Time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)				3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)				481	432		293	2047	916		2041	
v/s Ratio Prot				0.18	c0.22			0.22			0.26	
v/s Ratio Perm							c0.29		0.11			
v/c Ratio				0.68	0.80		0.50	0.38	0.18		0.44	
Uniform Delay, d1				19.5	20.3		7.5	6.8	6.0		7.2	
Progression Factor				1.00	1.00		0.54	0.57	0.49		1.00	
Incremental Delay, d2				3.7	9.9		5.0	0.5	0.4		0.7	
Delay (s)				23.2	30.2		9.0	4.4	3.3		7.9	
Level of Service				C	C		A	A	A		A	
Approach Delay (s)		0.0			27.3			4.7			7.9	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBT	SBT
Lane Group Flow (vph)	438	464	982	1154
v/c Ratio	0.72	0.82	0.53	0.62
Control Delay	24.2	28.8	3.3	8.9
Queue Delay	0.0	0.0	0.0	0.1
Total Delay	24.2	28.8	3.3	9.0
Queue Length 50th (ft)	128	130	45	100
Queue Length 95th (ft)	207	#227	63	126
Internal Link Dist (ft)	434		320	300
Turn Bay Length (ft)				
Base Capacity (vph)	708	657	1857	1857
Starvation Cap Reductn	0	0	0	34
Spillback Cap Reductn	0	1	0	85
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.62	0.71	0.53	0.65

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	416	441	0	933	1096	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1770	1583		3539	3539	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1770	1583		3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	438	464	0	982	1154	0
RTOR Reduction (vph)	0	26	0	0	0	0
Lane Group Flow (vph)	438	438	0	982	1154	0
Turn Type		custom				
Protected Phases				2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	20.5	20.5		31.5	31.5	
Effective Green, g (s)	20.5	20.5		31.5	31.5	
Actuated g/C Ratio	0.34	0.34		0.52	0.52	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	605	541		1858	1858	
v/s Ratio Prot				0.28	c0.33	
v/s Ratio Perm	0.25	c0.28				
v/c Ratio	0.72	0.81		0.53	0.62	
Uniform Delay, d1	17.3	18.0		9.4	10.0	
Progression Factor	1.00	1.00		0.23	0.66	
Incremental Delay, d2	4.3	8.9		0.9	1.4	
Delay (s)	21.6	26.9		3.1	8.1	
Level of Service	C	C		A	A	
Approach Delay (s)	24.3			3.1	8.1	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	199	526	337	114	327	85	191	755	463	205	1251	266
v/c Ratio	0.82	0.60	0.53	0.75	0.37	0.19	0.80	0.58	0.68	0.63	0.85	0.34
Control Delay	49.9	22.9	6.4	53.6	19.7	6.0	53.1	17.8	17.4	27.0	19.0	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.9	22.9	6.4	53.6	19.7	6.0	53.1	17.8	17.4	27.0	19.0	2.3
Queue Length 50th (ft)	66	85	4	37	50	0	68	115	92	77	245	4
Queue Length 95th (ft)	#164	129	57	#112	81	27	#165	167	#199	m112	#344	m12
Internal Link Dist (ft)		612			420			572			320	
Turn Bay Length (ft)	90			80			130			120		
Base Capacity (vph)	261	944	659	163	944	484	238	1306	679	325	1478	778
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.56	0.51	0.70	0.35	0.18	0.80	0.58	0.68	0.63	0.85	0.34

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	189	500	320	108	311	81	181	717	440	195	1188	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.53	1.00	1.00	0.33	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	979	3539	1583	611	3539	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	199	526	337	114	327	85	191	755	463	205	1251	266
RTOR Reduction (vph)	0	0	243	0	0	64	0	0	96	0	0	118
Lane Group Flow (vph)	199	526	94	114	327	21	191	755	367	205	1251	148
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	14.9	14.9	14.9	14.9	14.9	14.9	8.1	22.0	22.0	11.1	25.0	25.0
Effective Green, g (s)	14.9	14.9	14.9	14.9	14.9	14.9	8.1	22.0	22.0	11.1	25.0	25.0
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.25	0.25	0.13	0.37	0.37	0.18	0.42	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	243	879	393	152	879	393	239	1298	580	327	1475	660
v/s Ratio Prot		0.15			0.09		c0.11	0.21		0.12	c0.35	
v/s Ratio Perm	c0.20		0.06	0.19		0.01			0.23			0.09
v/c Ratio	0.82	0.60	0.24	0.75	0.37	0.05	0.80	0.58	0.63	0.63	0.85	0.22
Uniform Delay, d1	21.3	19.9	18.0	20.8	18.7	17.2	25.2	15.3	15.7	22.5	15.8	11.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.81	0.78	0.35
Incremental Delay, d2	18.9	1.1	0.3	18.6	0.3	0.1	16.8	1.9	5.2	3.0	5.1	0.6
Delay (s)	40.2	21.0	18.3	39.4	18.9	17.2	42.0	17.2	20.9	21.3	17.3	4.5
Level of Service	D	C	B	D	B	B	D	B	C	C	B	A
Approach Delay (s)		23.8			23.1			21.8			15.8	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	312	603	0	423	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	328	635	0	445	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	500					
pX, platoon unblocked						
vC, conflicting volume			963		551	164
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			963		551	164
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			710		464	851

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2
Volume Total	219	321	423	223	223
Volume Left	0	0	0	0	0
Volume Right	0	212	423	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.19	0.25	0.13	0.13
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					
Approach Delay (s)	0.0			0.0	
Approach LOS					

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	28.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	111	1826	1119	181
v/c Ratio	0.35	0.52	0.43	0.15
Control Delay	21.8	0.4	5.2	1.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	21.8	0.4	5.2	1.0
Queue Length 50th (ft)	43	0	98	0
Queue Length 95th (ft)	m51	0	133	16
Internal Link Dist (ft)		370	263	
Turn Bay Length (ft)	100			70
Base Capacity (vph)	354	3539	2629	1222
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.31	0.52	0.43	0.15

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	105	1735	1063	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.5	4.5	4.5
Lane Util. Factor			1.00	0.95	0.95	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			1770	3539	3539	1583
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			1770	3539	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	111	1826	1119	181
RTOR Reduction (vph)	0	0	0	0	0	51
Lane Group Flow (vph)	0	0	111	1826	1119	130
Turn Type			Prot			Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			11.2	70.0	50.3	50.3
Effective Green, g (s)			11.2	70.0	50.3	50.3
Actuated g/C Ratio			0.16	1.00	0.72	0.72
Clearance Time (s)			4.0	4.5	4.5	4.5
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			283	3539	2543	1137
v/s Ratio Prot			0.06	c0.52	0.32	
v/s Ratio Perm						0.08
v/c Ratio			0.39	0.52	0.44	0.11
Uniform Delay, d1			26.3	0.0	4.1	3.0
Progression Factor			0.78	1.00	1.00	1.00
Incremental Delay, d2			0.7	0.4	0.6	0.2
Delay (s)			21.4	0.4	4.6	3.2
Level of Service			C	A	A	A
Approach Delay (s)	0.0			1.6	4.4	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	2.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	194	111	0	1718	1081	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	204	117	0	1808	1138	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				382	450	
pX, platoon unblocked	0.72	0.87	0.87			
vC, conflicting volume	2042	569	1138			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	831	191	848			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	8	84	100			
cM capacity (veh/h)	222	708	679			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	136	185	904	904	569	569
Volume Left	136	68	0	0	0	0
Volume Right	0	117	0	0	0	0
cSH	222	392	1700	1700	1700	1700
Volume to Capacity	0.61	0.47	0.53	0.53	0.33	0.33
Queue Length 95th (ft)	89	61	0	0	0	0
Control Delay (s)	44.0	22.1	0.0	0.0	0.0	0.0
Lane LOS	E	C				
Approach Delay (s)	31.4		0.0		0.0	
Approach LOS	D					

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	266	166	25	78	199	1541	19	929	202
v/c Ratio	0.85	0.20	0.09	0.10	0.49	0.70	0.09	0.57	0.25
Control Delay	50.8	7.2	20.8	11.6	9.6	12.3	6.2	11.7	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.8	7.2	20.8	11.6	9.6	12.3	6.2	11.7	2.5
Queue Length 50th (ft)	107	6	8	6	31	198	1	150	2
Queue Length 95th (ft)	#223	27	26	21	56	377	m4	220	21
Internal Link Dist (ft)		646		699		573		302	
Turn Bay Length (ft)	120		220		200		260		70
Base Capacity (vph)	337	899	310	868	451	2199	219	1644	809
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	0.79	0.18	0.08	0.09	0.44	0.70	0.09	0.57	0.25

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	253	35	123	24	34	40	189	1425	39	18	883	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.88		1.00	0.92		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3127		1770	3253		1770	3525		1770	3539	1583
Flt Permitted	0.70	1.00		0.65	1.00		0.19	1.00		0.12	1.00	1.00
Satd. Flow (perm)	1311	3127		1205	3253		353	3525		229	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	266	37	129	25	36	42	199	1500	41	19	929	202
RTOR Reduction (vph)	0	98	0	0	32	0	0	3	0	0	0	74
Lane Group Flow (vph)	266	68	0	25	46	0	199	1538	0	19	929	128
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	16.8	16.8		16.8	16.8		45.2	40.4		33.3	32.5	32.5
Effective Green, g (s)	16.8	16.8		16.8	16.8		45.2	40.4		33.3	32.5	32.5
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.65	0.58		0.48	0.46	0.46
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	315	750		289	781		404	2034		127	1643	735
v/s Ratio Prot		0.02			0.01		c0.06	c0.44		0.00	0.26	
v/s Ratio Perm	c0.20			0.02			0.26			0.07		0.08
v/c Ratio	0.84	0.09		0.09	0.06		0.49	0.76		0.15	0.57	0.17
Uniform Delay, d1	25.4	20.7		20.6	20.5		7.1	11.1		10.9	13.6	10.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.93	0.71	0.38
Incremental Delay, d2	18.3	0.1		0.1	0.0		0.9	2.7		0.5	1.3	0.5
Delay (s)	43.7	20.7		20.8	20.5		8.0	13.8		10.6	11.0	4.6
Level of Service	D	C		C	C		A	B		B	B	A
Approach Delay (s)		34.8			20.6			13.1			9.9	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	15.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	1187	403	1021	131	172	1078
v/c Ratio	0.88	0.50	0.77	0.20	0.80	0.57
Control Delay	39.9	8.2	27.6	5.7	73.6	19.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.9	8.2	27.6	5.7	73.6	19.3
Queue Length 50th (ft)	383	42	216	8	119	269
Queue Length 95th (ft)	475	121	260	m23	#226	335
Internal Link Dist (ft)	720		1803			515
Turn Bay Length (ft)	240	240		150	215	
Base Capacity (vph)	1404	828	1321	645	226	1880
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.49	0.77	0.20	0.76	0.57

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	1128	383	970	124	163	1024
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1187	403	1021	131	172	1078
RTOR Reduction (vph)	0	186	0	54	0	0
Lane Group Flow (vph)	1187	217	1021	77	172	1078
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	43.1	43.1	41.0	41.0	13.4	58.4
Effective Green, g (s)	43.1	43.1	41.0	41.0	13.4	58.4
Actuated g/C Ratio	0.39	0.39	0.37	0.37	0.12	0.53
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1345	620	1319	590	216	1879
v/s Ratio Prot	c0.35		c0.29		c0.10	0.30
v/s Ratio Perm		0.14		0.05		
v/c Ratio	0.88	0.35	0.77	0.13	0.80	0.57
Uniform Delay, d1	31.1	23.6	30.4	22.7	47.0	17.4
Progression Factor	1.00	1.00	0.75	0.51	1.00	1.00
Incremental Delay, d2	7.2	0.3	3.9	0.4	18.1	1.3
Delay (s)	38.3	23.9	26.7	12.0	65.1	18.7
Level of Service	D	C	C	B	E	B
Approach Delay (s)	34.6		25.0			25.1
Approach LOS	C		C			C

Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	369	400	892	1325	175	2173
v/c Ratio	0.66	0.84	0.39	1.02	1.21	0.81
Control Delay	48.4	31.9	10.6	39.3	170.3	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.4	31.9	10.6	39.3	170.3	6.2
Queue Length 50th (ft)	126	99	147	~772	~154	117
Queue Length 95th (ft)	169	#223	206	#1035	m#242	354
Internal Link Dist (ft)	1134		595			1803
Turn Bay Length (ft)	75	50			235	
Base Capacity (vph)	687	523	2267	1303	145	2685
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.76	0.39	1.02	1.21	0.81

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	351	380	847	1259	166	2064
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	369	400	892	1325	175	2173
RTOR Reduction (vph)	0	216	0	289	0	0
Lane Group Flow (vph)	369	184	892	1036	175	2173
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	18.0	18.0	70.5	70.5	9.0	83.5
Effective Green, g (s)	18.0	18.0	70.5	70.5	9.0	83.5
Actuated g/C Ratio	0.16	0.16	0.64	0.64	0.08	0.76
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	562	259	2268	1015	145	2686
v/s Ratio Prot	0.11		0.25		c0.10	0.61
v/s Ratio Perm		c0.12		c0.65		
v/c Ratio	0.66	0.71	0.39	1.02	1.21	0.81
Uniform Delay, d1	43.1	43.5	9.5	19.8	50.5	8.3
Progression Factor	1.00	1.00	1.00	1.00	0.89	0.45
Incremental Delay, d2	2.8	8.9	0.5	33.7	130.0	2.0
Delay (s)	45.9	52.4	10.0	53.4	174.8	5.7
Level of Service	D	D	A	D	F	A
Approach Delay (s)	49.3		35.9			18.3
Approach LOS	D		D			B

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	78	102	1480	155	74	0
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	82	107	1558	163	78	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						800
pX, platoon unblocked						
vC, conflicting volume	1795	1639			1558	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1795	1639			1558	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	13			82	
cM capacity (veh/h)	72	124			425	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	82	107	1721	78	0
Volume Left	82	0	0	78	0
Volume Right	0	107	163	0	0
cSH	72	124	1700	425	1700
Volume to Capacity	1.14	0.87	1.01	0.18	0.00
Queue Length 95th (ft)	155	135	0	17	0
Control Delay (s)	248.8	114.8	0.0	15.4	0.0
Lane LOS	F	F		C	
Approach Delay (s)	172.9		0.0	15.4	
Approach LOS	F				

Intersection Summary			
Average Delay	17.1		
Intersection Capacity Utilization	100.3%	ICU Level of Service	G
Analysis Period (min)	15		

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2060	1613	557	171	997	685	965
v/c Ratio	0.92	1.02	0.50	0.75	0.95	0.95	0.66
Control Delay	38.5	32.3	1.8	66.3	54.0	71.2	40.2
Queue Delay	28.0	51.7	0.9	0.0	7.8	0.0	0.0
Total Delay	66.6	84.0	2.7	66.3	61.8	71.2	40.2
Queue Length 50th (ft)	533	~718	23	136	282	272	241
Queue Length 95th (ft)	608	m#763	m20	#239	#370	#390	290
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2251	1578	1110	229	1050	718	1462
Starvation Cap Reductn	0	175	297	0	0	0	0
Spillback Cap Reductn	304	0	0	0	51	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.06	1.15	0.69	0.75	1.00	0.95	0.66

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1823	134	0	1532	529	162	890	57	651	916	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5033			3539	1583	1770	5039		3433	5085	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5033			3539	1583	1770	5039		3433	5085	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1919	141	0	1613	557	171	937	60	685	964	1
RTOR Reduction (vph)	0	7	0	0	0	1	0	4	0	0	0	0
Lane Group Flow (vph)	0	2053	0	0	1613	556	171	993	0	685	965	0
Turn Type						pm+ov	Prot			Prot		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		53.5			53.5	78.6	15.5	24.9		25.1	34.5	
Effective Green, g (s)		53.5			53.5	78.6	15.5	24.9		25.1	34.5	
Actuated g/C Ratio		0.45			0.45	0.65	0.13	0.21		0.21	0.29	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2244			1578	1109	229	1046		718	1462	
v/s Ratio Prot		0.41			c0.46	0.10	0.10	c0.20		c0.20	0.19	
v/s Ratio Perm						0.25						
v/c Ratio		0.92			1.02	0.50	0.75	0.95		0.95	0.66	
Uniform Delay, d1		31.1			33.2	10.6	50.4	46.9		46.9	37.6	
Progression Factor		1.00			0.33	0.15	0.92	0.77		1.00	1.00	
Incremental Delay, d2		6.3			19.0	0.1	19.0	17.5		22.8	2.4	
Delay (s)		37.5			29.8	1.7	65.4	53.5		69.7	39.9	
Level of Service		D			C	A	E	D		E	D	
Approach Delay (s)		37.5			22.6			55.2			52.3	
Approach LOS		D			C			E			D	

Intersection Summary			
HCM Average Control Delay	39.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	93.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	414	2229	38	1712	634	98	355	734	604
v/c Ratio	0.99	0.79	0.53	1.00	0.96	0.36	0.95	0.73	0.83
Control Delay	65.7	9.9	82.5	68.4	63.6	13.1	88.2	43.8	24.3
Queue Delay	96.3	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	162.0	16.8	82.5	68.4	63.6	13.2	88.2	43.8	24.3
Queue Length 50th (ft)	342	313	27	424	133	4	142	270	162
Queue Length 95th (ft)	m#395	m351	m#58	#602	#244	m40	#237	342	#352
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		160
Base Capacity (vph)	420	2817	72	1720	657	269	375	1006	732
Starvation Cap Reductn	87	556	0	0	0	0	0	0	0
Spillback Cap Reductn	0	195	0	0	0	3	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.24	0.99	0.53	1.00	0.96	0.37	0.95	0.73	0.83

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	393	2090	28	36	1490	137	0	602	93	337	697	574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5075		1770	5021			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5075		1770	5021			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	414	2200	29	38	1568	144	0	634	98	355	734	604
RTOR Reduction (vph)	0	1	0	0	9	0	0	0	64	0	0	282
Lane Group Flow (vph)	414	2228	0	38	1703	0	0	634	34	355	734	322
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	29.6	65.5		3.9	39.8			15.5	15.5	13.1	34.1	34.1
Effective Green, g (s)	29.6	65.5		3.9	39.8			15.5	15.5	13.1	34.1	34.1
Actuated g/C Ratio	0.25	0.55		0.03	0.33			0.13	0.13	0.11	0.28	0.28
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	437	2770		58	1665			657	204	375	1006	450
v/s Ratio Prot	c0.23	0.44		0.02	c0.34			c0.12		c0.10	0.21	
v/s Ratio Perm									0.02			0.20
v/c Ratio	0.95	0.80		0.66	1.02			0.96	0.16	0.95	0.73	0.72
Uniform Delay, d1	44.4	22.1		57.4	40.1			52.0	46.5	53.1	38.8	38.6
Progression Factor	0.91	0.41		1.06	1.27			0.72	0.60	1.00	1.00	1.00
Incremental Delay, d2	15.1	1.0		21.0	26.6			24.9	1.5	34.8	4.7	9.4
Delay (s)	55.4	10.0		81.8	77.4			62.4	29.3	87.9	43.4	48.0
Level of Service	E	B		F	E			E	C	F	D	D
Approach Delay (s)		17.1			77.5			58.0			54.4	
Approach LOS		B			E			E			D	

Intersection Summary			
HCM Average Control Delay	46.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	93.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	162	783	79	1045	383	43	240	158	486	40
v/c Ratio	0.66	0.27	0.23	0.36	0.36	0.27	0.76	0.52	0.51	0.12
Control Delay	37.5	3.1	14.8	14.2	2.1	55.9	68.4	29.3	26.0	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.5	3.1	14.8	14.2	2.1	55.9	68.4	29.3	26.0	14.4
Queue Length 50th (ft)	57	14	29	151	0	32	95	151	155	24
Queue Length 95th (ft)	m118	m17	59	181	41	70	#154	m208	m197	m31
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	245	2881	344	2915	1071	158	317	304	951	338
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.27	0.23	0.36	0.36	0.27	0.76	0.52	0.51	0.12

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	154	665	79	75	993	364	41	216	12	254	358	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (prot)	1770	5004		1770	5085	1583	1770	3510		1522	4753	1583
Flt Permitted	0.23	1.00		0.32	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (perm)	429	5004		601	5085	1583	1770	3510		1522	4753	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	162	700	83	79	1045	383	43	227	13	267	377	40
RTOR Reduction (vph)	0	12	0	0	0	163	0	4	0	0	0	22
Lane Group Flow (vph)	162	771	0	79	1045	220	43	236	0	158	486	18
Turn Type	Perm			Perm		Perm	Split			Split		Perm
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	68.8	68.8		68.8	68.8	68.8	10.7	10.7		24.0	24.0	24.0
Effective Green, g (s)	68.8	68.8		68.8	68.8	68.8	10.7	10.7		24.0	24.0	24.0
Actuated g/C Ratio	0.57	0.57		0.57	0.57	0.57	0.09	0.09		0.20	0.20	0.20
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	246	2869		345	2915	908	158	313		304	951	317
v/s Ratio Prot		0.15			0.21		0.02	c0.07		c0.10	0.10	
v/s Ratio Perm	c0.38			0.13		0.14						0.01
v/c Ratio	0.66	0.27		0.23	0.36	0.24	0.27	0.76		0.52	0.51	0.06
Uniform Delay, d1	17.5	12.9		12.6	13.7	12.7	51.0	53.4		42.9	42.8	38.9
Progression Factor	1.39	0.23		1.00	1.00	1.00	1.00	1.00		0.57	0.57	0.71
Incremental Delay, d2	9.4	0.2		1.5	0.3	0.6	4.2	15.5		4.2	1.3	0.2
Delay (s)	33.8	3.2		14.1	14.1	13.3	55.2	68.9		28.9	25.9	27.8
Level of Service	C	A		B	B	B	E	E		C	C	C
Approach Delay (s)		8.4			13.9			66.8			26.7	
Approach LOS		A			B			E			C	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	26	2498	111	283	1739	55	13	132	258	87	64
v/c Ratio	0.30	0.94	0.13	0.98	0.51	0.66	0.11	0.43	1.01	0.26	0.19
Control Delay	81.9	16.8	2.5	61.6	6.8	90.2	54.9	29.4	106.0	43.3	11.0
Queue Delay	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.9	17.4	2.5	61.6	6.8	90.2	54.9	29.4	106.0	43.3	11.0
Queue Length 50th (ft)	21	142	4	194	100	42	10	49	186	57	0
Queue Length 95th (ft)	m27	m#797	m6	m#258	m120	#107	31	112	#365	105	38
Internal Link Dist (ft)		585			1015		352			692	
Turn Bay Length (ft)	270		180								
Base Capacity (vph)	89	2657	856	288	3415	87	124	308	255	373	368
Starvation Cap Reductn	0	31	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.95	0.13	0.98	0.51	0.63	0.10	0.43	1.01	0.23	0.17

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	2373	105	269	1615	37	52	12	125	245	83	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	1770	5068		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.70	1.00	1.00	0.46	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	1770	5068		1305	1863	1583	859	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	2498	111	283	1700	39	55	13	132	258	87	64
RTOR Reduction (vph)	0	0	30	0	2	0	0	0	50	0	0	52
Lane Group Flow (vph)	26	2498	81	283	1737	0	55	13	82	258	87	12
Turn Type	Prot		Perm	Prot			Perm		Over	pm+pt		Perm
Protected Phases	7	4		3	8			2	3	1	6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	3.6	59.4	59.4	21.7	77.5		6.4	6.4	21.7	22.4	22.4	22.4
Effective Green, g (s)	3.6	59.4	59.4	21.7	77.5		6.4	6.4	21.7	22.4	22.4	22.4
Actuated g/C Ratio	0.03	0.49	0.49	0.18	0.65		0.05	0.05	0.18	0.19	0.19	0.19
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	53	2517	784	320	3273		70	99	286	251	348	295
v/s Ratio Prot	0.01	c0.49		c0.16	0.34			0.01	0.05	c0.10	0.05	
v/s Ratio Perm			0.05				0.04			c0.09		0.01
v/c Ratio	0.49	0.99	0.10	0.88	0.53		0.79	0.13	0.29	1.03	0.25	0.04
Uniform Delay, d1	57.3	30.1	16.1	47.9	11.5		56.1	54.1	42.5	47.5	41.6	40.0
Progression Factor	1.38	0.37	0.29	0.58	0.59		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.1	12.0	0.2	11.3	0.2		42.6	0.6	0.6	64.2	0.4	0.1
Delay (s)	83.4	23.2	4.8	39.3	7.0		98.8	54.8	43.0	111.7	42.0	40.0
Level of Service	F	C	A	D	A		F	D	D	F	D	D
Approach Delay (s)		23.0			11.5			59.1			85.7	
Approach LOS		C			B			E			F	

Intersection Summary			
HCM Average Control Delay	24.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	29	2883	2248	469
v/c Ratio	0.18	1.06	0.92	0.44
Control Delay	33.7	40.7	19.0	35.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	33.7	40.7	19.0	35.7
Queue Length 50th (ft)	21	~878	613	156
Queue Length 95th (ft)	m24	m#956	#726	212
Internal Link Dist (ft)		1015	1000	632
Turn Bay Length (ft)				150
Base Capacity (vph)	413	2720	2455	1063
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.07	1.06	0.92	0.44

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	28	2739	1956	180	423	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5		5.5	
Lane Util. Factor	1.00	0.91	0.91		0.97	
Frt	1.00	1.00	0.99		0.99	
Flt Protected	0.95	1.00	1.00		0.95	
Satd. Flow (prot)	1770	5085	5021		3424	
Flt Permitted	0.95	1.00	1.00		0.95	
Satd. Flow (perm)	1770	5085	5021		3424	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	29	2883	2059	189	445	24
RTOR Reduction (vph)	0	0	9	0	3	0
Lane Group Flow (vph)	29	2883	2239	0	466	0
Turn Type	Prot					
Protected Phases	7 9	4	8		6	
Permitted Phases						
Actuated Green, G (s)	6.7	62.0	54.1		37.2	
Effective Green, g (s)	6.7	62.0	54.1		37.2	
Actuated g/C Ratio	0.06	0.52	0.45		0.31	
Clearance Time (s)		5.5	5.5		5.5	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)	99	2627	2264		1061	
v/s Ratio Prot	c0.02	c0.57	0.45		c0.14	
v/s Ratio Perm						
v/c Ratio	0.29	1.10	0.99		0.44	
Uniform Delay, d1	54.4	29.0	32.7		33.1	
Progression Factor	1.24	0.24	0.45		1.00	
Incremental Delay, d2	0.6	46.7	12.9		1.3	
Delay (s)	68.1	53.6	27.7		34.4	
Level of Service	E	D	C		C	
Approach Delay (s)		53.8	27.7		34.4	
Approach LOS		D	C		C	

Intersection Summary			
HCM Average Control Delay	41.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	128	3179	21	67	2304	75	121	202
v/c Ratio	0.54	0.90	0.02	0.65	0.76	0.63	0.72	0.58
Control Delay	35.8	5.9	0.6	83.8	19.6	65.7	74.0	20.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	5.9	0.6	83.8	19.6	65.7	74.0	20.2
Queue Length 50th (ft)	91	125	0	52	451	47	91	30
Queue Length 95th (ft)	m95	m119	m0	#120	510	#119	#183	108
Internal Link Dist (ft)		1000			893	425		590
Turn Bay Length (ft)	150			300				
Base Capacity (vph)	239	3544	1109	105	3039	119	169	347
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.90	0.02	0.64	0.76	0.63	0.72	0.58

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	122	3020	20	64	2121	67	27	27	18	115	34	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91			1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00			0.97		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5062			1766		1770	1633	
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.47		0.71	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5062			848		1325	1633	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	128	3179	21	67	2233	71	28	28	19	121	36	166
RTOR Reduction (vph)	0	0	6	0	3	0	0	10	0	0	139	0
Lane Group Flow (vph)	128	3179	15	67	2301	0	0	65	0	121	63	0
Turn Type	Prot		Perm	Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2			6		
Actuated Green, G (s)	17.3	82.5	82.5	5.7	70.9			15.3		15.3	15.3	
Effective Green, g (s)	17.3	82.5	82.5	5.7	70.9			15.3		15.3	15.3	
Actuated g/C Ratio	0.14	0.69	0.69	0.05	0.59			0.13		0.13	0.13	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	255	3496	1088	84	2991			108		169	208	
v/s Ratio Prot	0.07	c0.63		0.04	c0.45						0.04	
v/s Ratio Perm			0.01					0.08		c0.09		
v/c Ratio	0.50	0.91	0.01	0.80	0.77			0.60		0.72	0.30	
Uniform Delay, d1	47.4	15.6	5.9	56.6	18.4			49.4		50.3	47.5	
Progression Factor	0.68	0.27	0.21	1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	0.4	1.3	0.0	39.3	2.0			22.1		13.5	0.8	
Delay (s)	32.7	5.6	1.2	95.9	20.4			71.5		63.7	48.3	
Level of Service	C	A	A	F	C			E		E	D	
Approach Delay (s)		6.6			22.5			71.5			54.1	
Approach LOS		A			C			E			D	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
3: 7th St & Park Ave

2/20/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	29	1534	232	1106	73	252	292	25	285	19
v/c Ratio	0.12	0.89	0.73	0.48	0.50	0.61	0.61	0.15	0.69	0.05
Control Delay	14.1	26.5	27.2	7.8	37.2	31.6	17.1	24.2	34.6	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.1	26.5	27.2	7.8	37.2	31.6	17.1	24.2	34.6	10.2
Queue Length 50th (ft)	7	312	44	112	29	102	50	9	118	0
Queue Length 95th (ft)	26	#556	#159	200	69	171	124	28	194	15
Internal Link Dist (ft)		588		707		495			498	
Turn Bay Length (ft)	70		180		30		30	100		90
Base Capacity (vph)	236	1723	352	2373	209	600	619	248	600	523
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.89	0.66	0.47	0.35	0.42	0.47	0.10	0.47	0.04

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												
Volume (vph)	28	1351	106	220	1020	30	69	239	277	24	271	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3500		1770	3524		1770	1863	1583	1770	1863	1583
Flt Permitted	0.26	1.00		0.10	1.00		0.35	1.00	1.00	0.41	1.00	1.00
Satd. Flow (perm)	480	3500		195	3524		650	1863	1583	768	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	29	1422	112	232	1074	32	73	252	292	25	285	19
RTOR Reduction (vph)	0	7	0	0	2	0	0	0	125	0	0	15
Lane Group Flow (vph)	29	1527	0	232	1104	0	73	252	167	25	285	4
Turn Type	Perm			pm+pt			Perm		Perm	Perm		Perm
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	35.3	35.3		46.8	46.8		16.1	16.1	16.1	16.1	16.1	16.1
Effective Green, g (s)	35.3	35.3		46.8	46.8		16.1	16.1	16.1	16.1	16.1	16.1
Actuated g/C Ratio	0.49	0.49		0.65	0.65		0.22	0.22	0.22	0.22	0.22	0.22
Clearance Time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	236	1718		313	2294		146	417	354	172	417	354
v/s Ratio Prot		c0.44		c0.09	0.31			0.14			c0.15	
v/s Ratio Perm	0.06			0.40			0.11		0.11	0.03		0.00
v/c Ratio	0.12	0.89		0.74	0.48		0.50	0.60	0.47	0.15	0.68	0.01
Uniform Delay, d1	9.9	16.5		15.4	6.4		24.4	25.0	24.2	22.4	25.6	21.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	6.1		9.1	0.2		2.7	2.5	1.0	0.4	4.6	0.0
Delay (s)	10.1	22.6		24.5	6.5		27.1	27.5	25.2	22.8	30.2	21.7
Level of Service	B	C		C	A		C	C	C	C	C	C
Approach Delay (s)		22.4			9.7			26.4			29.1	
Approach LOS		C			A			C			C	

Intersection Summary			
HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	71.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues
25: I-405 SB Off Ramp & Studebaker Rd

11/21/2012

Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	321	1808	1138
v/c Ratio	0.57	0.69	0.43
Control Delay	21.9	4.1	4.0
Queue Delay	0.0	0.4	0.1
Total Delay	21.9	4.5	4.1
Queue Length 50th (ft)	43	58	1
Queue Length 95th (ft)	75	70	207
Internal Link Dist (ft)	342	302	370
Turn Bay Length (ft)	170		
Base Capacity (vph)	841	2634	2634
Starvation Cap Reductn	0	308	532
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.38	0.78	0.54

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	194	111	0	1718	1081	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.95			1.00	1.00	
Flt Protected	0.97			1.00	1.00	
Satd. Flow (prot)	3311			3539	3539	
Flt Permitted	0.97			1.00	1.00	
Satd. Flow (perm)	3311			3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	204	117	0	1808	1138	0
RTOR Reduction (vph)	94	0	0	0	0	0
Lane Group Flow (vph)	227	0	0	1808	1138	0
Turn Type						
Protected Phases	4			2	6	
Permitted Phases						
Actuated Green, G (s)	9.9			52.1	52.1	
Effective Green, g (s)	9.9			52.1	52.1	
Actuated g/C Ratio	0.14			0.74	0.74	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	468			2634	2634	
v/s Ratio Prot	c0.07			c0.51	0.32	
v/s Ratio Perm						
v/c Ratio	0.48			0.69	0.43	
Uniform Delay, d1	27.7			4.7	3.4	
Progression Factor	1.00			0.57	0.92	
Incremental Delay, d2	0.8			1.0	0.5	
Delay (s)	28.5			3.7	3.6	
Level of Service	C			A	A	
Approach Delay (s)	28.5			3.7	3.6	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	6.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Queues
29: College Park Dr & SR-22 Ramps

11/21/2012

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	82	107	1721	78	268
v/c Ratio	0.49	0.43	1.32	0.51	0.17
Control Delay	56.3	14.3	167.7	51.6	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	56.3	14.3	167.7	51.6	5.4
Queue Length 50th (ft)	56	0	~1581	55	58
Queue Length 95th (ft)	102	50	#1849	m#118	m118
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	257	322	1308	154	1551
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.32	0.33	1.32	0.51	0.17

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	78	102	1480	155	74	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1839		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	1839		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	82	107	1558	163	78	268
RTOR Reduction (vph)	0	97	3	0	0	0
Lane Group Flow (vph)	82	10	1718	0	78	268
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	10.4	10.4	78.0		9.6	91.6
Effective Green, g (s)	10.4	10.4	78.0		9.6	91.6
Actuated g/C Ratio	0.09	0.09	0.71		0.09	0.83
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	167	150	1304		154	1551
v/s Ratio Prot	c0.05		c0.93		c0.04	0.14
v/s Ratio Perm		0.01				
v/c Ratio	0.49	0.07	1.32		0.51	0.17
Uniform Delay, d1	47.3	45.4	16.0		47.9	1.8
Progression Factor	1.00	1.00	1.00		0.78	2.51
Incremental Delay, d2	2.3	0.2	148.2		2.4	0.2
Delay (s)	49.6	45.6	164.2		39.6	4.7
Level of Service	D	D	F		D	A
Approach Delay (s)	47.3		164.2			12.6
Approach LOS	D		F			B

Intersection Summary			
HCM Average Control Delay	131.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
12: Willow St & Bellflower St

3/27/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	68	598	100	268	2491	174	999	104	1007
v/c Ratio	0.86	0.62	0.26	0.31	1.25	1.26	0.60	0.68	0.68
Control Delay	114.1	36.0	8.0	17.3	133.9	197.3	17.8	54.8	21.4
Queue Delay	0.0	0.0	0.0	0.0	5.1	0.0	0.2	0.0	0.0
Total Delay	114.1	36.0	8.0	17.3	138.9	197.3	18.0	54.8	21.4
Queue Length 50th (ft)	39	115	0	45	~628	~131	82	30	186
Queue Length 95th (ft)	#119	142	38	m61	m#684	m#256	153	#69	79
Internal Link Dist (ft)		1129			409		285		200
Turn Bay Length (ft)	140			110		150		120	
Base Capacity (vph)	79	1554	553	855	1997	138	1664	153	1490
Starvation Cap Reductn	0	0	0	0	18	0	147	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	0.86	0.38	0.18	0.31	1.26	1.26	0.66	0.68	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	568	95	255	1743	623	165	931	18	99	845	112
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	0.91		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	4884		1770	5071		3433	4996	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	4884		1770	5071		3433	4996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	598	100	268	1835	656	174	980	19	104	889	118
RTOR Reduction (vph)	0	0	81	0	71	0	0	2	0	0	19	0
Lane Group Flow (vph)	68	598	19	268	2420	0	174	997	0	104	988	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	4.0	17.1	17.1	22.4	35.5		7.0	29.5		4.0	26.5	
Effective Green, g (s)	4.0	17.1	17.1	22.4	35.5		7.0	29.5		4.0	26.5	
Actuated g/C Ratio	0.04	0.19	0.19	0.25	0.39		0.08	0.33		0.04	0.29	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	79	966	301	854	1926		138	1662		153	1471	
v/s Ratio Prot	c0.04	0.12		0.08	c0.50		c0.10	0.20		0.03	c0.20	
v/s Ratio Perm			0.01									
v/c Ratio	0.86	0.62	0.06	0.31	1.26		1.26	0.60		0.68	0.67	
Uniform Delay, d1	42.7	33.5	29.9	27.5	27.2		41.5	25.3		42.4	27.9	
Progression Factor	1.00	1.00	1.00	0.59	0.69		1.25	0.65		0.77	0.70	
Incremental Delay, d2	57.2	1.2	0.1	0.1	117.0		154.5	1.3		10.5	2.3	
Delay (s)	99.9	34.7	30.0	16.2	135.8		206.2	17.7		43.3	21.8	
Level of Service	F	C	C	B	F		F	B		D	C	
Approach Delay (s)		39.8			124.1			45.6			23.8	
Approach LOS		D			F			D			C	

Intersection Summary			
HCM Average Control Delay	78.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
12: Willow St & Bellflower St

3/27/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	101	1752	158	215	1109	128	1988	146	1538
v/c Ratio	0.53	1.09	0.27	0.99	0.80	0.75	1.02	0.54	0.82
Control Delay	59.4	86.5	8.7	102.7	24.2	40.3	26.8	47.4	27.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	77.4	0.0	0.0
Total Delay	59.4	86.5	8.7	102.7	24.2	40.3	104.2	47.4	27.2
Queue Length 50th (ft)	70	~515	14	84	247	98	~231	52	364
Queue Length 95th (ft)	#153	#611	62	#164	298	m93	m165	85	274
Internal Link Dist (ft)		1129			409		285		200
Turn Bay Length (ft)	140			110		150		120	
Base Capacity (vph)	190	1612	590	218	1501	177	1957	281	1865
Starvation Cap Reductn	0	0	0	0	0	0	303	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	0.53	1.09	0.27	0.99	0.74	0.72	1.20	0.52	0.82

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	1664	150	204	781	273	122	1811	78	139	1403	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	0.91		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	4888		1770	5054		3433	5055	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	4888		1770	5054		3433	5055	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	101	1752	158	215	822	287	128	1906	82	146	1477	61
RTOR Reduction (vph)	0	0	88	0	59	0	0	4	0	0	4	0
Lane Group Flow (vph)	101	1752	70	215	1050	0	128	1984	0	146	1534	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	11.8	34.9	34.9	7.0	30.1		10.6	42.5		8.6	40.5	
Effective Green, g (s)	11.8	34.9	34.9	7.0	30.1		10.6	42.5		8.6	40.5	
Actuated g/C Ratio	0.11	0.32	0.32	0.06	0.27		0.10	0.39		0.08	0.37	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	190	1613	502	218	1338		171	1953		268	1861	
v/s Ratio Prot	0.06	c0.34		c0.06	0.21		c0.07	c0.39		0.04	0.30	
v/s Ratio Perm			0.04									
v/c Ratio	0.53	1.09	0.14	0.99	0.78		0.75	1.02		0.54	0.82	
Uniform Delay, d1	46.5	37.5	26.8	51.5	37.0		48.4	33.8		48.8	31.5	
Progression Factor	1.00	1.00	1.00	0.91	0.58		0.75	0.42		0.83	0.74	
Incremental Delay, d2	2.8	49.7	0.1	53.5	2.8		1.7	10.6		2.0	3.8	
Delay (s)	49.3	87.3	26.9	100.2	24.3		37.8	24.8		42.6	27.1	
Level of Service	D	F	C	F	C		D	C		D	C	
Approach Delay (s)		80.6			36.6			25.6			28.5	
Approach LOS		F			D			C			C	

Intersection Summary			
HCM Average Control Delay	43.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
16: Willow St & Los Coyotes Diagonal

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	82	680	340	2733	100	562	441	91	789
v/c Ratio	0.54	0.39	0.78	0.96	0.11	0.60	0.59	0.33	0.59
Control Delay	71.6	7.2	44.3	29.3	4.3	18.5	11.1	30.7	27.3
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay	71.6	7.2	44.3	29.4	4.3	18.5	11.1	30.7	27.3
Queue Length 50th (ft)	25	30	180	526	8	168	175	21	126
Queue Length 95th (ft)	m48	181	256	#684	30	182	267	43	167
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	153	1747	551	2859	921	944	746	275	1343
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	3	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.39	0.62	0.96	0.11	0.60	0.59	0.33	0.59

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	78	646	0	323	2596	95	0	534	419	86	460	290
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.91		1.00	0.91	1.00		0.95	1.00	0.97	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085		1770	5085	1583		3539	1583	3433	4790	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.29	1.00	
Satd. Flow (perm)	3433	5085		1770	5085	1583		3539	1583	1031	4790	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	82	680	0	340	2733	100	0	562	441	91	484	305
RTOR Reduction (vph)	0	0	0	0	0	31	0	0	323	0	66	0
Lane Group Flow (vph)	82	680	0	340	2733	69	0	562	118	91	723	0
Turn Type	Prot			Prot		Perm			Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8			2	6		
Actuated Green, G (s)	3.2	30.9		22.1	49.8	49.8		24.0	24.0	24.0	24.0	
Effective Green, g (s)	3.2	30.9		22.1	49.8	49.8		24.0	24.0	24.0	24.0	
Actuated g/C Ratio	0.04	0.34		0.25	0.55	0.55		0.27	0.27	0.27	0.27	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	122	1746		435	2814	876		944	422	275	1277	
v/s Ratio Prot	0.02	0.13		c0.19	c0.54			c0.16			0.15	
v/s Ratio Perm						0.04			0.07	0.09		
v/c Ratio	0.67	0.39		0.78	0.97	0.08		0.60	0.28	0.33	0.57	
Uniform Delay, d1	42.9	22.4		31.7	19.4	9.4		28.8	26.1	26.5	28.5	
Progression Factor	1.40	0.28		1.00	1.00	1.00		0.56	2.73	1.00	1.00	
Incremental Delay, d2	12.7	0.6		8.9	11.5	0.2		2.3	1.4	3.2	1.8	
Delay (s)	73.0	6.9		40.6	30.9	9.6		18.3	72.7	29.7	30.3	
Level of Service	E	A		D	C	A		B	E	C	C	
Approach Delay (s)		14.0			31.2			42.2			30.3	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues
16: Willow St & Los Coyotes Diagonal

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	155	1875	488	1229	292	683	781	235	566
v/c Ratio	0.55	1.03	1.17	0.47	0.35	0.67	0.99	1.11	0.39
Control Delay	18.8	22.8	136.8	17.9	14.1	28.8	48.6	133.9	29.6
Queue Delay	0.0	3.4	0.0	0.0	0.0	0.0	30.8	0.0	0.0
Total Delay	18.8	26.2	136.8	17.9	14.1	28.8	79.4	133.9	29.6
Queue Length 50th (ft)	43	~97	~411	195	94	257	436	~98	106
Queue Length 95th (ft)	m42	m73	#614	234	155	m296	m#537	#178	141
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	281	1826	418	2612	839	1013	785	211	1450
Starvation Cap Reductn	0	17	0	0	0	0	67	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	0.55	1.04	1.17	0.47	0.35	0.67	1.09	1.11	0.39

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	147	1781	0	464	1168	277	0	649	742	223	437	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.91		1.00	0.91	1.00		0.95	1.00	0.97	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085		1770	5085	1583		3539	1583	3433	4942	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.20	1.00	
Satd. Flow (perm)	3433	5085		1770	5085	1583		3539	1583	738	4942	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	155	1875	0	488	1229	292	0	683	781	235	460	106
RTOR Reduction (vph)	0	0	0	0	0	26	0	0	332	0	34	0
Lane Group Flow (vph)	155	1875	0	488	1229	266	0	683	449	235	532	0
Turn Type	Prot			Prot		Perm			Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8			2	6		
Actuated Green, G (s)	9.0	39.5		26.0	56.5	56.5		31.5	31.5	31.5	31.5	
Effective Green, g (s)	9.0	39.5		26.0	56.5	56.5		31.5	31.5	31.5	31.5	
Actuated g/C Ratio	0.08	0.36		0.24	0.51	0.51		0.29	0.29	0.29	0.29	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	281	1826		418	2612	813		1013	453	211	1415	
v/s Ratio Prot	0.05	c0.37		c0.28	0.24			0.19			0.11	
v/s Ratio Perm						0.17			0.28	c0.32		
v/c Ratio	0.55	1.03		1.17	0.47	0.33		0.67	0.99	1.11	0.38	
Uniform Delay, d1	48.6	35.2		42.0	17.2	15.6		34.7	39.1	39.2	31.4	
Progression Factor	0.37	0.14		1.00	1.00	1.00		0.76	1.62	1.00	1.00	
Incremental Delay, d2	0.2	14.8		98.4	0.6	1.1		2.2	31.1	95.8	0.8	
Delay (s)	18.1	19.6		140.4	17.8	16.7		28.6	94.3	135.1	32.2	
Level of Service	B	B		F	B	B		C	F	F	C	
Approach Delay (s)		19.5			47.4			63.6			62.3	
Approach LOS		B			D			E			E	

Intersection Summary			
HCM Average Control Delay	44.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
17: Willow St & Woodruff Ave

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	185	1628	111	2839	638	180	46	834	293
v/c Ratio	1.39	0.80	0.72	1.34	1.39	0.16	0.43	1.05	0.63
Control Delay	256.2	34.5	78.8	187.8	228.8	27.6	66.2	90.2	27.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	256.2	34.5	78.8	187.8	228.8	27.6	66.2	90.2	27.6
Queue Length 50th (ft)	~191	396	85	~1058	~339	47	35	~370	104
Queue Length 95th (ft)	#340	460	#167	#1147	#457	77	75	#497	202
Internal Link Dist (ft)		631		1090		191		644	
Turn Bay Length (ft)	200		180		140		120		120
Base Capacity (vph)	133	2031	162	2116	458	1093	118	796	467
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	1.39	0.80	0.69	1.34	1.39	0.16	0.39	1.05	0.63

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	176	1299	248	105	2667	30	606	141	30	44	792	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		0.97	0.95		1.00	0.95	1.00
Frt	1.00	0.98		1.00	1.00		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	4963		1770	5077		3433	3445		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	4963		1770	5077		3433	3445		1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	185	1367	261	111	2807	32	638	148	32	46	834	293
RTOR Reduction (vph)	0	23	0	0	1	0	0	15	0	0	0	110
Lane Group Flow (vph)	185	1605	0	111	2838	0	638	165	0	46	834	183
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	9.0	48.5		10.5	50.0		16.0	37.6		6.2	27.8	27.8
Effective Green, g (s)	9.0	48.5		10.5	50.0		16.0	37.6		6.2	27.8	27.8
Actuated g/C Ratio	0.07	0.40		0.09	0.41		0.13	0.31		0.05	0.23	0.23
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	132	1993		154	2101		455	1072		91	814	364
v/s Ratio Prot	c0.10	0.32		0.06	c0.56		c0.19	0.05		0.03	c0.24	
v/s Ratio Perm												0.12
v/c Ratio	1.40	0.81		0.72	1.35		1.40	0.15		0.51	1.02	0.50
Uniform Delay, d1	55.9	32.0		53.7	35.4		52.4	30.1		55.8	46.5	40.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	219.8	2.5		15.3	161.0		193.9	0.1		4.4	37.9	1.1
Delay (s)	275.7	34.4		69.0	196.4		246.3	30.2		60.2	84.4	41.6
Level of Service	F	C		E	F		F	C		E	F	D
Approach Delay (s)		59.1			191.7			198.7			72.8	
Approach LOS		E			F			F			E	

Intersection Summary			
HCM Average Control Delay	136.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	120.8	Sum of lost time (s)	13.0
Intersection Capacity Utilization	116.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Queues
17: Willow St & Woodruff Ave

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	339	1999	56	1264	320	241	14	409	200
v/c Ratio	0.85	0.83	0.71	0.89	0.83	0.21	0.18	0.64	0.44
Control Delay	54.9	23.7	87.8	40.8	59.5	23.0	48.5	38.8	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.9	23.7	87.8	40.8	59.5	23.0	48.5	38.8	8.1
Queue Length 50th (ft)	185	337	32	253	93	50	8	114	0
Queue Length 95th (ft)	#356	#460	#104	#374	#178	88	29	162	55
Internal Link Dist (ft)		631		1090		191		644	
Turn Bay Length (ft)	200		180		140		120		120
Base Capacity (vph)	417	2403	79	1421	385	1268	79	1031	603
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	0.81	0.83	0.71	0.89	0.83	0.19	0.18	0.40	0.33

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												
Volume (vph)	322	1316	583	53	1158	43	304	223	6	13	389	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		0.97	0.95		1.00	0.95	1.00
Frt	1.00	0.95		1.00	0.99		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	4851		1770	5058		3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	4851		1770	5058		3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	339	1385	614	56	1219	45	320	235	6	14	409	200
RTOR Reduction (vph)	0	75	0	0	4	0	0	2	0	0	0	159
Lane Group Flow (vph)	339	1924	0	56	1260	0	320	239	0	14	409	41
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	20.2	43.0		3.1	25.9		10.0	28.7		0.7	19.4	19.4
Effective Green, g (s)	20.2	43.0		3.1	25.9		10.0	28.7		0.7	19.4	19.4
Actuated g/C Ratio	0.22	0.46		0.03	0.28		0.11	0.31		0.01	0.21	0.21
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	382	2231		59	1401		367	1082		13	734	328
v/s Ratio Prot	c0.19	c0.40		0.03	0.25		c0.09	0.07		0.01	c0.12	
v/s Ratio Perm												0.03
v/c Ratio	0.89	0.86		0.95	0.90		0.87	0.22		1.08	0.56	0.13
Uniform Delay, d1	35.5	22.6		45.1	32.5		41.1	24.1		46.4	33.2	30.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.2	3.7		97.7	8.1		19.7	0.1		276.9	0.9	0.2
Delay (s)	56.7	26.3		142.8	40.6		60.8	24.2		323.3	34.1	30.3
Level of Service	E	C		F	D		E	C		F	C	C
Approach Delay (s)		30.7			44.9			45.1			39.4	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	37.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	93.5	Sum of lost time (s)	13.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues
29: College Park Dr & SR-22 Ramps

12/6/2012

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	185	156	847	39	293
v/c Ratio	0.57	0.37	0.39	0.23	0.23
Control Delay	28.7	6.8	8.0	28.1	2.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	28.7	6.8	8.0	28.1	2.9
Queue Length 50th (ft)	61	0	53	14	12
Queue Length 95th (ft)	109	39	148	m39	26
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	413	489	2160	177	1271
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.45	0.32	0.39	0.22	0.23

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	176	148	740	65	37	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3497		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3497		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	185	156	779	68	39	293
RTOR Reduction (vph)	0	127	9	0	0	0
Lane Group Flow (vph)	185	29	839	0	39	293
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	11.1	11.1	34.5		2.4	40.9
Effective Green, g (s)	11.1	11.1	34.5		2.4	40.9
Actuated g/C Ratio	0.18	0.18	0.58		0.04	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	327	293	2011		71	1270
v/s Ratio Prot	c0.10		c0.24		c0.02	0.16
v/s Ratio Perm		0.02				
v/c Ratio	0.57	0.10	0.42		0.55	0.23
Uniform Delay, d1	22.3	20.3	7.1		28.3	3.6
Progression Factor	1.00	1.00	1.00		0.99	0.58
Incremental Delay, d2	2.2	0.1	0.6		8.4	0.4
Delay (s)	24.5	20.4	7.8		36.3	2.5
Level of Service	C	C	A		D	A
Approach Delay (s)	22.6		7.8			6.5
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Queues
29: College Park Dr & SR-22 Ramps

12/6/2012

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	82	107	1721	78	268
v/c Ratio	0.69	0.52	0.67	0.60	0.17
Control Delay	60.7	17.0	7.3	50.7	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	60.7	17.0	7.3	50.7	1.6
Queue Length 50th (ft)	30	0	168	28	13
Queue Length 95th (ft)	#92	#46	240	#88	23
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	118	205	2570	129	1565
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.69	0.52	0.67	0.60	0.17

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	78	102	1480	155	74	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3489		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3489		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	82	107	1558	163	78	268
RTOR Reduction (vph)	0	101	12	0	0	0
Lane Group Flow (vph)	82	6	1709	0	78	268
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	3.2	3.2	41.6		3.2	48.8
Effective Green, g (s)	3.2	3.2	41.6		3.2	48.8
Actuated g/C Ratio	0.05	0.05	0.69		0.05	0.81
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	94	84	2419		94	1515
v/s Ratio Prot	c0.05		c0.49		c0.04	0.14
v/s Ratio Perm		0.00				
v/c Ratio	0.87	0.07	0.71		0.83	0.18
Uniform Delay, d1	28.2	27.0	5.5		28.1	1.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	53.6	0.3	1.8		42.7	0.3
Delay (s)	81.8	27.3	7.3		70.8	1.5
Level of Service	F	C	A		E	A
Approach Delay (s)	51.0		7.3			17.1
Approach LOS	D		A			B

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: 7th St & PCH

3/26/2013

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2396	1578	552	111	1059	478	641
v/c Ratio	0.99	0.93	0.52	0.52	0.87	0.91	0.46
Control Delay	48.7	26.7	12.1	45.2	26.8	77.3	40.8
Queue Delay	1.7	5.9	2.7	0.0	0.0	0.0	0.0
Total Delay	50.5	32.6	14.8	45.2	26.8	77.3	40.8
Queue Length 50th (ft)	711	270	159	98	317	207	165
Queue Length 95th (ft)	#848	m320	m199	163	273	#305	206
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2428	1701	1070	214	1213	523	1381
Starvation Cap Reductn	0	101	389	0	0	0	0
Spillback Cap Reductn	22	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.00	0.99	0.81	0.52	0.87	0.91	0.46

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	2143	133	0	1499	524	105	948	58	454	608	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5041			3539	1583	1770	5041		3433	5084	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5041			3539	1583	1770	5041		3433	5084	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	2256	140	0	1578	552	111	998	61	478	640	1
RTOR Reduction (vph)	0	5	0	0	0	1	0	3	0	0	0	0
Lane Group Flow (vph)	0	2391	0	0	1578	551	111	1056	0	478	641	0
Turn Type						pm+ov	Prot			Prot		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		62.5			62.5	82.3	15.7	31.2		19.8	35.3	
Effective Green, g (s)		62.5			62.5	82.3	15.7	31.2		19.8	35.3	
Actuated g/C Ratio		0.48			0.48	0.63	0.12	0.24		0.15	0.27	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2424			1701	1069	214	1210		523	1381	
v/s Ratio Prot		c0.47			0.45	0.08	0.06	c0.21		c0.14	0.13	
v/s Ratio Perm						0.27						
v/c Ratio		0.99			0.93	0.52	0.52	0.87		0.91	0.46	
Uniform Delay, d1		33.3			31.6	13.0	53.6	47.5		54.3	39.5	
Progression Factor		1.00			0.66	1.05	0.69	0.39		1.00	1.00	
Incremental Delay, d2		15.0			4.5	0.2	7.4	7.6		20.5	1.1	
Delay (s)		48.4			25.5	13.9	44.7	26.3		74.7	40.6	
Level of Service		D			C	B	D	C		E	D	
Approach Delay (s)		48.4			22.5			28.0			55.2	
Approach LOS		D			C			C			E	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	468	2281	33	2145	747	167	223	448	393
v/c Ratio	0.92	0.76	0.42	0.95	0.93	0.52	0.87	0.46	0.60
Control Delay	78.7	5.8	51.9	22.8	80.0	41.2	90.5	41.0	14.5
Queue Delay	0.0	1.2	0.0	2.3	0.0	0.0	0.0	0.0	0.7
Total Delay	78.7	7.0	51.9	25.1	80.0	41.2	90.5	41.0	15.2
Queue Length 50th (ft)	205	192	27	482	232	69	97	165	63
Queue Length 95th (ft)	m211	m205	m35	#138	#313	148	#170	218	174
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		
Base Capacity (vph)	515	2990	79	2251	802	319	256	972	650
Starvation Cap Reductn	0	450	0	55	0	0	0	0	0
Spillback Cap Reductn	0	0	0	6	0	0	0	0	73
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.90	0.42	0.98	0.93	0.52	0.87	0.46	0.68

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	445	2152	15	31	1685	352	0	710	159	212	426	373
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	0.97	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.97			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5080		1770	4953			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5080		1770	4953			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	468	2265	16	33	1774	371	0	747	167	223	448	393
RTOR Reduction (vph)	0	0	0	0	25	0	0	0	69	0	0	215
Lane Group Flow (vph)	468	2281	0	33	2120	0	0	747	98	223	448	178
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	19.4	74.3		3.5	58.4			20.5	20.5	9.7	35.7	35.7
Effective Green, g (s)	19.4	74.3		3.5	58.4			20.5	20.5	9.7	35.7	35.7
Actuated g/C Ratio	0.15	0.57		0.03	0.45			0.16	0.16	0.07	0.27	0.27
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	512	2903		48	2225			802	250	256	972	435
v/s Ratio Prot	c0.14	0.45		0.02	c0.43			c0.15		c0.06	0.13	
v/s Ratio Perm									0.06			0.11
v/c Ratio	0.91	0.79		0.69	0.95			0.93	0.39	0.87	0.46	0.41
Uniform Delay, d1	54.5	21.7		62.7	34.5			54.1	49.2	59.5	39.2	38.5
Progression Factor	1.30	0.25		0.68	0.42			1.18	1.40	1.00	1.00	1.00
Incremental Delay, d2	7.5	0.6		23.1	7.7			16.7	3.9	31.0	1.6	2.8
Delay (s)	78.2	6.0		65.7	22.3			80.4	72.6	90.5	40.7	41.3
Level of Service	E	A		E	C			F	E	F	D	D
Approach Delay (s)		18.3			23.0			79.0			51.4	
Approach LOS		B			C			E			D	

Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	80	649	44	1076	451	67	444	167	327	13
v/c Ratio	0.36	0.32	0.18	0.58	0.52	0.19	0.62	0.50	0.32	0.04
Control Delay	12.2	4.6	27.8	34.7	4.9	44.5	50.0	66.5	59.4	41.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.2	4.6	27.8	34.7	4.9	44.5	50.0	66.5	59.4	41.4
Queue Length 50th (ft)	10	30	24	265	1	47	175	173	112	7
Queue Length 95th (ft)	m32	m35	50	313	72	90	233	m260	m150	m21
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	224	2033	247	1858	864	361	717	334	1027	356
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.32	0.18	0.58	0.52	0.19	0.62	0.50	0.32	0.04

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	76	604	12	42	1022	428	64	362	60	317	152	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (prot)	1770	5070		1770	5085	1583	1770	3464		1522	4686	1583
Flt Permitted	0.19	1.00		0.30	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (perm)	360	5070		557	5085	1583	1770	3464		1522	4686	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	80	636	13	44	1076	451	67	381	63	334	160	13
RTOR Reduction (vph)	0	2	0	0	0	288	0	10	0	0	0	9
Lane Group Flow (vph)	80	647	0	44	1076	163	67	434	0	167	327	4
Turn Type	pm+pt			pm+pt		Perm	Split			Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	52.8	51.3		46.7	46.7	46.7	26.5	26.5		28.5	28.5	28.5
Effective Green, g (s)	52.8	51.3		46.7	46.7	46.7	26.5	26.5		28.5	28.5	28.5
Actuated g/C Ratio	0.41	0.39		0.36	0.36	0.36	0.20	0.20		0.22	0.22	0.22
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	231	2001		230	1827	569	361	706		334	1027	347
v/s Ratio Prot	c0.02	0.13		0.00	c0.21		0.04	c0.13		c0.11	0.07	
v/s Ratio Perm	0.12			0.06		0.10						0.00
v/c Ratio	0.35	0.32		0.19	0.59	0.29	0.19	0.61		0.50	0.32	0.01
Uniform Delay, d1	35.7	27.3		27.8	33.8	29.7	42.8	47.1		44.5	42.6	39.7
Progression Factor	0.26	0.16		1.00	1.00	1.00	1.00	1.00		1.36	1.37	2.11
Incremental Delay, d2	0.8	0.4		0.4	1.4	1.3	1.1	4.0		4.8	0.7	0.0
Delay (s)	10.1	4.6		28.2	35.3	31.0	44.0	51.1		65.5	59.1	84.0
Level of Service	B	A		C	D	C	D	D		E	E	F
Approach Delay (s)		5.2			33.8			50.1			61.9	
Approach LOS		A			C			D			E	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	100	2499	36	127	2495	91	87	162	45	51
v/c Ratio	0.85	0.72	0.03	0.79	0.75	0.87	0.79	0.71	0.22	0.39
Control Delay	86.7	2.4	0.1	65.1	0.9	117.6	103.0	26.0	60.2	35.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	86.7	2.4	0.1	65.1	0.9	117.6	103.0	26.0	60.2	35.4
Queue Length 50th (ft)	90	35	0	59	8	78	74	0	19	14
Queue Length 95th (ft)	m#133	60	m1	m64	12	#183	#168	#90	38	56
Internal Link Dist (ft)		585			1015		352			692
Turn Bay Length (ft)	270			275		100		350		
Base Capacity (vph)	118	3475	1090	161	3305	105	110	229	634	337
Starvation Cap Reductn	0	78	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	22	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.74	0.03	0.79	0.76	0.87	0.79	0.71	0.07	0.15

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	2374	34	121	1982	389	86	83	154	43	16	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	1.00	1.00	0.97	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	4960		1770	1863	1583	3433	1676	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	4960		1770	1863	1583	3433	1676	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	100	2499	36	127	2086	409	91	87	162	45	17	34
RTOR Reduction (vph)	0	0	8	0	16	0	0	0	154	0	32	0
Lane Group Flow (vph)	100	2499	28	127	2479	0	91	87	8	45	19	0
Turn Type	Prot		Perm	Prot			Split		Over	Split		
Protected Phases	7	4		3	8		2	2	3	6	6	
Permitted Phases			4									
Actuated Green, G (s)	8.7	87.7	87.7	6.1	85.1		7.7	7.7	6.1	6.5	6.5	
Effective Green, g (s)	8.7	87.7	87.7	6.1	85.1		7.7	7.7	6.1	6.5	6.5	
Actuated g/C Ratio	0.07	0.67	0.67	0.05	0.65		0.06	0.06	0.05	0.05	0.05	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	118	3430	1068	161	3247		105	110	74	172	84	
v/s Ratio Prot	c0.06	0.49		0.04	c0.50		c0.05	0.05	0.00	c0.01	0.01	
v/s Ratio Perm			0.02									
v/c Ratio	0.85	0.73	0.03	0.79	0.76		0.87	0.79	0.10	0.26	0.22	
Uniform Delay, d1	60.0	13.5	7.0	61.3	15.5		60.6	60.4	59.3	59.4	59.3	
Progression Factor	0.84	0.11	0.01	0.82	0.01		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	28.2	0.9	0.0	9.7	0.7		48.0	31.0	0.6	0.8	1.3	
Delay (s)	78.5	2.4	0.1	59.8	0.9		108.7	91.4	59.9	60.3	60.7	
Level of Service	E	A	A	E	A		F	F	E	E	E	
Approach Delay (s)		5.3			3.8			81.0			60.5	
Approach LOS		A			A			F			E	

Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Group Flow (vph)	95	2518	2657	576	148
v/c Ratio	0.48	0.78	0.93	0.57	0.26
Control Delay	29.2	20.5	11.3	1.5	32.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	29.2	20.5	11.3	1.5	32.0
Queue Length 50th (ft)	51	382	373	23	35
Queue Length 95th (ft)	m73	417	m350	m22	69
Internal Link Dist (ft)		1015	1000		632
Turn Bay Length (ft)	400			150	150
Base Capacity (vph)	383	3247	2871	1009	561
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.25	0.78	0.93	0.57	0.26

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	90	2392	2524	547	87	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	0.91	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.94	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1770	5085	5085	1583	3306	
Flt Permitted	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	1770	5085	5085	1583	3306	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	2518	2657	576	92	56
RTOR Reduction (vph)	0	0	0	115	47	0
Lane Group Flow (vph)	95	2518	2657	461	101	0
Turn Type	Prot			Perm		
Protected Phases	7 9	4	8		6	
Permitted Phases				8		
Actuated Green, G (s)	14.4	83.0	73.4	73.4	20.2	
Effective Green, g (s)	14.4	83.0	73.4	73.4	20.2	
Actuated g/C Ratio	0.11	0.64	0.56	0.56	0.16	
Clearance Time (s)		5.5	5.5	5.5	5.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	196	3247	2871	894	514	
v/s Ratio Prot	c0.05	c0.50	c0.52		c0.03	
v/s Ratio Perm				0.29		
v/c Ratio	0.48	0.78	0.93	0.52	0.20	
Uniform Delay, d1	54.3	16.8	25.8	17.4	47.8	
Progression Factor	0.71	1.12	0.39	0.14	1.00	
Incremental Delay, d2	1.3	1.3	0.7	0.2	0.9	
Delay (s)	39.8	20.2	10.8	2.6	48.7	
Level of Service	D	C	B	A	D	
Approach Delay (s)		20.9	9.3		48.7	
Approach LOS		C	A		D	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	144	2392	65	44	3371	214	173	48	113
v/c Ratio	0.95	0.68	0.06	0.42	1.03	0.20	1.01	0.26	0.36
Control Delay	94.2	5.9	1.4	70.3	47.1	5.5	124.8	53.9	16.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	94.2	5.9	1.4	70.3	47.1	5.5	124.8	53.9	16.3
Queue Length 50th (ft)	120	109	2	36	~1110	36	~148	37	12
Queue Length 95th (ft)	m#194	130	m3	77	#1184	69	#302	77	68
Internal Link Dist (ft)		1000			893		425		590
Turn Bay Length (ft)	150		150	300		150			
Base Capacity (vph)	151	3493	1101	120	3278	1054	172	183	315
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	0.95	0.68	0.06	0.37	1.03	0.20	1.01	0.26	0.36

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	137	2272	62	42	3202	203	117	36	11	46	15	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.99		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583		1782		1770	1623	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.64		0.69	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583		1186		1280	1623	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	144	2392	65	44	3371	214	123	38	12	48	16	97
RTOR Reduction (vph)	0	0	14	0	0	35	0	2	0	0	83	0
Lane Group Flow (vph)	144	2392	51	44	3371	179	0	171	0	48	30	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	12.2	88.2	88.2	6.7	82.7	82.7		18.6		18.6	18.6	
Effective Green, g (s)	12.2	88.2	88.2	6.7	82.7	82.7		18.6		18.6	18.6	
Actuated g/C Ratio	0.09	0.68	0.68	0.05	0.64	0.64		0.14		0.14	0.14	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	166	3450	1074	91	3235	1007		170		183	232	
v/s Ratio Prot	c0.08	0.47		0.02	c0.66						0.02	
v/s Ratio Perm			0.03			0.11		c0.14		0.04		
v/c Ratio	0.87	0.69	0.05	0.48	1.04	0.18		1.01		0.26	0.13	
Uniform Delay, d1	58.1	12.7	6.9	60.0	23.6	9.7		55.7		49.6	48.6	
Progression Factor	0.76	0.41	0.41	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	24.6	0.7	0.1	4.0	28.2	0.4		71.0		0.8	0.3	
Delay (s)	68.8	5.9	2.9	64.0	51.8	10.1		126.7		50.4	48.9	
Level of Service	E	A	A	E	D	B		F		D	D	
Approach Delay (s)		9.3			49.5			126.7			49.3	
Approach LOS		A			D			F			D	

Intersection Summary			
HCM Average Control Delay	35.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: 7th St & PCH

3/26/2013

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2060	1613	557	171	997	638	1013
v/c Ratio	0.88	0.98	0.50	0.76	0.93	0.95	0.71
Control Delay	36.6	25.6	4.9	61.9	60.5	75.7	45.3
Queue Delay	2.9	0.0	1.1	0.0	0.0	10.9	0.0
Total Delay	39.4	25.6	6.0	61.9	60.5	86.6	45.3
Queue Length 50th (ft)	559	187	99	153	321	276	281
Queue Length 95th (ft)	632	#843	m107	#260	#396	#391	334
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2349	1647	1115	225	1071	673	1428
Starvation Cap Reductn	0	0	322	0	0	0	0
Spillback Cap Reductn	195	0	0	0	0	39	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.96	0.98	0.70	0.76	0.93	1.01	0.71

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1823	134	0	1532	529	162	890	57	606	961	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5033			3539	1583	1770	5039		3433	5085	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5033			3539	1583	1770	5039		3433	5085	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1919	141	0	1613	557	171	937	60	638	1012	1
RTOR Reduction (vph)	0	6	0	0	0	1	0	5	0	0	0	0
Lane Group Flow (vph)	0	2054	0	0	1613	556	171	992	0	638	1013	0
Turn Type						pm+ov	Prot			Prot		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		60.5			60.5	86.0	16.5	27.5		25.5	36.5	
Effective Green, g (s)		60.5			60.5	86.0	16.5	27.5		25.5	36.5	
Actuated g/C Ratio		0.47			0.47	0.66	0.13	0.21		0.20	0.28	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2342			1647	1114	225	1066		673	1428	
v/s Ratio Prot		0.41			c0.46	0.10	0.10	c0.20		c0.19	0.20	
v/s Ratio Perm						0.25						
v/c Ratio		0.88			0.98	0.50	0.76	0.93		0.95	0.71	
Uniform Delay, d1		31.4			34.1	11.1	54.8	50.3		51.6	42.0	
Progression Factor		1.00			0.39	0.47	0.76	0.93		1.00	1.00	
Incremental Delay, d2		4.0			10.5	0.2	19.1	13.9		22.5	3.0	
Delay (s)		35.4			23.7	5.3	60.9	60.6		74.1	45.0	
Level of Service		D			C	A	E	E		E	D	
Approach Delay (s)		35.4			19.0			60.6			56.2	
Approach LOS		D			B			E			E	

Intersection Summary			
HCM Average Control Delay	39.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	406	2189	38	1712	641	138	355	734	604
v/c Ratio	0.83	0.86	0.55	0.89	0.73	0.41	0.79	0.60	0.85
Control Delay	71.1	13.8	92.4	27.3	44.5	18.1	67.9	37.4	36.1
Queue Delay	0.0	8.5	0.0	0.6	0.0	0.0	0.0	0.0	0.1
Total Delay	71.1	22.3	92.4	27.8	44.5	18.1	67.9	37.4	36.2
Queue Length 50th (ft)	169	241	33	143	141	27	151	266	304
Queue Length 95th (ft)	m191	m450	m#72	216	189	74	#217	333	#525
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		
Base Capacity (vph)	510	2551	69	1932	884	339	452	1230	708
Starvation Cap Reductn	0	354	0	0	0	0	0	0	0
Spillback Cap Reductn	0	47	0	46	0	0	0	0	2
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	1.00	0.55	0.91	0.73	0.41	0.79	0.60	0.86

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	386	2052	28	36	1490	137	0	609	131	337	697	574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	0.97	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5075		1770	5021			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5075		1770	5021			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	406	2160	29	38	1568	144	0	641	138	355	734	604
RTOR Reduction (vph)	0	1	0	0	8	0	0	0	64	0	0	158
Lane Group Flow (vph)	406	2188	0	38	1704	0	0	641	74	355	734	446
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	18.5	64.2		4.1	49.8			22.6	22.6	17.1	45.2	45.2
Effective Green, g (s)	18.5	64.2		4.1	49.8			22.6	22.6	17.1	45.2	45.2
Actuated g/C Ratio	0.14	0.49		0.03	0.38			0.17	0.17	0.13	0.35	0.35
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	489	2506		56	1923			884	275	452	1230	550
v/s Ratio Prot	c0.12	c0.43		0.02	0.34			0.13		0.10	0.21	
v/s Ratio Perm									0.05			c0.28
v/c Ratio	0.83	0.87		0.68	0.89			0.73	0.27	0.79	0.60	0.81
Uniform Delay, d1	54.2	29.3		62.3	37.5			50.8	46.6	54.7	34.9	38.5
Progression Factor	1.18	0.41		1.10	0.57			0.78	0.67	1.00	1.00	1.00
Incremental Delay, d2	5.2	2.0		24.8	5.7			4.6	2.1	12.9	2.1	12.3
Delay (s)	69.3	14.0		93.4	26.9			44.3	33.3	67.5	37.0	50.8
Level of Service	E	B		F	C			D	C	E	D	D
Approach Delay (s)		22.7			28.4			42.4			48.3	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	32.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	209	783	79	1045	383	43	240	158	486	40
v/c Ratio	0.68	0.33	0.26	0.53	0.46	0.19	0.53	0.49	0.48	0.11
Control Delay	20.1	13.8	32.1	32.9	5.2	53.3	57.1	20.4	17.0	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	13.8	32.1	32.9	5.2	53.3	57.1	20.4	17.0	4.2
Queue Length 50th (ft)	157	220	41	245	4	33	99	122	124	10
Queue Length 95th (ft)	m229	m271	83	319	77	71	144	m190	m132	m14
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	385	2379	306	1959	840	225	449	322	1005	355
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.33	0.26	0.53	0.46	0.19	0.53	0.49	0.48	0.11

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	199	665	79	75	993	364	41	216	12	254	358	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (prot)	1770	5004		1770	5085	1583	1770	3510		1522	4753	1583
Flt Permitted	0.15	1.00		0.34	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (perm)	271	5004		640	5085	1583	1770	3510		1522	4753	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	209	700	83	79	1045	383	43	227	13	267	377	40
RTOR Reduction (vph)	0	11	0	0	0	230	0	3	0	0	0	20
Lane Group Flow (vph)	209	772	0	79	1045	153	43	237	0	158	486	20
Turn Type	pm+pt			pm+pt		Perm	Split			Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	60.7	60.7		51.6	50.1	50.1	16.5	16.5		27.5	27.5	27.5
Effective Green, g (s)	60.7	60.7		51.6	50.1	50.1	16.5	16.5		27.5	27.5	27.5
Actuated g/C Ratio	0.47	0.47		0.40	0.39	0.39	0.13	0.13		0.21	0.21	0.21
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	304	2336		296	1960	610	225	446		322	1005	335
v/s Ratio Prot	c0.08	0.15		0.01	c0.21		0.02	c0.07		c0.10	0.10	
v/s Ratio Perm	c0.24			0.10		0.10						0.01
v/c Ratio	0.69	0.33		0.27	0.53	0.25	0.19	0.53		0.49	0.48	0.06
Uniform Delay, d1	23.7	21.8		27.0	30.9	27.2	50.8	53.1		45.1	45.0	40.9
Progression Factor	0.58	0.64		1.00	1.00	1.00	1.00	1.00		0.35	0.35	0.17
Incremental Delay, d2	4.3	0.3		0.5	1.0	1.0	1.9	4.5		4.2	1.3	0.3
Delay (s)	17.9	14.2		27.5	31.9	28.2	52.7	57.6		20.1	17.0	7.2
Level of Service	B	B		C	C	C	D	E		C	B	A
Approach Delay (s)		15.0			30.7			56.8			17.1	
Approach LOS		B			C			E			B	

Intersection Summary			
HCM Average Control Delay	25.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	26	2498	111	283	1739	55	13	132	258	151
v/c Ratio	0.32	0.83	0.11	0.92	0.51	0.73	0.16	0.55	0.61	0.64
Control Delay	52.9	9.4	1.4	65.6	0.5	109.0	64.9	24.7	60.1	57.2
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.9	9.5	1.4	65.6	0.5	109.0	64.9	24.7	60.1	57.2
Queue Length 50th (ft)	23	195	4	131	5	47	11	20	108	103
Queue Length 95th (ft)	m29	227	m5	m#188	6	#122	34	86	145	167
Internal Link Dist (ft)		585			1015		352			692
Turn Bay Length (ft)	270			275		100		350		
Base Capacity (vph)	83	3016	970	309	3407	75	79	240	634	342
Starvation Cap Reductn	0	61	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.85	0.11	0.92	0.51	0.73	0.16	0.55	0.41	0.44

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	2373	105	269	1615	37	52	12	125	245	83	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	1.00	1.00	0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	5068		1770	1863	1583	3433	1744	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	5068		1770	1863	1583	3433	1744	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	2498	111	283	1700	39	55	13	132	258	87	64
RTOR Reduction (vph)	0	0	33	0	1	0	0	0	96	0	22	0
Lane Group Flow (vph)	26	2498	78	283	1738	0	55	13	36	258	129	0
Turn Type	Prot		Perm	Prot			Split		Over	Split		
Protected Phases	7	4		3	8		2	2	3	6	6	
Permitted Phases			4									
Actuated Green, G (s)	3.7	73.8	73.8	13.9	84.0		4.4	4.4	13.9	15.9	15.9	
Effective Green, g (s)	3.7	73.8	73.8	13.9	84.0		4.4	4.4	13.9	15.9	15.9	
Actuated g/C Ratio	0.03	0.57	0.57	0.11	0.65		0.03	0.03	0.11	0.12	0.12	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	50	2887	899	367	3275		60	63	169	420	213	
v/s Ratio Prot	0.01	c0.49		c0.08	0.34		c0.03	0.01	0.02	c0.08	0.07	
v/s Ratio Perm			0.05									
v/c Ratio	0.52	0.87	0.09	0.77	0.53		0.92	0.21	0.22	0.61	0.61	
Uniform Delay, d1	62.3	23.9	12.8	56.5	12.4		62.6	61.1	53.1	54.1	54.1	
Progression Factor	0.78	0.33	0.24	0.70	0.01		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.1	2.1	0.1	5.9	0.4		85.9	1.6	0.6	2.7	4.8	
Delay (s)	54.0	9.9	3.1	45.5	0.5		148.5	62.7	53.7	56.8	58.9	
Level of Service	D	A	A	D	A		F	E	D	E	E	
Approach Delay (s)		10.0			6.8			80.4			57.6	
Approach LOS		B			A			F			E	

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Group Flow (vph)	29	2883	2059	189	469
v/c Ratio	0.14	1.02	0.79	0.22	0.44
Control Delay	37.4	39.5	13.2	2.9	38.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	37.4	39.5	13.2	2.9	38.4
Queue Length 50th (ft)	20	~557	151	11	170
Queue Length 95th (ft)	m26	#1009	202	m21	224
Internal Link Dist (ft)		1015	1000		632
Turn Bay Length (ft)	400			150	150
Base Capacity (vph)	457	2824	2599	855	1058
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.06	1.02	0.79	0.22	0.44

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	28	2739	1956	180	423	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	0.91	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	5085	5085	1583	3424	
Flt Permitted	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1770	5085	5085	1583	3424	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	29	2883	2059	189	445	24
RTOR Reduction (vph)	0	0	0	49	3	0
Lane Group Flow (vph)	29	2883	2059	140	466	0
Turn Type	Prot			Perm		
Protected Phases	7 9	4	8		6	
Permitted Phases				8		
Actuated Green, G (s)	11.4	70.0	62.0	62.0	40.1	
Effective Green, g (s)	11.4	70.0	62.0	62.0	40.1	
Actuated g/C Ratio	0.09	0.54	0.48	0.48	0.31	
Clearance Time (s)		5.5	5.5	5.5	5.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	155	2738	2425	755	1056	
v/s Ratio Prot	c0.02	c0.57	0.40		c0.14	
v/s Ratio Perm				0.09		
v/c Ratio	0.19	1.05	0.85	0.19	0.44	
Uniform Delay, d1	55.0	30.0	29.9	19.5	36.0	
Progression Factor	0.71	0.68	0.42	0.27	1.00	
Incremental Delay, d2	0.4	30.2	2.8	0.4	1.3	
Delay (s)	39.2	50.5	15.3	5.6	37.3	
Level of Service	D	D	B	A	D	
Approach Delay (s)		50.4	14.5		37.3	
Approach LOS		D	B		D	

Intersection Summary			
HCM Average Control Delay	35.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	128	3179	21	67	2233	71	75	121	202
v/c Ratio	0.54	0.88	0.02	0.67	0.72	0.07	0.66	0.74	0.60
Control Delay	36.7	5.7	0.9	91.0	19.2	5.0	73.2	80.8	24.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.7	5.7	0.9	91.0	19.2	5.0	73.2	80.8	24.8
Queue Length 50th (ft)	93	132	1	56	451	9	52	100	43
Queue Length 95th (ft)	m100	m131	m1	#128	505	28	#129	#196	126
Internal Link Dist (ft)		1000			893		425		590
Turn Bay Length (ft)	150		150	300		150			
Base Capacity (vph)	238	3603	1124	102	3110	985	114	164	335
Starvation Cap Reductn	0	8	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	0.54	0.88	0.02	0.66	0.72	0.07	0.66	0.74	0.60

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	122	3020	20	64	2121	67	27	27	18	115	34	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.97		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583		1766		1770	1633	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.45		0.70	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583		818		1296	1633	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	128	3179	21	67	2233	71	28	28	19	121	36	166
RTOR Reduction (vph)	0	0	3	0	0	17	0	10	0	0	127	0
Lane Group Flow (vph)	128	3179	18	67	2233	54	0	65	0	121	75	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	18.6	91.0	91.0	6.0	78.4	78.4		16.5		16.5	16.5	
Effective Green, g (s)	18.6	91.0	91.0	6.0	78.4	78.4		16.5		16.5	16.5	
Actuated g/C Ratio	0.14	0.70	0.70	0.05	0.60	0.60		0.13		0.13	0.13	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	253	3560	1108	82	3067	955		104		164	207	
v/s Ratio Prot	0.07	c0.63		0.04	c0.44						0.05	
v/s Ratio Perm			0.01			0.03		0.08		c0.09		
v/c Ratio	0.51	0.89	0.02	0.82	0.73	0.06		0.63		0.74	0.36	
Uniform Delay, d1	51.5	15.6	5.9	61.5	18.3	10.6		53.8		54.7	51.9	
Progression Factor	0.63	0.27	0.23	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.5	1.4	0.0	44.3	1.6	0.1		25.4		15.8	1.1	
Delay (s)	33.2	5.6	1.4	105.8	19.8	10.7		79.3		70.5	53.0	
Level of Service	C	A	A	F	B	B		E		E	D	
Approach Delay (s)		6.6			22.0			79.3			59.6	
Approach LOS		A			C			E			E	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Appendix A2

Year 2040 Alternative 2
Intersection Level of Service (LOS) Worksheets

This page intentionally left blank.

Queues
1: Carson St & I-605 SB Off Ramps

11/30/2012

Lane Group	EBT	WBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	1446	1524	82	781	471	381
v/c Ratio	0.57	0.75	0.05	0.46	0.32	0.53
Control Delay	23.8	18.7	0.1	18.0	16.1	20.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.8	18.7	0.1	18.0	16.1	20.9
Queue Length 50th (ft)	197	230	0	164	95	175
Queue Length 95th (ft)	225	261	0	223	139	286
Internal Link Dist (ft)	550	190			1136	
Turn Bay Length (ft)				300		300
Base Capacity (vph)	2750	2192	1611	1708	1485	721
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.70	0.05	0.46	0.32	0.53

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1305	68	0	1448	0	0	0	78	742	85	725
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9				4.0	5.4	5.4	5.4
Lane Util. Factor		0.86			0.91				1.00	0.97	0.91	0.91
Frt		0.99			1.00				0.86	1.00	0.88	0.85
Flt Protected		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (prot)		6360			5085				1611	3433	2978	1441
Flt Permitted		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (perm)		6360			5085				1611	3433	2978	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1374	72	0	1524	0	0	0	82	781	89	763
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	0	0	4	4
Lane Group Flow (vph)	0	1438	0	0	1524	0	0	0	82	781	467	377
Turn Type									Free	Split		Perm
Protected Phases		2			6					4	4	
Permitted Phases									Free			4
Actuated Green, G (s)		40.0			40.0				100.0	49.7	49.7	49.7
Effective Green, g (s)		40.0			40.0				100.0	49.7	49.7	49.7
Actuated g/C Ratio		0.40			0.40				1.00	0.50	0.50	0.50
Clearance Time (s)		4.9			4.9					5.4	5.4	5.4
Vehicle Extension (s)		5.0			5.0					2.5	2.5	2.5
Lane Grp Cap (vph)		2544			2034				1611	1706	1480	716
v/s Ratio Prot		0.23			c0.30					0.23	0.16	
v/s Ratio Perm									0.05			c0.26
v/c Ratio		0.57			0.75				0.05	0.46	0.32	0.53
Uniform Delay, d1		23.3			25.7				0.0	16.4	15.0	17.1
Progression Factor		1.00			0.65				1.00	1.00	1.00	1.00
Incremental Delay, d2		0.5			1.5				0.1	0.9	0.6	2.8
Delay (s)		23.7			18.2				0.1	17.3	15.6	19.9
Level of Service		C			B				A	B	B	B
Approach Delay (s)		23.7			18.2			0.1			17.4	
Approach LOS		C			B			A			B	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	1920	1317	874	708	611
v/c Ratio	0.53	0.66	0.69	0.61	0.64
Control Delay	10.6	8.3	5.7	30.1	30.6
Queue Delay	0.0	1.5	4.0	0.0	0.0
Total Delay	10.6	9.8	9.7	30.1	30.6
Queue Length 50th (ft)	150	143	127	191	178
Queue Length 95th (ft)	173	m178	m164	252	245
Internal Link Dist (ft)	410	90			
Turn Bay Length (ft)				300	300
Base Capacity (vph)	3627	2003	1275	1167	959
Starvation Cap Reductn	0	464	312	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.53	0.86	0.91	0.61	0.64

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1824	0	0	1251	830	673	0	580	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4			5.4	5.4	4.0		4.0			
Lane Util. Factor		0.86			0.95	1.00	0.97		0.88			
Frt		1.00			1.00	0.85	1.00		0.85			
Flt Protected		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)		6408			3539	1583	3433		2787			
Flt Permitted		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)		6408			3539	1583	3433		2787			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1920	0	0	1317	874	708	0	611	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	379	0	0	12	0	0	0
Lane Group Flow (vph)	0	1920	0	0	1317	495	708	0	599	0	0	0
Turn Type						Perm	custom		custom			
Protected Phases		2			6							
Permitted Phases						6	8		8			
Actuated Green, G (s)		56.6			56.6	56.6	34.0		34.0			
Effective Green, g (s)		56.6			56.6	56.6	34.0		34.0			
Actuated g/C Ratio		0.57			0.57	0.57	0.34		0.34			
Clearance Time (s)		5.4			5.4	5.4	4.0		4.0			
Vehicle Extension (s)		5.0			5.0	5.0	3.0		3.0			
Lane Grp Cap (vph)		3627			2003	896	1167		948			
v/s Ratio Prot		0.30			c0.37							
v/s Ratio Perm						0.31	0.21		c0.21			
v/c Ratio		0.53			0.66	0.55	0.61		0.63			
Uniform Delay, d1		13.4			15.0	13.7	27.4		27.7			
Progression Factor		0.74			0.47	4.04	1.00		1.00			
Incremental Delay, d2		0.2			0.6	0.8	2.3		3.2			
Delay (s)		10.2			7.7	56.2	29.8		30.9			
Level of Service		B			A	E	C		C			
Approach Delay (s)		10.2			27.0			30.3			0.0	
Approach LOS		B			C			C			A	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.4
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	653	1320	5	1266	285	194	103	328	324
v/c Ratio	0.98	0.51	0.04	0.85	0.98	0.21	0.43	0.78	0.66
Control Delay	60.9	10.8	44.2	40.9	90.1	28.6	50.5	25.9	11.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.9	10.8	44.2	40.9	90.1	28.6	50.5	25.9	11.2
Queue Length 50th (ft)	212	93	3	281	183	50	32	57	0
Queue Length 95th (ft)	#328	107	15	#394	#348	76	60	161	82
Internal Link Dist (ft)		311		731		382		448	
Turn Bay Length (ft)	250		80		120		140		140
Base Capacity (vph)	663	2572	124	1487	292	997	240	470	536
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	0.98	0.51	0.04	0.85	0.98	0.19	0.43	0.70	0.60

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												
Volume (vph)	620	1141	113	5	1171	31	271	173	11	98	49	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Lane Util. Factor	0.97	0.91		1.00	0.91		1.00	0.95		0.97	0.95	0.95
Frt	1.00	0.99		1.00	1.00		1.00	0.99		1.00	0.87	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	5017		1770	5065		1770	3506		3433	1546	1504
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	5017		1770	5065		1770	3506		3433	1546	1504
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	653	1201	119	5	1233	33	285	182	12	103	52	600
RTOR Reduction (vph)	0	10	0	0	3	0	0	5	0	0	197	274
Lane Group Flow (vph)	653	1310	0	5	1263	0	285	189	0	103	131	50
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	23.2	46.2		1.4	24.4		16.5	26.2		5.6	15.3	15.3
Effective Green, g (s)	23.2	46.2		1.4	24.4		16.5	26.2		5.6	15.3	15.3
Actuated g/C Ratio	0.23	0.46		0.01	0.24		0.16	0.26		0.06	0.15	0.15
Clearance Time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	796	2318		25	1236		292	919		192	237	230
v/s Ratio Prot	c0.19	0.26		0.00	c0.25		c0.16	0.05		0.03	c0.08	
v/s Ratio Perm												0.03
v/c Ratio	0.82	0.57		0.20	1.02		0.98	0.21		0.54	0.55	0.22
Uniform Delay, d1	36.4	19.6		48.7	37.8		41.6	28.8		45.9	39.2	37.1
Progression Factor	0.76	0.58		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.0	0.8		5.3	31.2		45.8	0.2		3.6	3.4	0.6
Delay (s)	33.6	12.3		54.1	69.0		87.4	28.9		49.6	42.6	37.7
Level of Service	C	B		D	E		F	C		D	D	D
Approach Delay (s)		19.3			69.0			63.7			41.5	
Approach LOS		B			E			E			D	

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.6
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	1305	1469	864	923
v/c Ratio	0.44	0.71	0.78	0.58
Control Delay	13.1	18.3	35.6	1.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.1	18.3	35.6	1.6
Queue Length 50th (ft)	161	331	253	0
Queue Length 95th (ft)	232	494	289	0
Internal Link Dist (ft)	898	560	1261	
Turn Bay Length (ft)			230	900
Base Capacity (vph)	2961	2061	1744	1583
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	113	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.46	0.71	0.50	0.58

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1240	1396	0	821	877
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.3	5.3		4.2	4.0
Lane Util. Factor		0.91	0.95		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	3539		3433	1583
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	3539		3433	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1305	1469	0	864	923
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1305	1469	0	864	923
Turn Type						Free
Protected Phases		2	6		4	
Permitted Phases						Free
Actuated Green, G (s)		58.2	58.2		32.3	100.0
Effective Green, g (s)		58.2	58.2		32.3	100.0
Actuated g/C Ratio		0.58	0.58		0.32	1.00
Clearance Time (s)		5.3	5.3		4.2	
Vehicle Extension (s)		5.0	5.0		2.5	
Lane Grp Cap (vph)		2959	2060		1109	1583
v/s Ratio Prot		0.26	c0.42		c0.25	
v/s Ratio Perm						0.58
v/c Ratio		0.44	0.71		0.78	0.58
Uniform Delay, d1		11.8	14.9		30.6	0.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.5	2.0		3.4	1.6
Delay (s)		12.2	16.9		34.0	1.6
Level of Service		B	B		C	A
Approach Delay (s)		12.2	16.9		17.3	
Approach LOS		B	B		B	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.5
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT
Lane Group Flow (vph)	1957	595	226	1492
v/c Ratio	0.75	0.48	0.74	0.42
Control Delay	12.0	5.0	53.8	0.4
Queue Delay	0.7	0.2	0.0	0.0
Total Delay	12.7	5.2	53.8	0.4
Queue Length 50th (ft)	391	123	137	0
Queue Length 95th (ft)	553	195	211	0
Internal Link Dist (ft)	560			522
Turn Bay Length (ft)			260	
Base Capacity (vph)	2600	1235	372	3539
Starvation Cap Reductn	296	176	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.85	0.56	0.61	0.42

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1859	565	215	1417	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	4.0	5.3		
Lane Util. Factor	0.95	1.00	1.00	0.95		
Frt	1.00	0.85	1.00	1.00		
Flt Protected	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	3539	1583	1770	3539		
Flt Permitted	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	3539	1583	1770	3539		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1957	595	226	1492	0	0
RTOR Reduction (vph)	0	71	0	0	0	0
Lane Group Flow (vph)	1957	524	226	1492	0	0
Turn Type		Perm	Prot			
Protected Phases	2		1	6		
Permitted Phases		2				
Actuated Green, G (s)	73.5	73.5	17.2	100.0		
Effective Green, g (s)	73.5	73.5	17.2	100.0		
Actuated g/C Ratio	0.74	0.74	0.17	1.00		
Clearance Time (s)	5.3	5.3	4.0	5.3		
Vehicle Extension (s)	5.0	5.0	3.0	5.0		
Lane Grp Cap (vph)	2601	1164	304	3539		
v/s Ratio Prot	c0.55		c0.13	0.42		
v/s Ratio Perm		0.33				
v/c Ratio	0.75	0.45	0.74	0.42		
Uniform Delay, d1	7.9	5.2	39.3	0.0		
Progression Factor	1.14	1.18	1.00	1.00		
Incremental Delay, d2	1.9	1.2	9.5	0.4		
Delay (s)	10.9	7.4	48.8	0.4		
Level of Service	B	A	D	A		
Approach Delay (s)	10.1			6.7	0.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	372	0	0	683	0	609	870	0	817	640
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	392	0	0	719	0	641	916	0	860	674
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1120				
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	1074	1501	287	928	1501	214	860			641		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	895	1344	287	741	1344	0	860			440		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	45	100	100	30	100			100		
cM capacity (veh/h)	68	143	710	130	143	1031	777			1061		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	392	719	256	256	433	611	344	344	397	449
Volume Left	0	0	0	0	0	0	0	0	0	0
Volume Right	392	719	0	0	305	611	0	0	225	449
cSH	710	1031	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.55	0.70	0.15	0.15	0.25	0.36	0.20	0.20	0.23	0.26
Queue Length 95th (ft)	85	150	0	0	0	0	0	0	0	0
Control Delay (s)	16.1	16.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	C								
Approach Delay (s)	16.1	16.1	0.0				0.0			
Approach LOS	C	C								

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	675	0	1399	856	362
Sign Control	Yield			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	711	0	1473	901	381
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked	0.89					
vC, conflicting volume	1269	300	901			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	663	300	901			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	0	100			
cM capacity (veh/h)	349	696	750			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	711	368	368	368	368	360	360	307	254
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	711	0	0	0	0	0	0	127	254
cSH	696	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	1.02	0.22	0.22	0.22	0.22	0.21	0.21	0.18	0.15
Queue Length 95th (ft)	432	0	0	0	0	0	0	0	0
Control Delay (s)	63.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	F								
Approach Delay (s)	63.9	0.0				0.0			
Approach LOS	F								

Intersection Summary			
Average Delay	13.1		
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	108	861	128	80	1163	252	266	1257	112	1482
v/c Ratio	0.58	0.61	0.18	0.48	0.88	0.47	0.77	0.55	0.27	0.84
Control Delay	55.3	29.7	12.8	52.3	39.8	9.4	55.3	23.6	38.0	29.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.3	29.7	12.8	52.3	39.8	9.4	55.3	23.6	38.0	29.0
Queue Length 50th (ft)	31	156	32	23	247	18	77	171	29	256
Queue Length 95th (ft)	#65	200	68	46	#336	93	#140	188	58	317
Internal Link Dist (ft)		578			652			1209		560
Turn Bay Length (ft)	175			150			180		150	
Base Capacity (vph)	185	1460	720	165	1349	538	346	2540	424	1863
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.59	0.18	0.48	0.86	0.47	0.77	0.49	0.26	0.80

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												
Volume (vph)	103	818	122	76	1078	266	253	980	214	106	962	446
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Lane Util. Factor	0.97	0.91	1.00	0.97	0.86	0.86	0.97	0.86		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	5085	1583	3433	4789	1362	3433	6236		3433	4844	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	5085	1583	3433	4789	1362	3433	6236		3433	4844	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	108	861	128	80	1135	280	266	1032	225	112	1013	469
RTOR Reduction (vph)	0	0	20	0	3	157	0	45	0	0	92	0
Lane Group Flow (vph)	108	861	108	80	1160	95	266	1212	0	112	1390	0
Turn Type	Prot		pm+ov	Prot		Perm	Prot			Prot		
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	3.5	24.1	32.8	3.1	23.7	23.7	8.7	30.7		9.0	31.0	
Effective Green, g (s)	3.5	24.1	32.8	3.1	23.7	23.7	8.7	30.7		9.0	31.0	
Actuated g/C Ratio	0.04	0.27	0.37	0.04	0.27	0.27	0.10	0.35		0.10	0.35	
Clearance Time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	136	1385	683	120	1282	365	337	2163		349	1697	
v/s Ratio Prot	0.03	c0.17	0.02	0.02	c0.24		c0.08	0.19		0.03	c0.29	
v/s Ratio Perm			0.05			0.07						
v/c Ratio	0.79	0.62	0.16	0.67	0.90	0.26	0.79	0.56		0.32	0.82	
Uniform Delay, d1	42.1	28.2	18.6	42.2	31.3	25.5	39.0	23.4		36.9	26.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	26.4	0.9	0.1	13.1	9.2	0.4	11.6	0.3		0.5	3.2	
Delay (s)	68.6	29.1	18.7	55.3	40.5	25.9	50.6	23.8		37.4	29.4	
Level of Service	E	C	B	E	D	C	D	C		D	C	
Approach Delay (s)		31.8			38.9			28.5			30.0	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM Average Control Delay	32.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	88.5	Sum of lost time (s)	16.2
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	661	510	0	894	0	0	0	0	0	0	542
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	696	537	0	941	0	0	0	0	0	0	571
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		732										
pX, platoon unblocked				0.87			0.87	0.87	0.87	0.87	0.87	
vC, conflicting volume	941			1233			1278	1905	500	1173	2174	314
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	941			730			782	1506	0	661	1816	314
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	16
cM capacity (veh/h)	724			754			40	104	940	301	67	682

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	278	278	676	314	314	314	571
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	537	0	0	0	571
cSH	1700	1700	1700	1700	1700	1700	682
Volume to Capacity	0.16	0.16	0.40	0.18	0.18	0.18	0.84
Queue Length 95th (ft)	0	0	0	0	0	0	231
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	31.3
Lane LOS							D
Approach Delay (s)	0.0			0.0			31.3
Approach LOS							D

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	60	200	200	200	6	1547	457	1462
v/c Ratio	0.41	0.54	0.48	0.47	0.05	0.61	0.34	0.54
Control Delay	23.6	25.2	12.0	11.8	11.0	9.5	0.3	12.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.6	25.2	12.0	11.8	11.0	9.5	0.3	12.0
Queue Length 50th (ft)	8	67	26	25	1	90	0	131
Queue Length 95th (ft)	39	109	70	66	m2	m122	m0	211
Internal Link Dist (ft)	296		624			121		607
Turn Bay Length (ft)				470	120			
Base Capacity (vph)	146	532	546	559	131	2543	1362	2710
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.38	0.37	0.36	0.05	0.61	0.34	0.54

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	0	35	211	1	358	6	1069	835	0	1381	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		5.0	5.0	5.0	5.0	5.0	4.0		5.0	
Lane Util. Factor		1.00		0.95	0.91	0.95	1.00	0.86	0.86		0.91	
Frt		0.92		1.00	0.87	0.85	1.00	0.96	0.85		1.00	
Flt Protected		0.98		0.95	0.99	1.00	0.95	1.00	1.00		1.00	
Satd. Flow (prot)		1676		1681	1462	1504	1770	4609	1362		5081	
Flt Permitted		0.98		0.95	0.99	1.00	0.13	1.00	1.00		1.00	
Satd. Flow (perm)		1676		1681	1462	1504	245	4609	1362		5081	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	23	0	37	222	1	377	6	1125	879	0	1454	8
RTOR Reduction (vph)	0	36	0	0	94	94	0	90	0	0	0	0
Lane Group Flow (vph)	0	24	0	200	106	106	6	1457	457	0	1462	0
Turn Type	Split			Split		Perm	Perm		Free			
Protected Phases	4	4		8	8			2			6	
Permitted Phases						8	2		Free			
Actuated Green, G (s)		2.4		13.2	13.2	13.2	30.4	30.4	60.0		30.4	
Effective Green, g (s)		2.4		13.2	13.2	13.2	30.4	30.4	60.0		30.4	
Actuated g/C Ratio		0.04		0.22	0.22	0.22	0.51	0.51	1.00		0.51	
Clearance Time (s)		4.0		5.0	5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		67		370	322	331	124	2335	1362		2574	
v/s Ratio Prot		0.01		c0.12	0.07			c0.32			0.29	
v/s Ratio Perm						0.07	0.02		c0.34			
v/c Ratio		0.37		0.54	0.33	0.32	0.05	0.62	0.34		0.57	
Uniform Delay, d1		28.1		20.7	19.7	19.6	7.5	10.7	0.0		10.3	
Progression Factor		1.00		1.00	1.00	1.00	0.96	0.91	1.00		1.00	
Incremental Delay, d2		3.4		1.6	0.6	0.6	0.4	0.6	0.3		0.9	
Delay (s)		31.4		22.3	20.3	20.2	7.5	10.3	0.3		11.2	
Level of Service		C		C	C	C	A	B	A		B	
Approach Delay (s)		31.4			20.9			8.0			11.2	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	74	754	291	2692	187	1079	113	1089
v/c Ratio	1.00	0.45	0.81	1.09	1.06	0.84	0.96	0.97
Control Delay	162.5	32.1	60.6	59.1	115.9	29.8	116.2	63.8
Queue Delay	0.0	0.0	0.0	30.5	0.0	3.1	0.0	0.0
Total Delay	162.5	32.1	60.6	89.6	115.9	32.9	116.2	63.8
Queue Length 50th (ft)	~59	161	195	~212	~161	105	90	227
Queue Length 95th (ft)	#161	217	m186	m#253	#314	125	#206	#363
Internal Link Dist (ft)		1129		409		285		200
Turn Bay Length (ft)	140		110		150		120	
Base Capacity (vph)	74	1677	457	2475	177	1290	118	1118
Starvation Cap Reductn	0	0	0	149	0	128	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.00	0.45	0.64	1.16	1.06	0.93	0.96	0.97

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	614	103	276	1884	674	178	1006	19	107	914	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.91		1.00	0.91	
Frt	1.00	0.98		1.00	0.96		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4976		1770	4884		1770	5071		1770	4996	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4976		1770	4884		1770	5071		1770	4996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	646	108	291	1983	709	187	1059	20	113	962	127
RTOR Reduction (vph)	0	18	0	0	54	0	0	1	0	0	14	0
Lane Group Flow (vph)	74	736	0	291	2638	0	187	1078	0	113	1075	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	5.0	40.0		24.5	59.5		12.0	30.5		8.0	26.5	
Effective Green, g (s)	5.0	40.0		24.5	59.5		12.0	30.5		8.0	26.5	
Actuated g/C Ratio	0.04	0.33		0.20	0.50		0.10	0.25		0.07	0.22	
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	74	1659		361	2422		177	1289		118	1103	
v/s Ratio Prot	0.04	0.15		c0.16	c0.54		c0.11	0.21		0.06	c0.22	
v/s Ratio Perm												
v/c Ratio	1.00	0.44		0.81	1.09		1.06	0.84		0.96	0.97	
Uniform Delay, d1	57.5	31.3		45.5	30.2		54.0	42.4		55.8	46.4	
Progression Factor	1.00	1.00		1.21	0.50		0.73	0.57		0.85	0.96	
Incremental Delay, d2	104.6	0.2		4.4	42.9		75.5	5.2		63.6	19.9	
Delay (s)	162.1	31.5		59.5	57.9		114.8	29.6		111.2	64.5	
Level of Service	F	C		E	E		F	C		F	E	
Approach Delay (s)		43.2			58.1			42.1			68.9	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM Average Control Delay	55.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	331	1139	330	164	636	15	980	246	1244
v/c Ratio	0.69	0.77	0.61	0.71	0.72	0.13	0.62	0.29	0.56
Control Delay	47.1	36.0	18.6	62.5	36.8	26.3	28.6	3.8	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total Delay	47.1	36.0	18.6	62.5	36.8	26.3	28.6	3.8	9.0
Queue Length 50th (ft)	234	247	111	136	147	7	311	0	83
Queue Length 95th (ft)	346	291	169	m200	190	25	406	50	m87
Internal Link Dist (ft)		339			174		323		285
Turn Bay Length (ft)	200			175		175			
Base Capacity (vph)	520	1605	567	280	1038	119	1588	846	2241
Starvation Cap Reductn	0	0	0	0	0	0	0	0	276
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	0.64	0.71	0.58	0.59	0.61	0.13	0.62	0.29	0.63

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	314	921	475	156	604	0	14	931	234	0	642	540
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor	1.00	0.86	0.86	1.00	0.91		1.00	0.95	1.00		0.91	
Frt	1.00	0.98	0.85	1.00	1.00		1.00	1.00	0.85		0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)	1770	4698	1362	1770	5085		1770	3539	1583		4737	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.14	1.00	1.00		1.00	
Satd. Flow (perm)	1770	4698	1362	1770	5085		264	3539	1583		4737	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	331	969	500	164	636	0	15	980	246	0	676	568
RTOR Reduction (vph)	0	19	111	0	0	0	0	0	136	0	115	0
Lane Group Flow (vph)	331	1120	219	164	636	0	15	980	110	0	1129	0
Turn Type	Prot		Perm	Prot			Perm		Perm			
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2		2			
Actuated Green, G (s)	32.5	37.5	37.5	15.7	20.7		53.8	53.8	53.8		53.8	
Effective Green, g (s)	32.5	37.5	37.5	15.7	20.7		53.8	53.8	53.8		53.8	
Actuated g/C Ratio	0.27	0.31	0.31	0.13	0.17		0.45	0.45	0.45		0.45	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	479	1468	426	232	877		118	1587	710		2124	
v/s Ratio Prot	c0.19	c0.24		0.09	0.13			c0.28			0.24	
v/s Ratio Perm			0.16				0.06		0.07			
v/c Ratio	0.69	0.76	0.51	0.71	0.73		0.13	0.62	0.16		0.53	
Uniform Delay, d1	39.2	37.2	33.8	49.9	47.0		19.4	25.3	19.6		24.0	
Progression Factor	1.02	0.90	0.83	1.00	0.71		1.00	1.00	1.00		0.40	
Incremental Delay, d2	3.7	2.1	0.9	7.0	2.2		2.2	1.8	0.5		0.5	
Delay (s)	44.0	35.8	29.1	57.1	35.4		21.6	27.1	20.1		10.1	
Level of Service	D	D	C	E	D		C	C	C		B	
Approach Delay (s)		36.0			39.9			25.6			10.1	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM Average Control Delay	27.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	192	1102	0	0	1300
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	202	1160	0	0	1368
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						629
pX, platoon unblocked						
vC, conflicting volume	1616	387			1160	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1616	387			1160	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	67			100	
cM capacity (veh/h)	94	612			598	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	202	387	387	387	456	456	456
Volume Left	0	0	0	0	0	0	0
Volume Right	202	0	0	0	0	0	0
cSH	612	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.33	0.23	0.23	0.23	0.27	0.27	0.27
Queue Length 95th (ft)	36	0	0	0	0	0	0
Control Delay (s)	13.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						
Approach Delay (s)	13.8	0.0			0.0		
Approach LOS	B						

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	1351	887	777
v/c Ratio	0.48	0.32	0.71
Control Delay	9.8	6.4	20.0
Queue Delay	0.0	0.0	0.0
Total Delay	9.8	6.4	20.0
Queue Length 50th (ft)	100	78	112
Queue Length 95th (ft)	162	125	143
Internal Link Dist (ft)	736	218	493
Turn Bay Length (ft)			
Base Capacity (vph)	2793	2793	1389
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.48	0.32	0.56

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1283	843	0	576	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5		4.0	
Lane Util. Factor		0.91	0.91		0.97	
Frt		1.00	1.00		0.97	
Flt Protected		1.00	1.00		0.96	
Satd. Flow (prot)		5085	5085		3363	
Flt Permitted		1.00	1.00		0.96	
Satd. Flow (perm)		5085	5085		3363	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1351	887	0	606	171
RTOR Reduction (vph)	0	0	0	0	51	0
Lane Group Flow (vph)	0	1351	887	0	726	0
Turn Type						
Protected Phases		4	8		6	
Permitted Phases						
Actuated Green, G (s)		33.0	33.0		18.5	
Effective Green, g (s)		33.0	33.0		18.5	
Actuated g/C Ratio		0.55	0.55		0.31	
Clearance Time (s)		4.5	4.5		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2797	2797		1037	
v/s Ratio Prot		c0.27	0.17		c0.22	
v/s Ratio Perm						
v/c Ratio		0.48	0.32		0.70	
Uniform Delay, d1		8.3	7.4		18.3	
Progression Factor		1.00	0.77		1.00	
Incremental Delay, d2		0.6	0.3		2.1	
Delay (s)		8.9	5.9		20.4	
Level of Service		A	A		C	
Approach Delay (s)		8.9	5.9		20.4	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.5
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	88	735	367	2955	108	607	477	98	854
v/c Ratio	0.99	0.36	0.84	0.98	0.11	0.69	0.64	1.02	0.68
Control Delay	151.2	10.5	59.3	36.0	6.0	62.2	32.0	143.9	39.6
Queue Delay	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Total Delay	151.2	10.5	59.3	36.5	6.0	62.2	32.0	143.9	39.6
Queue Length 50th (ft)	73	57	270	766	17	258	254	~80	197
Queue Length 95th (ft)	m#169	m68	358	#938	42	321	302	#193	246
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	89	2015	546	3021	962	876	751	96	1253
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	12	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.99	0.36	0.67	0.98	0.11	0.69	0.64	1.02	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	698	0	349	2807	103	0	577	453	93	497	314
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00		0.95	1.00	1.00	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085		1770	5085	1583		3539	1583	1770	4790	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.21	1.00	
Satd. Flow (perm)	1770	5085		1770	5085	1583		3539	1583	390	4790	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	88	735	0	367	2955	108	0	607	477	98	523	331
RTOR Reduction (vph)	0	0	0	0	0	21	0	0	359	0	68	0
Lane Group Flow (vph)	88	735	0	367	2955	87	0	607	118	98	786	0
Turn Type	Prot		Perm	Prot		Perm			Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8			2	6		
Actuated Green, G (s)	6.0	47.6		29.7	71.3	71.3		29.7	29.7	29.7	29.7	
Effective Green, g (s)	6.0	47.6		29.7	71.3	71.3		29.7	29.7	29.7	29.7	
Actuated g/C Ratio	0.05	0.40		0.25	0.59	0.59		0.25	0.25	0.25	0.25	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	89	2017		438	3021	941		876	392	97	1186	
v/s Ratio Prot	0.05	0.14		c0.21	c0.58			0.17			0.16	
v/s Ratio Perm						0.05			0.07	c0.25		
v/c Ratio	0.99	0.36		0.84	0.98	0.09		0.69	0.30	1.01	0.66	
Uniform Delay, d1	57.0	25.5		42.9	23.6	10.5		41.0	36.7	45.1	40.6	
Progression Factor	1.17	0.38		1.00	1.00	1.00		1.42	8.29	1.00	1.00	
Incremental Delay, d2	84.8	0.4		13.1	12.0	0.2		3.5	1.5	94.2	2.9	
Delay (s)	151.3	10.1		56.0	35.6	10.7		61.7	305.7	139.3	43.6	
Level of Service	F	B		E	D	B		E	F	F	D	
Approach Delay (s)		25.2			37.0			169.1			53.4	
Approach LOS		C			D			F			D	

Intersection Summary			
HCM Average Control Delay	60.7	HCM Level of Service	E
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	200	1760	120	3069	689	160	34	51	901	317
v/c Ratio	1.69	1.00	0.90	1.69	2.03	0.12	0.06	0.44	1.09	0.68
Control Delay	380.3	59.8	110.9	339.6	501.6	26.0	8.7	65.1	102.3	32.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	380.3	59.8	110.9	339.6	501.6	26.0	8.7	65.1	102.3	32.5
Queue Length 50th (ft)	~227	488	94	~1287	~837	44	0	38	~414	134
Queue Length 95th (ft)	#379	#610	#211	#1372	#1069	70	23	81	#543	239
Internal Link Dist (ft)		631		1090		191			644	
Turn Bay Length (ft)	200		180		140		60	120		120
Base Capacity (vph)	118	1760	133	1819	339	1326	614	133	826	468
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.69	1.00	0.90	1.69	2.03	0.12	0.06	0.38	1.09	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	190	1404	268	114	2883	32	655	152	32	48	856	301
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4963		1770	5077		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4963		1770	5077		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	1478	282	120	3035	34	689	160	34	51	901	317
RTOR Reduction (vph)	0	23	0	0	1	0	0	0	21	0	0	98
Lane Group Flow (vph)	200	1737	0	120	3068	0	689	160	13	51	901	219
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	8.0	42.0		9.0	43.0		23.0	45.0	45.0	6.8	28.8	28.8
Effective Green, g (s)	8.0	42.0		9.0	43.0		23.0	45.0	45.0	6.8	28.8	28.8
Actuated g/C Ratio	0.07	0.35		0.07	0.36		0.19	0.37	0.37	0.06	0.24	0.24
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	117	1726		132	1807		337	1318	590	100	844	377
v/s Ratio Prot	c0.11	0.35		0.07	c0.60		c0.39	0.05		0.03	c0.25	
v/s Ratio Perm									0.01			0.14
v/c Ratio	1.71	1.01		0.91	1.70		2.04	0.12	0.02	0.51	1.07	0.58
Uniform Delay, d1	56.4	39.4		55.5	38.9		48.9	24.9	24.0	55.4	46.0	40.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	352.8	23.1		51.0	316.5		480.3	0.0	0.0	4.3	50.6	2.3
Delay (s)	409.2	62.5		106.5	355.4		529.2	24.9	24.0	59.7	96.6	42.9
Level of Service	F	E		F	F		F	C	C	E	F	D
Approach Delay (s)		97.9			346.1			418.3			81.7	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	242.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.53		
Actuated Cycle Length (s)	120.8	Sum of lost time (s)	13.0
Intersection Capacity Utilization	141.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations										
Volume (veh/h)	0	190	0	710	0	0	847	470	0	0
Sign Control	Yield			Free			Free		Yield	
Grade	0%			0%			0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	200	0	747	0	0	892	495	0	0
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type				None			None			
Median storage veh)										
Upstream signal (ft)							271			
pX, platoon unblocked	0.76		0.76						0.76	0.76
vC, conflicting volume	2134	374	1386			747			1465	1639
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	2339	374	1350			747			1454	1684
tC, single (s)	6.5	6.9	4.1			4.1			7.5	6.5
tC, 2 stage (s)										
tF (s)	4.0	3.3	2.2			2.2			3.5	4.0
p0 queue free %	100	68	100			100			100	100
cM capacity (veh/h)	27	624	382			857			47	70

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	200	374	374	892	495
Volume Left	0	0	0	0	0
Volume Right	200	0	0	0	495
cSH	624	1700	1700	1700	1700
Volume to Capacity	0.32	0.22	0.22	0.52	0.29
Queue Length 95th (ft)	35	0	0	0	0
Control Delay (s)	13.5	0.0	0.0	0.0	0.0
Lane LOS	B				
Approach Delay (s)	13.5	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	820	0	0	0	0	0	0	710	125	0
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	863	0	0	0	0	0	0	747	132	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											795	
pX, platoon unblocked												
vC, conflicting volume	1626	1626	132	2489	1626	0	132			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1626	1626	132	2489	1626	0	132			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	6	100	100	100	100			54		
cM capacity (veh/h)	52	55	918	1	55	1085	1454			1623		

Direction, Lane #	EB 1	SB 1	SB 2
Volume Total	863	747	132
Volume Left	0	747	0
Volume Right	863	0	0
cSH	918	1623	1700
Volume to Capacity	0.94	0.46	0.08
Queue Length 95th (ft)	372	63	0
Control Delay (s)	38.4	9.1	0.0
Lane LOS	E	A	
Approach Delay (s)	38.4	7.7	
Approach LOS	E		

Intersection Summary			
Average Delay	22.9		
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	496	252	106	853	168	1310
v/c Ratio	0.90	0.42	0.77	0.43	0.17	0.66
Control Delay	45.8	10.8	50.7	9.7	2.3	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1
Total Delay	45.8	10.8	50.7	9.7	2.3	13.1
Queue Length 50th (ft)	199	34	39	111	6	194
Queue Length 95th (ft)	#366	89	m#96	163	m17	261
Internal Link Dist (ft)		1190		300		620
Turn Bay Length (ft)	600		90			
Base Capacity (vph)	569	617	138	1987	962	1985
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	111
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.41	0.77	0.43	0.17	0.70

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	471	34	205	101	810	160	0	1239	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor				1.00	1.00		1.00	0.95	1.00		0.95	
Frt				1.00	0.87		1.00	1.00	0.85		1.00	
Flt Protected				0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)				1770	1623		1770	3539	1583		3537	
Flt Permitted				0.95	1.00		0.13	1.00	1.00		1.00	
Satd. Flow (perm)				1770	1623		246	3539	1583		3537	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	496	36	216	106	853	168	0	1304	6
RTOR Reduction (vph)	0	0	0	0	97	0	0	0	74	0	0	0
Lane Group Flow (vph)	0	0	0	496	155	0	106	853	94	0	1310	0
Turn Type				Split			Perm		Perm			
Protected Phases				8	8			2			6	
Permitted Phases							2		2			
Actuated Green, G (s)				21.7	21.7		39.3	39.3	39.3		39.3	
Effective Green, g (s)				21.7	21.7		39.3	39.3	39.3		39.3	
Actuated g/C Ratio				0.31	0.31		0.56	0.56	0.56		0.56	
Clearance Time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)				3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)				549	503		138	1987	889		1986	
v/s Ratio Prot				c0.28	0.10			0.24			0.37	
v/s Ratio Perm							c0.43		0.06			
v/c Ratio				0.90	0.31		0.77	0.43	0.11		0.66	
Uniform Delay, d1				23.1	18.4		11.8	8.9	7.2		10.7	
Progression Factor				1.00	1.00		1.07	0.98	1.32		1.00	
Incremental Delay, d2				18.2	0.3		29.3	0.6	0.2		1.7	
Delay (s)				41.3	18.8		42.0	9.3	9.6		12.4	
Level of Service				D	B		D	A	A		B	
Approach Delay (s)		0.0			33.7			12.4			12.4	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBT	SBT
Lane Group Flow (vph)	433	436	745	1826
v/c Ratio	0.81	0.90	0.36	0.88
Control Delay	36.6	46.4	2.6	12.7
Queue Delay	0.0	0.0	0.0	1.8
Total Delay	36.6	46.4	2.6	14.5
Queue Length 50th (ft)	167	169	23	186
Queue Length 95th (ft)	#304	#329	m38	m#240
Internal Link Dist (ft)	434		320	300
Turn Bay Length (ft)				
Base Capacity (vph)	556	507	2070	2070
Starvation Cap Reductn	0	0	0	7
Spillback Cap Reductn	0	0	0	123
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.78	0.86	0.36	0.94

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	411	414	0	708	1735	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1770	1583		3539	3539	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1770	1583		3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	433	436	0	745	1826	0
RTOR Reduction (vph)	0	10	0	0	0	0
Lane Group Flow (vph)	433	426	0	745	1826	0
Turn Type		custom				
Protected Phases				2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.1	21.1		40.9	40.9	
Effective Green, g (s)	21.1	21.1		40.9	40.9	
Actuated g/C Ratio	0.30	0.30		0.58	0.58	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	534	477		2068	2068	
v/s Ratio Prot				0.21	c0.52	
v/s Ratio Perm	0.24	c0.27				
v/c Ratio	0.81	0.89		0.36	0.88	
Uniform Delay, d1	22.6	23.4		7.7	12.5	
Progression Factor	1.00	1.00		0.27	0.58	
Incremental Delay, d2	9.1	18.8		0.5	4.2	
Delay (s)	31.7	42.1		2.5	11.4	
Level of Service	C	D		A	B	
Approach Delay (s)	36.9			2.5	11.4	
Approach LOS	D			A	B	

Intersection Summary			
HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	187	408	147	51	307	80	162	421	121	198	1659	415
v/c Ratio	0.89	0.53	0.32	0.32	0.40	0.20	0.92	0.30	0.17	0.52	0.92	0.47
Control Delay	70.1	26.8	6.6	28.6	24.9	7.4	84.3	15.5	3.8	24.5	15.5	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.3
Total Delay	70.1	26.8	6.6	28.6	24.9	7.4	84.3	15.5	3.8	24.5	23.7	3.7
Queue Length 50th (ft)	78	81	0	18	58	0	71	64	0	84	143	11
Queue Length 95th (ft)	#187	122	41	49	93	31	#177	97	29	m89	m#474	m28
Internal Link Dist (ft)		612			420			572			320	
Turn Bay Length (ft)	90			80			130			120		
Base Capacity (vph)	219	809	475	169	809	424	177	1401	700	379	1806	891
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	141	114
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.50	0.31	0.30	0.38	0.19	0.92	0.30	0.17	0.52	1.00	0.53

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	178	388	140	48	292	76	154	400	115	188	1576	394
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.51	1.00	1.00	0.40	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	956	3539	1583	742	3539	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	408	147	51	307	80	162	421	121	198	1659	415
RTOR Reduction (vph)	0	0	115	0	0	63	0	0	73	0	0	83
Lane Group Flow (vph)	187	408	32	51	307	17	162	421	48	198	1659	332
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	15.3	15.3	15.3	15.3	15.3	15.3	7.0	27.7	27.7	15.0	35.7	35.7
Effective Green, g (s)	15.3	15.3	15.3	15.3	15.3	15.3	7.0	27.7	27.7	15.0	35.7	35.7
Actuated g/C Ratio	0.22	0.22	0.22	0.22	0.22	0.22	0.10	0.40	0.40	0.21	0.51	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	209	774	346	162	774	346	177	1400	626	379	1805	807
v/s Ratio Prot		0.12			0.09		c0.09	0.12		0.11	c0.47	
v/s Ratio Perm	c0.20		0.02	0.07		0.01			0.03			0.21
v/c Ratio	0.89	0.53	0.09	0.31	0.40	0.05	0.92	0.30	0.08	0.52	0.92	0.41
Uniform Delay, d1	26.6	24.2	21.8	23.0	23.4	21.6	31.2	14.5	13.2	24.3	15.8	10.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	0.57	0.39
Incremental Delay, d2	34.8	0.7	0.1	1.1	0.3	0.1	43.8	0.6	0.2	0.6	4.6	0.7
Delay (s)	61.3	24.8	21.9	24.1	23.7	21.7	75.0	15.1	13.4	22.1	13.7	4.9
Level of Service	E	C	C	C	C	C	E	B	B	C	B	A
Approach Delay (s)		33.4			23.4			28.6			12.8	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	174	468	0	449	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	183	493	0	473	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	500					
pX, platoon unblocked						
vC, conflicting volume			676		419	92
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			676		419	92
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			912		562	948

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2
Volume Total	122	225	328	236	236
Volume Left	0	0	0	0	0
Volume Right	0	164	328	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.07	0.13	0.19	0.14	0.14
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					
Approach Delay (s)	0.0			0.0	
Approach LOS					

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	22.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	106	1233	1674	294
v/c Ratio	0.45	0.35	0.61	0.23
Control Delay	25.9	0.3	5.4	1.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	25.9	0.3	5.4	1.1
Queue Length 50th (ft)	37	0	133	3
Queue Length 95th (ft)	68	0	188	18
Internal Link Dist (ft)		370	263	
Turn Bay Length (ft)	100			70
Base Capacity (vph)	266	3539	2732	1281
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.40	0.35	0.61	0.23

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	101	1171	1590	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.5	4.5	4.5
Lane Util. Factor			1.00	0.95	0.95	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			1770	3539	3539	1583
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			1770	3539	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	106	1233	1674	294
RTOR Reduction (vph)	0	0	0	0	0	67
Lane Group Flow (vph)	0	0	106	1233	1674	227
Turn Type			Prot			Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			6.9	60.0	44.6	44.6
Effective Green, g (s)			6.9	60.0	44.6	44.6
Actuated g/C Ratio			0.12	1.00	0.74	0.74
Clearance Time (s)			4.0	4.5	4.5	4.5
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			204	3539	2631	1177
v/s Ratio Prot			0.06	c0.35	c0.47	
v/s Ratio Perm						0.14
v/c Ratio			0.52	0.35	0.64	0.19
Uniform Delay, d1			25.0	0.0	3.7	2.3
Progression Factor			0.84	1.00	1.00	1.00
Incremental Delay, d2			2.1	0.3	1.2	0.4
Delay (s)			23.1	0.3	4.9	2.7
Level of Service			C	A	A	A
Approach Delay (s)	0.0			2.1	4.6	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	3.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	4.5
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	203	247	0	1096	1593	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	214	260	0	1154	1677	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				382	450	
pX, platoon unblocked	0.80	0.72	0.72			
vC, conflicting volume	2254	838	1677			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1225	16	1174			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	66	100			
cM capacity (veh/h)	137	767	428			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	142	331	577	577	838	838
Volume Left	142	71	0	0	0	0
Volume Right	0	260	0	0	0	0
cSH	137	385	1700	1700	1700	1700
Volume to Capacity	1.04	0.86	0.34	0.34	0.49	0.49
Queue Length 95th (ft)	192	207	0	0	0	0
Control Delay (s)	152.3	50.7	0.0	0.0	0.0	0.0
Lane LOS	F	F				
Approach Delay (s)	81.3		0.0		0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	11.6		
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	137	132	39	92	186	991	9	1227	532
v/c Ratio	0.56	0.19	0.17	0.14	0.55	0.40	0.02	0.66	0.54
Control Delay	29.9	6.6	20.2	13.2	14.9	6.8	3.8	10.5	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.9	6.6	20.2	13.2	14.9	6.8	3.8	10.5	3.3
Queue Length 50th (ft)	45	3	12	8	20	68	1	112	8
Queue Length 95th (ft)	85	20	31	23	#99	184	m2	223	18
Internal Link Dist (ft)		646		699		573		302	
Turn Bay Length (ft)	120		220		200		260		70
Base Capacity (vph)	345	906	332	917	341	2468	439	1870	993
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	0.40	0.15	0.12	0.10	0.55	0.40	0.02	0.66	0.54

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	20	105	37	55	32	177	934	8	9	1166	505
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.87		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3093		1770	3343		1770	3535		1770	3539	1583
Flt Permitted	0.69	1.00		0.67	1.00		0.12	1.00		0.29	1.00	1.00
Satd. Flow (perm)	1293	3093		1245	3343		227	3535		539	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	137	21	111	39	58	34	186	983	8	9	1227	532
RTOR Reduction (vph)	0	92	0	0	28	0	0	1	0	0	0	161
Lane Group Flow (vph)	137	40	0	39	64	0	186	990	0	9	1227	371
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	10.1	10.1		10.1	10.1		41.9	37.1		31.7	30.9	30.9
Effective Green, g (s)	10.1	10.1		10.1	10.1		41.9	37.1		31.7	30.9	30.9
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.70	0.62		0.53	0.51	0.51
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	218	521		210	563		339	2186		301	1823	815
v/s Ratio Prot		0.01			0.02		c0.06	0.28		0.00	c0.35	
v/s Ratio Perm	c0.11			0.03			0.32			0.02		0.23
v/c Ratio	0.63	0.08		0.19	0.11		0.55	0.45		0.03	0.67	0.46
Uniform Delay, d1	23.2	21.0		21.4	21.2		7.0	6.1		6.7	10.8	9.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.79	0.70	0.32
Incremental Delay, d2	5.6	0.1		0.4	0.1		1.8	0.7		0.0	1.7	1.6
Delay (s)	28.8	21.1		21.8	21.2		8.8	6.8		5.3	9.2	4.6
Level of Service	C	C		C	C		A	A		A	A	A
Approach Delay (s)		25.0			21.4			7.1			7.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	695	225	700	134	100	902
v/c Ratio	0.75	0.38	0.46	0.18	0.46	0.43
Control Delay	25.9	5.0	9.5	1.4	33.3	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.9	5.0	9.5	1.4	33.3	7.8
Queue Length 50th (ft)	113	0	105	0	33	89
Queue Length 95th (ft)	168	42	111	15	#90	122
Internal Link Dist (ft)	720		1803			515
Turn Bay Length (ft)	240	240		150	215	
Base Capacity (vph)	981	613	1614	795	219	2096
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.37	0.43	0.17	0.46	0.43

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	660	214	665	127	95	857
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	695	225	700	134	100	902
RTOR Reduction (vph)	0	165	0	78	0	0
Lane Group Flow (vph)	695	60	700	56	100	902
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	16.1	16.1	25.2	25.2	6.2	35.4
Effective Green, g (s)	16.1	16.1	25.2	25.2	6.2	35.4
Actuated g/C Ratio	0.27	0.27	0.42	0.42	0.10	0.59
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	921	425	1486	665	183	2088
v/s Ratio Prot	c0.20		c0.20		0.06	c0.25
v/s Ratio Perm		0.04		0.04		
v/c Ratio	0.75	0.14	0.47	0.08	0.55	0.43
Uniform Delay, d1	20.1	16.7	12.6	10.5	25.6	6.8
Progression Factor	1.00	1.00	0.65	0.48	1.00	1.00
Incremental Delay, d2	3.6	0.2	1.0	0.2	3.3	0.7
Delay (s)	23.7	16.9	9.2	5.3	28.9	7.4
Level of Service	C	B	A	A	C	A
Approach Delay (s)	22.0		8.6			9.6
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	13.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.5
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	65	156	787	1462	247	1349
v/c Ratio	0.27	0.61	0.31	1.10	1.19	0.44
Control Delay	54.9	18.7	7.1	69.6	164.4	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.9	18.7	7.1	69.6	164.4	1.8
Queue Length 50th (ft)	25	0	104	~1120	~236	36
Queue Length 95th (ft)	46	64	154	#1396	m#401	62
Internal Link Dist (ft)	1134		595			1803
Turn Bay Length (ft)	75	50			235	
Base Capacity (vph)	629	418	2513	1327	207	3044
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.37	0.31	1.10	1.19	0.44

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	62	148	748	1389	235	1282
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	65	156	787	1462	247	1349
RTOR Reduction (vph)	0	145	0	203	0	0
Lane Group Flow (vph)	65	11	787	1259	247	1349
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	8.3	8.3	85.2	85.2	14.0	103.2
Effective Green, g (s)	8.3	8.3	85.2	85.2	14.0	103.2
Actuated g/C Ratio	0.07	0.07	0.71	0.71	0.12	0.86
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	109	2513	1124	207	3044
v/s Ratio Prot	c0.02		0.22		c0.14	0.38
v/s Ratio Perm		0.01		c0.79		
v/c Ratio	0.27	0.10	0.31	1.12	1.19	0.44
Uniform Delay, d1	53.0	52.3	6.5	17.4	53.0	1.9
Progression Factor	1.00	1.00	1.00	1.00	0.97	0.66
Incremental Delay, d2	0.6	0.4	0.3	66.1	119.8	0.4
Delay (s)	53.6	52.7	6.8	83.5	171.5	1.7
Level of Service	D	D	A	F	F	A
Approach Delay (s)	53.0		56.7			27.9
Approach LOS	D		E			C

Intersection Summary			
HCM Average Control Delay	45.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	106.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	190	160	800	70	40	0
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	200	168	842	74	42	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						800
pX, platoon unblocked						
vC, conflicting volume	963	879			842	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	963	879			842	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	25	51			95	
cM capacity (veh/h)	268	347			794	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	200	168	916	42	0
Volume Left	200	0	0	42	0
Volume Right	0	168	74	0	0
cSH	268	347	1700	794	1700
Volume to Capacity	0.75	0.49	0.54	0.05	0.00
Queue Length 95th (ft)	135	64	0	4	0
Control Delay (s)	49.3	24.8	0.0	9.8	0.0
Lane LOS	E	C		A	
Approach Delay (s)	38.1		0.0	9.8	
Approach LOS	E				

Intersection Summary			
Average Delay	10.9		
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2591	1705	597	119	1145	567	642
v/c Ratio	1.12	1.05	0.54	0.54	1.03	0.84	0.44
Control Delay	94.4	63.5	5.8	43.6	76.7	62.8	38.6
Queue Delay	618.6	392.1	15.3	0.0	14.6	0.0	0.0
Total Delay	713.0	455.6	21.1	43.6	91.4	62.8	38.6
Queue Length 50th (ft)	~921	~846	163	101	~386	239	161
Queue Length 95th (ft)	#1010	m731	m85	165	#485	#324	200
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2312	1620	1102	222	1110	673	1475
Starvation Cap Reductn	0	738	493	0	0	0	0
Spillback Cap Reductn	1307	0	0	0	41	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	2.58	1.93	0.98	0.54	1.07	0.84	0.44

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	2317	144	0	1620	567	113	1025	63	539	609	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5041			3539	1583	1770	5041		3433	5084	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5041			3539	1583	1770	5041		3433	5084	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	2439	152	0	1705	597	119	1079	66	567	641	1
RTOR Reduction (vph)	0	5	0	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	2586	0	0	1705	597	119	1140	0	567	642	0
Turn Type						pm+ov	Prot			Prot		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		59.5			59.5	85.0	16.3	28.5		25.5	37.7	
Effective Green, g (s)		59.5			59.5	85.0	16.3	28.5		25.5	37.7	
Actuated g/C Ratio		0.46			0.46	0.65	0.13	0.22		0.20	0.29	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2307			1620	1102	222	1105		673	1474	
v/s Ratio Prot		c0.51			0.48	0.11	0.07	c0.23		c0.17	0.13	
v/s Ratio Perm						0.27						
v/c Ratio		1.12			1.05	0.54	0.54	1.03		0.84	0.44	
Uniform Delay, d1		35.2			35.2	12.1	53.3	50.8		50.3	37.5	
Progression Factor		1.00			1.11	0.57	0.66	0.87		1.00	1.00	
Incremental Delay, d2		60.8			25.5	0.0	7.7	33.4		9.4	0.9	
Delay (s)		96.1			64.6	6.9	43.2	77.6		59.7	38.4	
Level of Service		F			E	A	D	E		E	D	
Approach Delay (s)		96.1			49.7			74.4			48.4	
Approach LOS		F			D			E			D	

Intersection Summary			
HCM Average Control Delay	70.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	98.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	516	2508	36	2318	799	139	241	484	424
v/c Ratio	1.24	0.80	0.53	1.14	1.24	0.54	1.08	0.58	0.61
Control Delay	147.1	32.8	94.1	118.0	171.7	45.2	137.8	47.4	7.9
Queue Delay	192.4	284.5	0.0	402.0	0.0	0.9	619.7	0.0	1.0
Total Delay	339.5	317.3	94.1	520.0	171.7	46.1	757.6	47.4	8.8
Queue Length 50th (ft)	~556	676	30	~818	~310	64	~115	191	0
Queue Length 95th (ft)	m#509	m630	m36	#912	#401	133	#203	250	90
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		160
Base Capacity (vph)	415	3130	68	2025	645	259	224	830	696
Starvation Cap Reductn	107	1593	0	16	0	0	0	0	0
Spillback Cap Reductn	0	795	0	889	0	24	224	0	100
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.68	1.63	0.53	2.04	1.24	0.59	241.00	0.58	0.71

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	490	2366	16	34	1822	380	0	759	132	229	460	403
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.97			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5080		1770	4954			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5080		1770	4954			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	516	2491	17	36	1918	400	0	799	139	241	484	424
RTOR Reduction (vph)	0	0	0	0	24	0	0	0	58	0	0	325
Lane Group Flow (vph)	516	2508	0	36	2294	0	0	799	81	241	484	99
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	30.5	79.0		4.0	52.5			16.5	16.5	8.5	30.5	30.5
Effective Green, g (s)	30.5	79.0		4.0	52.5			16.5	16.5	8.5	30.5	30.5
Actuated g/C Ratio	0.23	0.61		0.03	0.40			0.13	0.13	0.07	0.23	0.23
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	415	3087		54	2001			645	201	224	830	371
v/s Ratio Prot	c0.29	0.49		0.02	c0.46			c0.16		c0.07	0.14	
v/s Ratio Perm									0.05			0.06
v/c Ratio	1.24	0.81		0.67	1.15			1.24	0.40	1.08	0.58	0.27
Uniform Delay, d1	49.8	19.8		62.3	38.8			56.8	52.2	60.8	44.1	40.6
Progression Factor	0.81	1.65		1.29	1.48			1.19	1.36	1.00	1.00	1.00
Incremental Delay, d2	111.5	0.2		15.3	69.4			118.5	5.0	81.7	3.0	1.8
Delay (s)	151.8	32.8		96.0	126.6			186.0	76.2	142.5	47.1	42.4
Level of Service	F	C		F	F			F	E	F	D	D
Approach Delay (s)		53.1			126.1			169.7			65.4	
Approach LOS		D			F			F			E	

Intersection Summary			
HCM Average Control Delay	92.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	110.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	35	701	47	1163	487	73	480	180	354	14
v/c Ratio	0.31	0.34	0.19	0.57	0.53	0.18	0.60	0.49	0.31	0.04
Control Delay	40.9	32.9	27.9	31.3	4.7	42.0	47.4	77.9	71.4	49.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	32.9	27.9	31.3	4.7	42.0	47.4	77.9	71.4	49.2
Queue Length 50th (ft)	27	197	25	273	5	50	186	187	122	6
Queue Length 95th (ft)	m55	m227	56	321	75	94	246	m275	m160	m18
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	113	2049	242	2054	924	402	796	369	1135	393
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.34	0.19	0.57	0.53	0.18	0.60	0.49	0.31	0.04

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	653	13	45	1105	463	69	391	65	343	164	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (prot)	1770	5070		1770	5085	1583	1770	3464		1522	4686	1583
Flt Permitted	0.15	1.00		0.32	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (perm)	279	5070		598	5085	1583	1770	3464		1522	4686	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	687	14	47	1163	487	73	412	68	361	173	14
RTOR Reduction (vph)	0	2	0	0	0	285	0	10	0	0	0	10
Lane Group Flow (vph)	35	699	0	47	1163	202	73	470	0	180	354	4
Turn Type	Perm			Perm		Perm	Split			Split		Perm
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	52.5	52.5		52.5	52.5	52.5	29.5	29.5		31.5	31.5	31.5
Effective Green, g (s)	52.5	52.5		52.5	52.5	52.5	29.5	29.5		31.5	31.5	31.5
Actuated g/C Ratio	0.40	0.40		0.40	0.40	0.40	0.23	0.23		0.24	0.24	0.24
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	113	2048		242	2054	639	402	786		369	1135	384
v/s Ratio Prot		0.14			c0.23		0.04	c0.14		c0.12	0.08	
v/s Ratio Perm	0.13			0.08		0.13						0.00
v/c Ratio	0.31	0.34		0.19	0.57	0.32	0.18	0.60		0.49	0.31	0.01
Uniform Delay, d1	26.4	26.8		25.1	29.9	26.5	40.5	44.9		42.3	40.4	37.4
Progression Factor	1.21	1.21		1.00	1.00	1.00	1.00	1.00		1.72	1.75	2.76
Incremental Delay, d2	5.8	0.4		1.8	1.1	1.3	1.0	3.3		3.8	0.6	0.0
Delay (s)	37.8	32.9		26.9	31.1	27.8	41.5	48.3		76.6	71.1	103.4
Level of Service	D	C		C	C	C	D	D		E	E	F
Approach Delay (s)		33.1			30.0			47.4			73.7	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM Average Control Delay	40.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	108	2701	39	138	2698	98	95	176	49	18	37
v/c Ratio	0.72	0.86	0.04	0.77	0.85	0.69	0.50	0.57	0.27	0.06	0.14
Control Delay	79.6	42.8	14.6	51.5	0.9	79.7	63.5	17.1	48.3	44.9	14.6
Queue Delay	0.0	66.6	0.0	0.0	6.1	670.8	0.0	0.0	0.0	0.0	394.3
Total Delay	79.6	109.4	14.6	51.5	7.0	750.6	63.5	17.1	48.3	44.9	408.9
Queue Length 50th (ft)	83	850	15	124	13	80	76	8	35	13	0
Queue Length 95th (ft)	m108	m890	m20	m105	m11	141	132	80	72	36	31
Internal Link Dist (ft)		585			1015		352			692	
Turn Bay Length (ft)	270		180								
Base Capacity (vph)	159	3149	988	189	3174	171	229	318	179	344	322
Starvation Cap Reductn	0	793	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	443	171	0	0	0	0	301
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	1.15	0.04	0.73	0.99	98.00	0.41	0.55	0.27	0.05	1.76

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	103	2566	37	131	2143	420	93	90	167	47	17	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	1770	4960		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.75	1.00	1.00	0.49	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	1770	4960		1389	1863	1583	921	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	108	2701	39	138	2256	442	98	95	176	49	18	37
RTOR Reduction (vph)	0	0	8	0	21	0	0	0	149	0	0	31
Lane Group Flow (vph)	108	2701	31	138	2677	0	98	95	27	49	18	6
Turn Type	Prot		Perm	Prot			Perm		Over	pm+pt		Perm
Protected Phases	7	4		3	8			2	3	1	6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	11.0	79.8	79.8	13.2	82.0		13.3	13.3	13.2	20.5	20.5	20.5
Effective Green, g (s)	11.0	79.8	79.8	13.2	82.0		13.3	13.3	13.2	20.5	20.5	20.5
Actuated g/C Ratio	0.08	0.61	0.61	0.10	0.63		0.10	0.10	0.10	0.16	0.16	0.16
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	150	3121	972	180	3129		142	191	161	166	294	250
v/s Ratio Prot	0.06	0.53		c0.08	c0.54			0.05	0.02	c0.01	0.01	
v/s Ratio Perm			0.02				c0.07			0.04		0.00
v/c Ratio	0.72	0.87	0.03	0.77	0.86		0.69	0.50	0.17	0.30	0.06	0.02
Uniform Delay, d1	58.0	20.7	9.9	56.9	19.3		56.4	55.2	53.4	47.5	46.6	46.3
Progression Factor	1.11	1.91	2.19	0.85	0.02		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.9	2.0	0.0	1.8	0.3		13.5	2.0	0.5	1.0	0.1	0.0
Delay (s)	73.3	41.4	21.7	49.9	0.7		69.8	57.2	53.9	48.5	46.7	46.3
Level of Service	E	D	C	D	A		E	E	D	D	D	D
Approach Delay (s)		42.4			3.1			59.0			47.4	
Approach LOS		D			A			E			D	

Intersection Summary			
HCM Average Control Delay	25.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	102	2722	3495	159
v/c Ratio	0.40	0.82	1.21	0.29
Control Delay	32.1	12.1	115.3	32.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	32.1	12.1	115.3	32.9
Queue Length 50th (ft)	68	257	~1293	38
Queue Length 95th (ft)	m79	357	m#368	75
Internal Link Dist (ft)		1015	1000	632
Turn Bay Length (ft)				150
Base Capacity (vph)	456	3325	2900	542
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.22	0.82	1.21	0.29

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	97	2586	2729	591	94	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5		5.5	
Lane Util. Factor	1.00	0.91	0.91		0.97	
Frt	1.00	1.00	0.97		0.94	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	5085	4950		3306	
Flt Permitted	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	5085	4950		3306	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	102	2722	2873	622	99	60
RTOR Reduction (vph)	0	0	26	0	51	0
Lane Group Flow (vph)	102	2722	3469	0	108	0
Turn Type	Prot					
Protected Phases	7 9	4	8		6	
Permitted Phases						
Actuated Green, G (s)	18.7	85.0	75.5		19.3	
Effective Green, g (s)	18.7	85.0	75.5		19.3	
Actuated g/C Ratio	0.14	0.65	0.58		0.15	
Clearance Time (s)		5.5	5.5		5.5	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)	255	3325	2875		491	
v/s Ratio Prot	c0.06	c0.54	c0.70		c0.03	
v/s Ratio Perm						
v/c Ratio	0.40	0.82	1.21		0.22	
Uniform Delay, d1	50.6	16.8	27.2		48.7	
Progression Factor	0.59	0.63	0.77		1.00	
Incremental Delay, d2	0.5	1.3	93.3		1.0	
Delay (s)	30.5	11.9	114.4		49.8	
Level of Service	C	B	F		D	
Approach Delay (s)		12.6	114.4		49.8	
Approach LOS		B	F		D	

Intersection Summary			
HCM Average Control Delay	68.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	156	2585	71	47	3875	187	53	121
v/c Ratio	1.09	0.73	0.06	0.43	1.17	1.22	0.30	0.39
Control Delay	121.5	1.5	0.1	70.7	102.4	190.7	56.1	16.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	121.5	1.5	0.1	70.7	102.4	190.7	56.1	16.8
Queue Length 50th (ft)	~145	27	0	39	~1424	~193	41	13
Queue Length 95th (ft)	m#210	31	m0	80	#1487	#350	84	71
Internal Link Dist (ft)		1000			893	425		590
Turn Bay Length (ft)	150			300				
Base Capacity (vph)	143	3528	1120	124	3320	153	174	308
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.09	0.73	0.06	0.38	1.17	1.22	0.30	0.39

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	148	2456	67	45	3462	219	126	39	12	50	16	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91			1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99			0.99		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.97		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5040			1782		1770	1623	
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.61		0.69	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5040			1121		1288	1623	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	156	2585	71	47	3644	231	133	41	13	53	17	104
RTOR Reduction (vph)	0	0	22	0	6	0	0	2	0	0	90	0
Lane Group Flow (vph)	156	2585	49	47	3869	0	0	185	0	53	31	0
Turn Type	Prot		Perm	Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2			6		
Actuated Green, G (s)	11.6	89.1	89.1	6.9	84.4			17.5		17.5	17.5	
Effective Green, g (s)	11.6	89.1	89.1	6.9	84.4			17.5		17.5	17.5	
Actuated g/C Ratio	0.09	0.69	0.69	0.05	0.65			0.13		0.13	0.13	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	158	3485	1085	94	3272			151		173	218	
v/s Ratio Prot	c0.09	0.51		0.03	c0.77						0.02	
v/s Ratio Perm			0.03					c0.17		0.04		
v/c Ratio	0.99	0.74	0.05	0.50	1.18			1.23		0.31	0.14	
Uniform Delay, d1	59.1	13.1	6.6	59.9	22.8			56.2		50.8	49.6	
Progression Factor	0.62	0.05	0.00	1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	50.2	0.8	0.0	4.1	85.6			146.9		1.0	0.3	
Delay (s)	87.0	1.5	0.0	64.0	108.4			203.2		51.8	49.9	
Level of Service	F	A	A	E	F			F		D	D	
Approach Delay (s)		6.2			107.8			203.2			50.5	
Approach LOS		A			F			F			D	

Intersection Summary			
HCM Average Control Delay	68.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	110.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Queues
3: 7th St & Park Ave

2/20/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	17	1211	80	1377	77	182	534	57	136	95
v/c Ratio	0.15	0.81	0.34	0.77	0.18	0.28	0.82	0.14	0.21	0.17
Control Delay	18.9	24.0	13.0	17.8	16.1	16.8	25.7	15.7	16.1	12.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.9	24.0	13.0	17.8	16.1	16.8	25.7	15.7	16.1	12.6
Queue Length 50th (ft)	4	235	15	232	22	55	148	16	40	20
Queue Length 95th (ft)	21	#397	39	360	49	98	270	39	75	49
Internal Link Dist (ft)		588		707		495			498	
Turn Bay Length (ft)	70		180		30		30	100		90
Base Capacity (vph)	129	1672	232	2087	613	916	854	569	916	790
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.72	0.34	0.66	0.13	0.20	0.63	0.10	0.15	0.12

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												
Volume (vph)	16	1085	66	76	1296	12	73	173	507	54	129	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3509		1770	3534		1770	1863	1583	1770	1863	1583
Flt Permitted	0.15	1.00		0.13	1.00		0.67	1.00	1.00	0.62	1.00	1.00
Satd. Flow (perm)	272	3509		245	3534		1248	1863	1583	1157	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	1142	69	80	1364	13	77	182	534	57	136	95
RTOR Reduction (vph)	0	6	0	0	1	0	0	0	97	0	0	15
Lane Group Flow (vph)	17	1205	0	80	1376	0	77	182	437	57	136	80
Turn Type	Perm			pm+pt			Perm		Perm	Perm		Perm
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	27.4	27.4		33.3	33.3		22.6	22.6	22.6	22.6	22.6	22.6
Effective Green, g (s)	27.4	27.4		33.3	33.3		22.6	22.6	22.6	22.6	22.6	22.6
Actuated g/C Ratio	0.42	0.42		0.51	0.51		0.35	0.35	0.35	0.35	0.35	0.35
Clearance Time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	115	1481		194	1813		435	649	551	403	649	551
v/s Ratio Prot		0.34		0.02	c0.39			0.10			0.07	
v/s Ratio Perm	0.06			0.19			0.06		c0.28	0.05		0.05
v/c Ratio	0.15	0.81		0.41	0.76		0.18	0.28	0.79	0.14	0.21	0.15
Uniform Delay, d1	11.6	16.5		11.1	12.6		14.7	15.3	19.0	14.5	14.9	14.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	3.5		1.4	1.9		0.2	0.2	7.7	0.2	0.2	0.1
Delay (s)	12.2	20.1		12.5	14.5		14.9	15.5	26.7	14.7	15.0	14.6
Level of Service	B	C		B	B		B	B	C	B	B	B
Approach Delay (s)		19.9			14.4			23.0			14.8	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	64.9	Sum of lost time (s)	9.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues
25: I-405 SB Off Ramp & Studebaker Rd

11/21/2012

Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	474	1154	1677
v/c Ratio	0.65	0.50	0.73
Control Delay	24.2	6.1	9.6
Queue Delay	0.0	0.1	1.0
Total Delay	24.2	6.3	10.6
Queue Length 50th (ft)	75	144	247
Queue Length 95th (ft)	111	45	391
Internal Link Dist (ft)	342	302	370
Turn Bay Length (ft)	170		
Base Capacity (vph)	883	2288	2288
Starvation Cap Reductn	0	283	341
Spillback Cap Reductn	0	0	37
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.54	0.58	0.86

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	203	247	0	1096	1593	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.92			1.00	1.00	
Flt Protected	0.98			1.00	1.00	
Satd. Flow (prot)	3243			3539	3539	
Flt Permitted	0.98			1.00	1.00	
Satd. Flow (perm)	3243			3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	214	260	0	1154	1677	0
RTOR Reduction (vph)	20	0	0	0	0	0
Lane Group Flow (vph)	455	0	0	1154	1677	0
Turn Type						
Protected Phases	4			2	6	
Permitted Phases						
Actuated Green, G (s)	13.2			38.8	38.8	
Effective Green, g (s)	13.2			38.8	38.8	
Actuated g/C Ratio	0.22			0.65	0.65	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	713			2289	2289	
v/s Ratio Prot	c0.14			0.33	c0.47	
v/s Ratio Perm						
v/c Ratio	0.64			0.50	0.73	
Uniform Delay, d1	21.2			5.6	7.1	
Progression Factor	1.00			0.88	0.98	
Incremental Delay, d2	1.9			0.7	1.7	
Delay (s)	23.1			5.6	8.7	
Level of Service	C			A	A	
Approach Delay (s)	23.1			5.6	8.7	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
29: College Park Dr & SR-22 Ramps

11/21/2012

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	200	168	916	42	316
v/c Ratio	0.57	0.38	0.81	0.25	0.25
Control Delay	27.7	6.3	21.9	31.4	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	27.7	6.3	21.9	31.4	4.4
Queue Length 50th (ft)	66	0	175	15	46
Queue Length 95th (ft)	112	38	#582	33	70
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	472	545	1124	168	1246
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.42	0.31	0.81	0.25	0.25

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	190	160	800	70	40	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1842		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	1842		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	168	842	74	42	316
RTOR Reduction (vph)	0	135	4	0	0	0
Lane Group Flow (vph)	200	33	912	0	42	316
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	11.9	11.9	34.1		2.0	40.1
Effective Green, g (s)	11.9	11.9	34.1		2.0	40.1
Actuated g/C Ratio	0.20	0.20	0.57		0.03	0.67
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	351	314	1047		59	1245
v/s Ratio Prot	c0.11		c0.49		c0.02	0.17
v/s Ratio Perm		0.02				
v/c Ratio	0.57	0.11	0.87		0.71	0.25
Uniform Delay, d1	21.7	19.7	11.1		28.7	4.0
Progression Factor	1.00	1.00	1.00		1.08	0.87
Incremental Delay, d2	2.1	0.1	9.9		33.0	0.5
Delay (s)	23.9	19.8	21.0		64.0	3.9
Level of Service	C	B	C		E	A
Approach Delay (s)	22.0		21.0			11.0
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	19.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Carson St & I-605 SB Off Ramps

12/3/2012

Lane Group	EBT	WBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	2197	1514	586	1073	613	282
v/c Ratio	0.78	0.67	0.36	0.67	0.41	0.42
Control Delay	28.3	16.7	0.6	25.7	20.4	21.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.3	16.7	0.6	25.7	20.4	21.3
Queue Length 50th (ft)	368	250	0	298	152	137
Queue Length 95th (ft)	416	276	0	372	201	216
Internal Link Dist (ft)	550	190			1136	
Turn Bay Length (ft)				300		300
Base Capacity (vph)	2835	2270	1611	1597	1478	675
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.67	0.36	0.67	0.41	0.42

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1896	191	0	1438	0	0	0	557	1019	326	524
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9				4.0	5.4	5.4	5.4
Lane Util. Factor		0.86			0.91				1.00	0.97	0.91	0.91
Frt		0.99			1.00				0.86	1.00	0.93	0.85
Flt Protected		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (prot)		6320			5085				1611	3433	3166	1441
Flt Permitted		1.00			1.00				1.00	0.95	1.00	1.00
Satd. Flow (perm)		6320			5085				1611	3433	3166	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1996	201	0	1514	0	0	0	586	1073	343	552
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	0	0	5	5
Lane Group Flow (vph)	0	2182	0	0	1514	0	0	0	586	1073	608	277
Turn Type									Free	Split		Perm
Protected Phases		2			6					4	4	
Permitted Phases									Free			4
Actuated Green, G (s)		48.5			48.5				110.0	51.2	51.2	51.2
Effective Green, g (s)		48.5			48.5				110.0	51.2	51.2	51.2
Actuated g/C Ratio		0.44			0.44				1.00	0.47	0.47	0.47
Clearance Time (s)		4.9			4.9					5.4	5.4	5.4
Vehicle Extension (s)		5.0			5.0					2.5	2.5	2.5
Lane Grp Cap (vph)		2787			2242				1611	1598	1474	671
v/s Ratio Prot		c0.35			0.30					c0.31	0.19	
v/s Ratio Perm									0.36			0.19
v/c Ratio		0.78			0.68				0.36	0.67	0.41	0.41
Uniform Delay, d1		26.3			24.5				0.0	22.9	19.4	19.4
Progression Factor		1.00			0.62				1.00	1.00	1.00	1.00
Incremental Delay, d2		1.7			0.8				0.6	2.3	0.9	1.9
Delay (s)		28.0			16.1				0.6	25.1	20.3	21.3
Level of Service		C			B				A	C	C	C
Approach Delay (s)		28.0			16.1			0.6			23.1	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	3366	1284	779	747	368
v/c Ratio	0.85	0.59	0.61	0.73	0.44
Control Delay	13.5	6.2	3.5	39.3	33.0
Queue Delay	0.1	1.1	2.5	0.0	0.0
Total Delay	13.6	7.3	6.0	39.3	33.0
Queue Length 50th (ft)	315	112	65	242	118
Queue Length 95th (ft)	332	m179	m83	312	167
Internal Link Dist (ft)	410	90			
Turn Bay Length (ft)				300	300
Base Capacity (vph)	3938	2175	1273	1030	837
Starvation Cap Reductn	21	596	354	0	0
Spillback Cap Reductn	33	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.86	0.81	0.85	0.73	0.44

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	3198	0	0	1220	740	710	0	350	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4			5.4	5.4	4.0		4.0			
Lane Util. Factor		0.86			0.95	1.00	0.97		0.88			
Frt		1.00			1.00	0.85	1.00		0.85			
Flt Protected		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)		6408			3539	1583	3433		2787			
Flt Permitted		1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)		6408			3539	1583	3433		2787			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	3366	0	0	1284	779	747	0	368	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	300	0	0	1	0	0	0
Lane Group Flow (vph)	0	3366	0	0	1284	479	747	0	367	0	0	0
Turn Type						Perm	custom		custom			
Protected Phases		2			6							
Permitted Phases						6	8		8			
Actuated Green, G (s)		67.6			67.6	67.6	33.0		33.0			
Effective Green, g (s)		67.6			67.6	67.6	33.0		33.0			
Actuated g/C Ratio		0.61			0.61	0.61	0.30		0.30			
Clearance Time (s)		5.4			5.4	5.4	4.0		4.0			
Vehicle Extension (s)		5.0			5.0	5.0	3.0		3.0			
Lane Grp Cap (vph)		3938			2175	973	1030		836			
v/s Ratio Prot		c0.53			0.36							
v/s Ratio Perm						0.30	c0.22		0.13			
v/c Ratio		0.85			0.59	0.49	0.73		0.44			
Uniform Delay, d1		17.2			12.8	11.7	34.4		31.0			
Progression Factor		0.66			0.42	2.79	1.00		1.00			
Incremental Delay, d2		1.7			0.4	0.5	4.5		1.7			
Delay (s)		13.0			5.8	33.2	38.9		32.7			
Level of Service		B			A	C	D		C			
Approach Delay (s)		13.0			16.1			36.9			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	9.4
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	823	2290	5	1142	267	112	157	340	335
v/c Ratio	0.97	0.87	0.04	0.89	0.90	0.33	0.21	0.85	0.67
Control Delay	44.7	13.2	49.4	49.0	78.4	44.8	36.7	38.1	11.7
Queue Delay	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.7	14.2	49.4	49.0	78.4	44.8	36.7	38.1	11.7
Queue Length 50th (ft)	295	87	3	282	~201	36	46	95	0
Queue Length 95th (ft)	m#405	#354	16	#360	#366	64	78	#249	88
Internal Link Dist (ft)		311		731		382		448	
Turn Bay Length (ft)	250		80		120		140		140
Base Capacity (vph)	852	2636	113	1283	297	784	739	426	526
Starvation Cap Reductn	0	147	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	0.97	0.92	0.04	0.89	0.90	0.14	0.21	0.80	0.64

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	782	1947	229	5	989	96	254	96	10	149	51	590
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Lane Util. Factor	0.97	0.91		1.00	0.91		1.00	0.95		0.97	0.95	0.95
Frt	1.00	0.98		1.00	0.99		1.00	0.99		1.00	0.87	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	5005		1770	5018		1770	3487		3433	1546	1504
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	5005		1770	5018		1770	3487		3433	1546	1504
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	823	2049	241	5	1041	101	267	101	11	157	54	621
RTOR Reduction (vph)	0	12	0	0	11	0	0	9	0	0	177	287
Lane Group Flow (vph)	823	2278	0	5	1131	0	267	103	0	157	163	48
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	31.2	53.8		1.4	24.0		18.5	10.5		23.7	15.7	15.7
Effective Green, g (s)	31.2	53.8		1.4	24.0		18.5	10.5		23.7	15.7	15.7
Actuated g/C Ratio	0.28	0.49		0.01	0.22		0.17	0.10		0.22	0.14	0.14
Clearance Time (s)	4.9	5.4		4.9	5.4		4.9	5.4		4.9	5.4	5.4
Vehicle Extension (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	974	2448		23	1095		298	333		740	221	215
v/s Ratio Prot	0.24	c0.46		0.00	c0.23		c0.15	0.03		c0.05	c0.11	
v/s Ratio Perm												0.03
v/c Ratio	0.84	0.93		0.22	1.03		0.90	0.31		0.21	0.74	0.22
Uniform Delay, d1	37.1	26.4		53.8	43.0		44.8	46.4		35.5	45.2	41.7
Progression Factor	0.66	0.40		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.1	4.7		6.4	36.0		27.7	0.7		0.2	12.7	0.7
Delay (s)	28.6	15.3		60.2	79.0		72.5	47.1		35.7	57.9	42.5
Level of Service	C	B		E	E		E	D		D	E	D
Approach Delay (s)		18.8			78.9			65.0			47.5	
Approach LOS		B			E			E			D	

Intersection Summary			
HCM Average Control Delay	39.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.6
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	2006	1331	649	982
v/c Ratio	0.66	0.63	0.71	0.62
Control Delay	11.5	11.6	27.2	1.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	11.5	11.6	27.2	1.8
Queue Length 50th (ft)	186	172	129	0
Queue Length 95th (ft)	292	292	161	0
Internal Link Dist (ft)	898	560	1261	
Turn Bay Length (ft)			230	900
Base Capacity (vph)	3035	2112	1658	1583
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	9	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.66	0.63	0.39	0.62

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1906	1264	0	617	933
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.3	5.3		4.2	4.0
Lane Util. Factor		0.91	0.95		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	3539		3433	1583
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	3539		3433	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	2006	1331	0	649	982
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	2006	1331	0	649	982
Turn Type						Free
Protected Phases		2	6		4	
Permitted Phases						Free
Actuated Green, G (s)		41.8	41.8		18.7	70.0
Effective Green, g (s)		41.8	41.8		18.7	70.0
Actuated g/C Ratio		0.60	0.60		0.27	1.00
Clearance Time (s)		5.3	5.3		4.2	
Vehicle Extension (s)		5.0	5.0		2.5	
Lane Grp Cap (vph)		3036	2113		917	1583
v/s Ratio Prot		0.39	0.38		0.19	
v/s Ratio Perm						c0.62
v/c Ratio		0.66	0.63		0.71	0.62
Uniform Delay, d1		9.4	9.1		23.2	0.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		1.1	1.4		2.3	1.8
Delay (s)		10.5	10.5		25.5	1.8
Level of Service		B	B		C	A
Approach Delay (s)		10.5	10.5		11.3	
Approach LOS		B	B		B	

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT
Lane Group Flow (vph)	2108	1012	167	1304
v/c Ratio	0.80	0.83	0.75	0.37
Control Delay	9.7	12.7	52.4	0.3
Queue Delay	0.2	0.1	0.0	0.0
Total Delay	9.9	12.8	52.4	0.3
Queue Length 50th (ft)	337	278	70	0
Queue Length 95th (ft)	475	#478	#159	0
Internal Link Dist (ft)	560			522
Turn Bay Length (ft)			260	
Base Capacity (vph)	2625	1225	228	3539
Starvation Cap Reductn	96	10	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.83	0.83	0.73	0.37

Intersection Summary

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

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2003	961	159	1239	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	4.0	5.3		
Lane Util. Factor	0.95	1.00	1.00	0.95		
Frt	1.00	0.85	1.00	1.00		
Flt Protected	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	3539	1583	1770	3539		
Flt Permitted	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	3539	1583	1770	3539		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2108	1012	167	1304	0	0
RTOR Reduction (vph)	0	52	0	0	0	0
Lane Group Flow (vph)	2108	960	167	1304	0	0
Turn Type		Perm	Prot			
Protected Phases	2		1	6		
Permitted Phases		2				
Actuated Green, G (s)	51.9	51.9	8.8	70.0		
Effective Green, g (s)	51.9	51.9	8.8	70.0		
Actuated g/C Ratio	0.74	0.74	0.13	1.00		
Clearance Time (s)	5.3	5.3	4.0	5.3		
Vehicle Extension (s)	5.0	5.0	3.0	5.0		
Lane Grp Cap (vph)	2624	1174	223	3539		
v/s Ratio Prot	0.60		c0.09	0.37		
v/s Ratio Perm		c0.61				
v/c Ratio	0.80	0.82	0.75	0.37		
Uniform Delay, d1	5.8	5.9	29.5	0.0		
Progression Factor	1.16	1.18	1.00	1.00		
Incremental Delay, d2	2.4	5.6	12.9	0.3		
Delay (s)	9.1	12.6	42.4	0.3		
Level of Service	A	B	D	A		
Approach Delay (s)	10.3			5.1	0.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.3
Intersection Capacity Utilization	76.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	377	0	0	675	0	793	660	0	748	322
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	397	0	0	711	0	835	695	0	787	339
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1120				
pX, platoon unblocked	0.89	0.89		0.89	0.89	0.89				0.89		
vC, conflicting volume	1066	1622	262	1097	1622	278	787			835		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	624	1252	262	659	1252	0	787			363		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	46	100	100	26	100			100		
cM capacity (veh/h)	85	152	736	142	152	961	828			1056		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	397	711	334	334	399	463	315	315	270	226
Volume Left	0	0	0	0	0	0	0	0	0	0
Volume Right	397	711	0	0	232	463	0	0	113	226
cSH	736	961	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.54	0.74	0.20	0.20	0.23	0.27	0.19	0.19	0.16	0.13
Queue Length 95th (ft)	81	174	0	0	0	0	0	0	0	0
Control Delay (s)	15.5	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	C								
Approach Delay (s)	15.5	18.6	0.0				0.0			
Approach LOS	C	C								

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	758	0	1330	634	400
Sign Control	Yield			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	798	0	1400	667	421
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				640		
pX, platoon unblocked	0.87					
vC, conflicting volume	1017	222	667			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	252	222	667			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	0	100			
cM capacity (veh/h)	619	781	918			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	798	350	350	350	350	267	267	274	281
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	798	0	0	0	0	0	0	140	281
cSH	781	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	1.02	0.21	0.21	0.21	0.21	0.16	0.16	0.16	0.17
Queue Length 95th (ft)	459	0	0	0	0	0	0	0	0
Control Delay (s)	60.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	F								
Approach Delay (s)	60.7	0.0				0.0			
Approach LOS	F								

Intersection Summary			
Average Delay	14.7		
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	146	2240	294	238	1005	246	228	1120	195	1176
v/c Ratio	0.54	1.04	0.37	0.95	0.50	0.35	0.94	0.77	0.71	0.98
Control Delay	56.6	62.5	10.9	97.4	24.6	4.0	95.4	42.4	65.3	63.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.6	62.5	10.9	97.4	24.6	4.0	95.4	42.4	65.3	63.9
Queue Length 50th (ft)	52	~627	76	87	199	0	84	206	71	300
Queue Length 95th (ft)	85	#723	117	#167	243	55	#160	247	#132	#402
Internal Link Dist (ft)		578			652			1209		560
Turn Bay Length (ft)	175			150			180		150	
Base Capacity (vph)	281	2154	785	250	2003	713	243	1520	273	1196
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	1.04	0.37	0.95	0.50	0.35	0.94	0.74	0.71	0.98

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	139	2128	279	226	929	259	217	903	161	185	991	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Lane Util. Factor	0.97	0.91	1.00	0.97	0.86	0.86	0.97	0.86		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	5085	1583	3433	4787	1362	3433	6263		3433	4999	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	5085	1583	3433	4787	1362	3433	6263		3433	4999	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	146	2240	294	238	978	273	228	951	169	195	1043	133
RTOR Reduction (vph)	0	0	3	0	2	143	0	29	0	0	15	0
Lane Group Flow (vph)	146	2240	291	238	1003	103	228	1091	0	195	1161	0
Turn Type	Prot		pm+ov	Prot		Perm	Prot			Prot		
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	8.6	46.6	54.4	8.0	46.0	46.0	7.8	25.0		8.8	26.0	
Effective Green, g (s)	8.6	46.6	54.4	8.0	46.0	46.0	7.8	25.0		8.8	26.0	
Actuated g/C Ratio	0.08	0.42	0.49	0.07	0.42	0.42	0.07	0.23		0.08	0.24	
Clearance Time (s)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4		5.4	5.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	268	2154	783	250	2002	570	243	1423		275	1182	
v/s Ratio Prot	0.04	c0.44	0.03	c0.07	0.21		0.07	c0.17		0.06	c0.23	
v/s Ratio Perm			0.16			0.08						
v/c Ratio	0.54	1.04	0.37	0.95	0.50	0.18	0.94	0.77		0.71	0.98	
Uniform Delay, d1	48.8	31.7	17.2	50.8	23.6	20.1	50.9	39.8		49.4	41.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.3	30.7	0.3	43.6	0.2	0.2	40.6	2.5		8.1	21.9	
Delay (s)	51.1	62.4	17.5	94.4	23.7	20.3	91.5	42.3		57.5	63.7	
Level of Service	D	E	B	F	C	C	F	D		E	E	
Approach Delay (s)		56.9			34.5			50.6			62.8	
Approach LOS		E			C			D			E	

Intersection Summary			
HCM Average Control Delay	52.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	21.6
Intersection Capacity Utilization	93.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1851	690	0	795	0	0	0	0	0	0	732
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	1948	726	0	837	0	0	0	0	0	0	771
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		732										
pX, platoon unblocked				0.59			0.59	0.59	0.59	0.59	0.59	
vC, conflicting volume	837			2675			2591	3148	1013	1486	3512	279
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	837			1415			1273	2216	0	0	2830	279
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			0	100	100	100	100	0
cM capacity (veh/h)	793			282			0	26	642	605	10	718

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	779	779	1116	279	279	279	771
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	726	0	0	0	771
cSH	1700	1700	1700	1700	1700	1700	718
Volume to Capacity	0.46	0.46	0.66	0.16	0.16	0.16	1.07
Queue Length 95th (ft)	0	0	0	0	0	0	514
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	78.2
Lane LOS							F
Approach Delay (s)	0.0			0.0			78.2
Approach LOS							F

Intersection Summary			
Average Delay	14.1		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	48	182	235	225	19	1788	511	1926
v/c Ratio	0.43	0.65	0.76	0.73	0.20	0.56	0.38	0.57
Control Delay	45.2	52.9	45.6	42.7	3.6	2.8	0.6	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.2	52.9	45.6	42.7	3.6	2.8	0.6	11.7
Queue Length 50th (ft)	19	127	123	110	2	62	0	258
Queue Length 95th (ft)	58	194	209	189	m2	m60	m0	347
Internal Link Dist (ft)	296		624			121		607
Turn Bay Length (ft)				470	120			
Base Capacity (vph)	113	367	383	383	95	3197	1362	3400
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.50	0.61	0.59	0.20	0.56	0.38	0.57

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	0	20	192	43	375	18	1606	578	0	1810	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		5.0	5.0	5.0	5.0	5.0	4.0		5.0	
Lane Util. Factor		1.00		0.95	0.91	0.95	1.00	0.86	0.86		0.91	
Frt		0.94		1.00	0.89	0.85	1.00	0.99	0.85		1.00	
Flt Protected		0.97		0.95	1.00	1.00	0.95	1.00	1.00		1.00	
Satd. Flow (prot)		1705		1681	1505	1504	1770	4767	1362		5077	
Flt Permitted		0.97		0.95	1.00	1.00	0.08	1.00	1.00		1.00	
Satd. Flow (perm)		1705		1681	1505	1504	141	4767	1362		5077	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	27	0	21	202	45	395	19	1691	608	0	1905	21
RTOR Reduction (vph)	0	20	0	0	58	58	0	4	0	0	1	0
Lane Group Flow (vph)	0	28	0	182	177	167	19	1784	511	0	1925	0
Turn Type	Split			Split		Perm	Perm		Free			
Protected Phases	4	4		8	8			2			6	
Permitted Phases						8	2		Free			
Actuated Green, G (s)		4.8		18.4	18.4	18.4	72.8	72.8	110.0		72.8	
Effective Green, g (s)		4.8		18.4	18.4	18.4	72.8	72.8	110.0		72.8	
Actuated g/C Ratio		0.04		0.17	0.17	0.17	0.66	0.66	1.00		0.66	
Clearance Time (s)		4.0		5.0	5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		74		281	252	252	93	3155	1362		3360	
v/s Ratio Prot		0.02		0.11	c0.12			0.37			c0.38	
v/s Ratio Perm						0.11	0.13		c0.38			
v/c Ratio		0.38		0.65	0.70	0.66	0.20	0.57	0.38		0.57	
Uniform Delay, d1		51.1		42.8	43.2	42.9	7.3	10.1	0.0		10.1	
Progression Factor		1.00		1.00	1.00	1.00	0.28	0.25	1.00		1.00	
Incremental Delay, d2		3.2		5.1	8.5	6.4	0.4	0.1	0.1		0.7	
Delay (s)		54.4		47.8	51.7	49.3	2.5	2.6	0.1		10.8	
Level of Service		D		D	D	D	A	A	A		B	
Approach Delay (s)		54.4			49.8			2.0			10.8	
Approach LOS		D			D			A			B	

Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	109	2065	233	1199	139	2149	158	1663
v/c Ratio	0.55	1.43	1.21	0.83	0.79	1.15	1.09	0.94
Control Delay	58.6	227.5	169.1	11.8	33.6	87.0	153.7	37.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	87.6	0.0	0.9
Total Delay	58.6	227.5	169.1	11.8	33.6	174.6	153.7	38.0
Queue Length 50th (ft)	75	~727	~186	34	90	~483	~125	307
Queue Length 95th (ft)	#144	#825	m#329	41	m77	m#133	#268	#495
Internal Link Dist (ft)		1129		409		285		200
Turn Bay Length (ft)	140		110		150		120	
Base Capacity (vph)	197	1448	193	1502	177	1866	145	1773
Starvation Cap Reductn	0	0	0	0	0	272	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	24
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	1.43	1.21	0.80	0.79	1.35	1.09	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	104	1799	162	221	844	295	132	1958	84	150	1517	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.91		1.00	0.91	
Frt	1.00	0.99		1.00	0.96		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5022		1770	4887		1770	5054		1770	5055	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5022		1770	4887		1770	5054		1770	5055	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	109	1894	171	233	888	311	139	2061	88	158	1597	66
RTOR Reduction (vph)	0	9	0	0	59	0	0	4	0	0	4	0
Lane Group Flow (vph)	109	2056	0	233	1140	0	139	2145	0	158	1659	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	12.3	31.5		12.0	31.2		11.0	40.5		9.0	38.5	
Effective Green, g (s)	12.3	31.5		12.0	31.2		11.0	40.5		9.0	38.5	
Actuated g/C Ratio	0.11	0.29		0.11	0.28		0.10	0.37		0.08	0.35	
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	198	1438		193	1386		177	1861		145	1769	
v/s Ratio Prot	0.06	c0.41		c0.13	0.23		0.08	c0.42		0.09	c0.33	
v/s Ratio Perm												
v/c Ratio	0.55	1.43		1.21	0.82		0.79	1.15		1.09	0.94	
Uniform Delay, d1	46.2	39.2		49.0	36.8		48.3	34.8		50.5	34.6	
Progression Factor	1.00	1.00		1.11	0.22		0.58	0.42		1.31	0.78	
Incremental Delay, d2	3.3	197.4		123.1	3.0		2.1	69.2		94.6	9.6	
Delay (s)	49.5	236.6		177.6	11.2		30.2	83.9		160.7	36.6	
Level of Service	D	F		F	B		C	F		F	D	
Approach Delay (s)		227.3			38.3			80.7			47.4	
Approach LOS		F			D			F			D	

Intersection Summary			
HCM Average Control Delay	106.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	112.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	477	1295	346	291	727	27	1817	558	2001
v/c Ratio	1.17	0.99	0.87	1.06	0.73	0.40	1.13	0.60	0.88
Control Delay	137.8	57.8	51.8	80.7	29.7	41.2	96.4	9.3	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	12.9	0.1	4.3
Total Delay	137.8	57.8	51.8	80.7	29.7	41.2	109.3	9.4	12.0
Queue Length 50th (ft)	~417	362	182	~235	123	12	~785	76	98
Queue Length 95th (ft)	#643	#452	#429	m#225	m101	#47	#923	185	m98
Internal Link Dist (ft)		339			174		323		285
Turn Bay Length (ft)	200			175		175			
Base Capacity (vph)	408	1307	396	274	1109	68	1609	930	2278
Starvation Cap Reductn	0	0	0	0	0	0	0	0	216
Spillback Cap Reductn	0	0	0	0	0	0	41	26	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.17	0.99	0.87	1.06	0.66	0.40	1.16	0.62	0.97

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	453	1193	366	276	686	5	26	1726	530	0	1343	558
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor	1.00	0.86	0.86	1.00	0.91		1.00	0.95	1.00		0.91	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)	1770	4784	1362	1770	5080		1770	3539	1583		4862	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.08	1.00	1.00		1.00	
Satd. Flow (perm)	1770	4784	1362	1770	5080		149	3539	1583		4862	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	477	1256	385	291	722	5	27	1817	558	0	1414	587
RTOR Reduction (vph)	0	3	25	0	1	0	0	0	210	0	68	0
Lane Group Flow (vph)	477	1292	321	291	726	0	27	1817	348	0	1933	0
Turn Type	Prot		Perm	Prot			Perm		Perm			
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2		2			
Actuated Green, G (s)	25.4	30.0	30.0	17.0	21.6		50.0	50.0	50.0		50.0	
Effective Green, g (s)	25.4	30.0	30.0	17.0	21.6		50.0	50.0	50.0		50.0	
Actuated g/C Ratio	0.23	0.27	0.27	0.15	0.20		0.45	0.45	0.45		0.45	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	409	1305	371	274	998		68	1609	720		2210	
v/s Ratio Prot	c0.27	c0.27		0.16	0.14			c0.51			0.40	
v/s Ratio Perm			0.24				0.18		0.22			
v/c Ratio	1.17	0.99	0.87	1.06	0.73		0.40	1.13	0.48		0.87	
Uniform Delay, d1	42.3	39.9	38.1	46.5	41.4		20.0	30.0	21.0		27.2	
Progression Factor	1.04	0.89	0.85	0.99	0.71		1.00	1.00	1.00		0.27	
Incremental Delay, d2	96.8	21.5	17.4	35.8	0.2		16.4	66.7	2.3		0.5	
Delay (s)	140.8	56.8	49.8	81.9	29.7		36.4	96.7	23.3		7.9	
Level of Service	F	E	D	F	C		D	F	C		A	
Approach Delay (s)		74.6			44.6			79.0			7.9	
Approach LOS		E			D			E			A	

Intersection Summary			
HCM Average Control Delay	54.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	398	1933	0	0	1963
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	419	2035	0	0	2066
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						629
pX, platoon unblocked	0.69					
vC, conflicting volume	2724	678			2035	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1925	678			2035	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	0			100	
cM capacity (veh/h)	40	395			274	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	419	678	678	678	689	689	689
Volume Left	0	0	0	0	0	0	0
Volume Right	419	0	0	0	0	0	0
cSH	395	1700	1700	1700	1700	1700	1700
Volume to Capacity	1.06	0.40	0.40	0.40	0.41	0.41	0.41
Queue Length 95th (ft)	354	0	0	0	0	0	0
Control Delay (s)	95.5	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	F						
Approach Delay (s)	95.5	0.0			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	8.9		
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	1404	1122	714
v/c Ratio	0.42	0.33	0.79
Control Delay	9.7	4.6	43.1
Queue Delay	0.0	0.0	0.0
Total Delay	9.7	4.6	43.1
Queue Length 50th (ft)	153	61	236
Queue Length 95th (ft)	222	m141	277
Internal Link Dist (ft)	736	218	493
Turn Bay Length (ft)			
Base Capacity (vph)	3363	3363	1368
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.42	0.33	0.52

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1334	1066	0	576	103
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5		4.0	
Lane Util. Factor		0.91	0.91		0.97	
Frt		1.00	1.00		0.98	
Flt Protected		1.00	1.00		0.96	
Satd. Flow (prot)		5085	5085		3388	
Flt Permitted		1.00	1.00		0.96	
Satd. Flow (perm)		5085	5085		3388	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1404	1122	0	606	108
RTOR Reduction (vph)	0	0	0	0	17	0
Lane Group Flow (vph)	0	1404	1122	0	697	0
Turn Type						
Protected Phases		4	8		6	
Permitted Phases						
Actuated Green, G (s)		72.8	72.8		28.7	
Effective Green, g (s)		72.8	72.8		28.7	
Actuated g/C Ratio		0.66	0.66		0.26	
Clearance Time (s)		4.5	4.5		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		3365	3365		884	
v/s Ratio Prot		c0.28	0.22		c0.21	
v/s Ratio Perm						
v/c Ratio		0.42	0.33		0.79	
Uniform Delay, d1		8.7	8.1		37.8	
Progression Factor		1.00	0.51		1.00	
Incremental Delay, d2		0.4	0.2		4.7	
Delay (s)		9.1	4.3		42.5	
Level of Service		A	A		D	
Approach Delay (s)		9.1	4.3		42.5	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.5
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	167	2026	528	1329	315	739	844	254	612
v/c Ratio	0.74	1.23	1.73	0.71	0.48	0.54	0.97	1.42	0.31
Control Delay	30.4	127.4	369.8	32.3	19.5	38.1	48.8	247.6	21.8
Queue Delay	0.0	3.4	0.0	0.0	0.0	0.0	13.9	0.0	0.0
Total Delay	30.4	130.8	369.8	32.3	19.5	38.1	62.7	247.6	21.8
Queue Length 50th (ft)	80	~612	~553	290	106	268	485	~243	98
Queue Length 95th (ft)	m54	m115	#762	345	189	m276	m#509	#405	129
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	225	1641	306	1872	654	1367	866	179	1944
Starvation Cap Reductn	0	10	0	0	0	0	47	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	0.74	1.24	1.73	0.71	0.48	0.54	1.03	1.42	0.31

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	159	1925	0	502	1263	299	0	702	802	241	472	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00		0.95	1.00	1.00	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085		1770	5085	1583		3539	1583	1770	4942	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.25	1.00	
Satd. Flow (perm)	1770	5085		1770	5085	1583		3539	1583	462	4942	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	167	2026	0	528	1329	315	0	739	844	254	497	115
RTOR Reduction (vph)	0	0	0	0	0	71	0	0	255	0	34	0
Lane Group Flow (vph)	167	2026	0	528	1329	244	0	739	589	254	578	0
Turn Type	Prot		Perm	Prot		Perm			Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8			2	6		
Actuated Green, G (s)	14.0	35.5		19.0	40.5	40.5		42.5	42.5	42.5	42.5	
Effective Green, g (s)	14.0	35.5		19.0	40.5	40.5		42.5	42.5	42.5	42.5	
Actuated g/C Ratio	0.13	0.32		0.17	0.37	0.37		0.39	0.39	0.39	0.39	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	225	1641		306	1872	583		1367	612	179	1909	
v/s Ratio Prot	0.09	c0.40		c0.30	0.26			0.21			0.12	
v/s Ratio Perm						0.15			0.37	c0.55		
v/c Ratio	0.74	1.23		1.73	0.71	0.42		0.54	0.96	1.42	0.30	
Uniform Delay, d1	46.3	37.2		45.5	29.7	26.0		26.2	33.0	33.8	23.5	
Progression Factor	0.58	0.49		1.00	1.00	1.00		1.41	2.08	1.00	1.00	
Incremental Delay, d2	1.2	106.1		339.9	2.3	2.2		0.7	17.4	218.0	0.4	
Delay (s)	28.0	124.5		385.4	32.0	28.2		37.7	86.0	251.8	23.9	
Level of Service	C	F		F	C	C		D	F	F	C	
Approach Delay (s)		117.2			117.4			63.5			90.7	
Approach LOS		F			F			E			F	

Intersection Summary			
HCM Average Control Delay	101.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	112.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	366	2161	60	1366	346	254	7	15	442	216
v/c Ratio	1.09	1.07	0.80	1.06	1.09	0.19	0.01	0.20	0.66	0.46
Control Delay	113.4	68.9	108.3	79.2	115.7	20.9	12.0	52.1	40.8	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	113.4	68.9	108.3	79.2	115.7	20.9	12.0	52.1	40.8	7.9
Queue Length 50th (ft)	~250	~514	37	~334	~236	50	0	9	131	0
Queue Length 95th (ft)	#455	#666	#116	#466	#436	87	9	31	182	58
Internal Link Dist (ft)		631		1090		191			644	
Turn Bay Length (ft)	200		180		140		60	120		120
Base Capacity (vph)	336	2021	75	1285	317	1372	618	75	859	547
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.09	1.07	0.80	1.06	1.09	0.19	0.01	0.20	0.51	0.39

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	348	1423	630	57	1252	46	329	241	7	14	420	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.95		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	4851		1770	5058		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	4851		1770	5058		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	366	1498	663	60	1318	48	346	254	7	15	442	216
RTOR Reduction (vph)	0	79	0	0	4	0	0	0	4	0	0	171
Lane Group Flow (vph)	366	2082	0	60	1362	0	346	254	3	15	442	45
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	18.0	38.1		4.0	24.1		17.0	35.8	35.8	1.5	20.3	20.3
Effective Green, g (s)	18.0	38.1		4.0	24.1		17.0	35.8	35.8	1.5	20.3	20.3
Actuated g/C Ratio	0.18	0.39		0.04	0.25		0.17	0.37	0.37	0.02	0.21	0.21
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	327	1898		73	1252		309	1301	582	27	738	330
v/s Ratio Prot	c0.21	c0.43		0.03	0.27		c0.20	0.07		0.01	c0.12	
v/s Ratio Perm									0.00			0.03
v/c Ratio	1.12	1.10		0.82	1.09		1.12	0.20	0.00	0.56	0.60	0.14
Uniform Delay, d1	39.7	29.7		46.3	36.7		40.2	21.0	19.5	47.6	34.9	31.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	85.9	52.6		49.9	52.9		87.4	0.1	0.0	22.5	1.3	0.2
Delay (s)	125.6	82.3		96.3	89.6		127.6	21.1	19.5	70.1	36.2	31.6
Level of Service	F	F		F	F		F	C	B	E	D	C
Approach Delay (s)		88.6			89.9			81.8			35.5	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	81.3	HCM Level of Service	F
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	97.4	Sum of lost time (s)	13.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations										
Volume (veh/h)	0	246	0	380	0	0	924	340	0	0
Sign Control	Yield			Free			Free		Yield	
Grade	0%			0%			0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	259	0	400	0	0	973	358	0	0
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type				None			None			
Median storage veh)										
Upstream signal (ft)							271			
pX, platoon unblocked	0.87		0.87						0.87	0.87
vC, conflicting volume	1731	200	1331			400			1432	1373
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	1764	200	1306			400			1422	1354
tC, single (s)	6.5	6.9	4.1			4.1			7.5	6.5
tC, 2 stage (s)										
tF (s)	4.0	3.3	2.2			2.2			3.5	4.0
p0 queue free %	100	68	100			100			100	100
cM capacity (veh/h)	73	808	459			1155			57	129

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	259	200	200	973	358
Volume Left	0	0	0	0	0
Volume Right	259	0	0	0	358
cSH	808	1700	1700	1700	1700
Volume to Capacity	0.32	0.12	0.12	0.57	0.21
Queue Length 95th (ft)	35	0	0	0	0
Control Delay (s)	11.5	0.0	0.0	0.0	0.0
Lane LOS	B				
Approach Delay (s)	11.5	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	748	0	0	0	0	0	0	424	485	0
Sign Control		Yield			Yield			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	787	0	0	0	0	0	0	446	511	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											795	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	1403	1403	511	2191	1403	0	511			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1398	1398	456	2228	1398	0	456			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	0	0	100	100	100			73		
cM capacity (veh/h)	88	97	573	0	97	1085	1047			1623		

Direction, Lane #	EB 1	SB 1	SB 2
Volume Total	787	446	511
Volume Left	0	446	0
Volume Right	787	0	0
cSH	573	1623	1700
Volume to Capacity	1.37	0.27	0.30
Queue Length 95th (ft)	880	28	0
Control Delay (s)	200.4	8.1	0.0
Lane LOS	F	A	
Approach Delay (s)	200.4	3.8	
Approach LOS	F		

Intersection Summary			
Average Delay	92.5		
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	352	501	158	845	316	982
v/c Ratio	0.69	0.89	0.63	0.43	0.31	0.50
Control Delay	26.4	35.9	18.0	4.9	1.0	9.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	35.9	18.0	4.9	1.0	9.4
Queue Length 50th (ft)	108	122	20	53	2	106
Queue Length 95th (ft)	188	#285	m#109	65	m8	150
Internal Link Dist (ft)		1190		300		620
Turn Bay Length (ft)	600		90			
Base Capacity (vph)	546	587	249	1983	1026	1980
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	58
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.85	0.63	0.43	0.31	0.51

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	334	13	463	150	803	300	0	916	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Lane Util. Factor				1.00	1.00		1.00	0.95	1.00		0.95	
Frt				1.00	0.85		1.00	1.00	0.85		1.00	
Flt Protected				0.95	1.00		0.95	1.00	1.00		1.00	
Satd. Flow (prot)				1770	1591		1770	3539	1583		3529	
Flt Permitted				0.95	1.00		0.24	1.00	1.00		1.00	
Satd. Flow (perm)				1770	1591		444	3539	1583		3529	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	352	14	487	158	845	316	0	964	18
RTOR Reduction (vph)	0	0	0	0	99	0	0	0	139	0	2	0
Lane Group Flow (vph)	0	0	0	352	402	0	158	845	177	0	980	0
Turn Type				Split			Perm		Perm			
Protected Phases				8	8			2			6	
Permitted Phases							2		2			
Actuated Green, G (s)				17.4	17.4		33.6	33.6	33.6		33.6	
Effective Green, g (s)				17.4	17.4		33.6	33.6	33.6		33.6	
Actuated g/C Ratio				0.29	0.29		0.56	0.56	0.56		0.56	
Clearance Time (s)				4.5	4.5		4.5	4.5	4.5		4.5	
Vehicle Extension (s)				3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)				513	461		249	1982	886		1976	
v/s Ratio Prot				0.20	c0.25			0.24			0.28	
v/s Ratio Perm							c0.36		0.11			
v/c Ratio				0.69	0.87		0.63	0.43	0.20		0.50	
Uniform Delay, d1				18.9	20.2		9.0	7.6	6.5		8.0	
Progression Factor				1.00	1.00		0.52	0.54	0.34		1.00	
Incremental Delay, d2				3.8	16.3		9.3	0.5	0.4		0.9	
Delay (s)				22.7	36.6		14.0	4.7	2.6		8.9	
Level of Service				C	D		B	A	A		A	
Approach Delay (s)		0.0			30.8			5.3			8.9	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBT	SBT
Lane Group Flow (vph)	474	502	1062	1247
v/c Ratio	0.74	0.85	0.60	0.70
Control Delay	23.9	31.2	3.9	10.2
Queue Delay	0.0	0.0	0.1	0.2
Total Delay	23.9	31.2	4.0	10.4
Queue Length 50th (ft)	135	143	52	110
Queue Length 95th (ft)	228	#292	m67	134
Internal Link Dist (ft)	434		320	300
Turn Bay Length (ft)				
Base Capacity (vph)	708	651	1782	1782
Starvation Cap Reductn	0	0	133	16
Spillback Cap Reductn	0	1	0	97
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.67	0.77	0.64	0.74

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	450	477	0	1009	1185	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1770	1583		3539	3539	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1770	1583		3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	474	502	0	1062	1247	0
RTOR Reduction (vph)	0	18	0	0	0	0
Lane Group Flow (vph)	474	484	0	1062	1247	0
Turn Type		custom				
Protected Phases				2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.8	21.8		30.2	30.2	
Effective Green, g (s)	21.8	21.8		30.2	30.2	
Actuated g/C Ratio	0.36	0.36		0.50	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	643	575		1781	1781	
v/s Ratio Prot				0.30	c0.35	
v/s Ratio Perm	0.27	c0.31				
v/c Ratio	0.74	0.84		0.60	0.70	
Uniform Delay, d1	16.6	17.5		10.6	11.4	
Progression Factor	1.00	1.00		0.24	0.66	
Incremental Delay, d2	4.4	10.7		1.1	2.0	
Delay (s)	21.0	28.2		3.6	9.5	
Level of Service	C	C		A	A	
Approach Delay (s)	24.7			3.6	9.5	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	215	568	364	123	354	93	206	816	501	222	1352	287
v/c Ratio	0.89	0.62	0.56	0.84	0.39	0.19	0.84	0.65	0.77	0.68	0.95	0.39
Control Delay	60.9	22.9	7.7	69.2	19.6	5.8	58.4	19.2	23.2	28.1	26.7	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.9	22.9	7.7	69.2	19.6	5.8	58.4	19.2	23.2	28.1	26.7	3.1
Queue Length 50th (ft)	74	94	12	42	54	0	74	127	117	79	256	6
Queue Length 95th (ft)	#185	140	71	#127	87	29	#181	183	#269	m102	#375	m15
Internal Link Dist (ft)		612			420			572			320	
Turn Bay Length (ft)	90			80			130			120		
Base Capacity (vph)	249	944	656	150	944	490	244	1265	649	325	1425	742
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.60	0.55	0.82	0.38	0.19	0.84	0.65	0.77	0.68	0.95	0.39

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	204	540	346	117	336	88	196	775	476	211	1284	273
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.50	1.00	1.00	0.30	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	933	3539	1583	563	3539	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	215	568	364	123	354	93	206	816	501	222	1352	287
RTOR Reduction (vph)	0	0	236	0	0	69	0	0	83	0	0	105
Lane Group Flow (vph)	215	568	128	123	354	24	206	816	418	222	1352	182
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	15.6	15.6	15.6	15.6	15.6	15.6	8.3	21.3	21.3	11.1	24.1	24.1
Effective Green, g (s)	15.6	15.6	15.6	15.6	15.6	15.6	8.3	21.3	21.3	11.1	24.1	24.1
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.26	0.26	0.14	0.36	0.36	0.18	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	243	920	412	146	920	412	245	1256	562	327	1421	636
v/s Ratio Prot		0.16			0.10		0.12	0.23		0.13	c0.38	
v/s Ratio Perm	c0.23		0.08	0.22		0.02			c0.26			0.12
v/c Ratio	0.88	0.62	0.31	0.84	0.38	0.06	0.84	0.65	0.74	0.68	0.95	0.29
Uniform Delay, d1	21.3	19.6	17.9	21.0	18.3	16.7	25.2	16.2	17.0	22.8	17.4	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.78	0.74	0.37
Incremental Delay, d2	29.3	1.2	0.4	33.4	0.3	0.1	22.1	2.6	8.6	4.0	11.7	0.8
Delay (s)	50.7	20.8	18.3	54.4	18.5	16.7	47.3	18.8	25.6	21.8	24.6	5.3
Level of Service	D	C	B	D	B	B	D	B	C	C	C	A
Approach Delay (s)		25.6			26.0			24.9			21.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	337	652	0	457	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	355	686	0	481	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	500					
pX, platoon unblocked						
vC, conflicting volume			1041		595	177
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1041		595	177
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			664		435	835

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2
Volume Total	236	347	458	241	241
Volume Left	0	0	0	0	0
Volume Right	0	229	458	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.20	0.27	0.14	0.14
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					
Approach Delay (s)	0.0			0.0	
Approach LOS					

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	120	1975	1209	196
v/c Ratio	0.38	0.56	0.46	0.16
Control Delay	21.7	0.6	5.5	1.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	21.7	0.6	5.5	1.1
Queue Length 50th (ft)	46	0	110	1
Queue Length 95th (ft)	m51	0	150	17
Internal Link Dist (ft)		370	263	
Turn Bay Length (ft)	100			70
Base Capacity (vph)	354	3539	2629	1224
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.34	0.56	0.46	0.16

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	114	1876	1149	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.5	4.5	4.5
Lane Util. Factor			1.00	0.95	0.95	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			1770	3539	3539	1583
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			1770	3539	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	120	1975	1209	196
RTOR Reduction (vph)	0	0	0	0	0	53
Lane Group Flow (vph)	0	0	120	1975	1209	143
Turn Type			Prot			Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			11.2	70.0	50.3	50.3
Effective Green, g (s)			11.2	70.0	50.3	50.3
Actuated g/C Ratio			0.16	1.00	0.72	0.72
Clearance Time (s)			4.0	4.5	4.5	4.5
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			283	3539	2543	1137
v/s Ratio Prot			0.07	c0.56	0.34	
v/s Ratio Perm						0.09
v/c Ratio			0.42	0.56	0.48	0.13
Uniform Delay, d1			26.5	0.0	4.2	3.0
Progression Factor			0.77	1.00	1.00	1.00
Incremental Delay, d2			0.7	0.5	0.6	0.2
Delay (s)			21.2	0.5	4.9	3.3
Level of Service			C	A	A	A
Approach Delay (s)	0.0			1.6	4.6	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	2.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	210	120	0	1857	1169	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	221	126	0	1955	1231	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				382	450	
pX, platoon unblocked	0.67	0.85	0.85			
vC, conflicting volume	2208	615	1231			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	767	180	907			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	2	82	100			
cM capacity (veh/h)	226	704	631			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	147	200	977	977	615	615
Volume Left	147	74	0	0	0	0
Volume Right	0	126	0	0	0	0
cSH	226	395	1700	1700	1700	1700
Volume to Capacity	0.65	0.51	0.57	0.57	0.36	0.36
Queue Length 95th (ft)	100	69	0	0	0	0
Control Delay (s)	46.8	23.1	0.0	0.0	0.0	0.0
Lane LOS	E	C				
Approach Delay (s)	33.1		0.0		0.0	
Approach LOS	D					

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	287	180	27	84	215	1666	20	1005	219
v/c Ratio	0.89	0.21	0.09	0.10	0.57	0.77	0.09	0.63	0.28
Control Delay	57.1	7.1	20.9	11.6	12.9	14.3	6.2	12.9	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.1	7.1	20.9	11.6	12.9	14.3	6.2	12.9	2.8
Queue Length 50th (ft)	118	6	9	6	34	230	2	168	4
Queue Length 95th (ft)	#248	28	27	22	76	#495	m4	244	21
Internal Link Dist (ft)		646		699		573		302	
Turn Bay Length (ft)	120		220		200		260		70
Base Capacity (vph)	335	908	305	871	420	2174	216	1605	793
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	0.86	0.20	0.09	0.10	0.51	0.77	0.09	0.63	0.28

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	273	38	133	26	37	43	204	1541	42	19	955	208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.88		1.00	0.92		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3126		1770	3255		1770	3525		1770	3539	1583
Flt Permitted	0.70	1.00		0.64	1.00		0.16	1.00		0.13	1.00	1.00
Satd. Flow (perm)	1303	3126		1189	3255		294	3525		235	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	287	40	140	27	39	45	215	1622	44	20	1005	219
RTOR Reduction (vph)	0	105	0	0	34	0	0	3	0	0	0	76
Lane Group Flow (vph)	287	75	0	27	50	0	215	1663	0	20	1005	143
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	17.3	17.3		17.3	17.3		44.7	39.9		32.5	31.7	31.7
Effective Green, g (s)	17.3	17.3		17.3	17.3		44.7	39.9		32.5	31.7	31.7
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.64	0.57		0.46	0.45	0.45
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	322	773		294	804		378	2009		127	1603	717
v/s Ratio Prot		0.02			0.02		c0.07	c0.47		0.00	0.28	
v/s Ratio Perm	c0.22			0.02			0.29			0.07		0.09
v/c Ratio	0.89	0.10		0.09	0.06		0.57	0.83		0.16	0.63	0.20
Uniform Delay, d1	25.4	20.3		20.3	20.1		8.3	12.3		12.2	14.6	11.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.91	0.72	0.36
Incremental Delay, d2	25.0	0.1		0.1	0.0		2.0	4.1		0.5	1.7	0.6
Delay (s)	50.4	20.4		20.4	20.2		10.2	16.4		11.6	12.2	4.7
Level of Service	D	C		C	C		B	B		B	B	A
Approach Delay (s)		38.9			20.2			15.7			10.9	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	1283	436	1104	141	185	1165
v/c Ratio	0.93	0.53	0.87	0.23	0.85	0.63
Control Delay	43.9	9.8	31.4	6.1	79.4	21.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.9	9.8	31.4	6.1	79.4	21.0
Queue Length 50th (ft)	432	60	238	9	129	301
Queue Length 95th (ft)	#573	152	#398	m24	#250	373
Internal Link Dist (ft)	720		1803			515
Turn Bay Length (ft)	240	240		150	215	
Base Capacity (vph)	1404	826	1275	625	225	1840
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.53	0.87	0.23	0.82	0.63

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	1219	414	1049	134	176	1107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1283	436	1104	141	185	1165
RTOR Reduction (vph)	0	180	0	55	0	0
Lane Group Flow (vph)	1283	256	1104	86	185	1165
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	44.3	44.3	39.6	39.6	13.6	57.2
Effective Green, g (s)	44.3	44.3	39.6	39.6	13.6	57.2
Actuated g/C Ratio	0.40	0.40	0.36	0.36	0.12	0.52
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1383	638	1274	570	219	1840
v/s Ratio Prot	c0.37		c0.31		c0.10	0.33
v/s Ratio Perm		0.16		0.05		
v/c Ratio	0.93	0.40	0.87	0.15	0.84	0.63
Uniform Delay, d1	31.3	23.4	32.7	23.8	47.2	18.9
Progression Factor	1.00	1.00	0.72	0.50	1.00	1.00
Incremental Delay, d2	10.9	0.4	6.9	0.5	24.6	1.7
Delay (s)	42.2	23.8	30.5	12.4	71.8	20.6
Level of Service	D	C	C	B	E	C
Approach Delay (s)	37.6		28.4			27.6
Approach LOS	D		C			C

Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	399	433	964	1433	188	2348
v/c Ratio	0.65	0.90	0.43	1.11	1.30	0.89
Control Delay	47.1	42.2	11.7	73.1	199.4	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	42.2	11.7	73.1	199.4	9.7
Queue Length 50th (ft)	132	136	181	~935	~171	152
Queue Length 95th (ft)	182	#312	227	#1201	m#257	722
Internal Link Dist (ft)	1134		595			1803
Turn Bay Length (ft)	75	50			235	
Base Capacity (vph)	687	510	2218	1291	145	2636
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.85	0.43	1.11	1.30	0.89

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	379	411	916	1361	179	2231
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	3539	1583	1770	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	399	433	964	1433	188	2348
RTOR Reduction (vph)	0	199	0	299	0	0
Lane Group Flow (vph)	399	234	964	1134	188	2348
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	19.6	19.6	68.9	68.9	9.0	81.9
Effective Green, g (s)	19.6	19.6	68.9	68.9	9.0	81.9
Actuated g/C Ratio	0.18	0.18	0.63	0.63	0.08	0.74
Clearance Time (s)	4.0	4.0	4.5	4.5	4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	612	282	2217	992	145	2635
v/s Ratio Prot	0.12		0.27		c0.11	0.66
v/s Ratio Perm		c0.15		c0.72		
v/c Ratio	0.65	0.83	0.43	1.14	1.30	0.89
Uniform Delay, d1	42.0	43.6	10.6	20.5	50.5	10.7
Progression Factor	1.00	1.00	1.00	1.00	0.87	0.49
Incremental Delay, d2	2.5	18.3	0.6	76.5	161.9	3.3
Delay (s)	44.5	61.9	11.2	97.0	206.0	8.6
Level of Service	D	E	B	F	F	A
Approach Delay (s)	53.6		62.5			23.2
Approach LOS	D		E			C

Intersection Summary			
HCM Average Control Delay	43.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	84	110	1600	168	80	0
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	88	116	1684	177	84	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						800
pX, platoon unblocked						
vC, conflicting volume	1941	1773			1684	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1941	1773			1684	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	0			78	
cM capacity (veh/h)	56	103			380	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	88	116	1861	84	0
Volume Left	88	0	0	84	0
Volume Right	0	116	177	0	0
cSH	56	103	1700	380	1700
Volume to Capacity	1.59	1.12	1.09	0.22	0.00
Queue Length 95th (ft)	204	186	0	21	0
Control Delay (s)	453.2	203.8	0.0	17.2	0.0
Lane LOS	F	F		C	
Approach Delay (s)	311.8		0.0	17.2	
Approach LOS	F				

Intersection Summary			
Average Delay	30.3		
Intersection Capacity Utilization	107.9%	ICU Level of Service	G
Analysis Period (min)	15		

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2228	1743	602	184	1078	741	1043
v/c Ratio	0.99	1.10	0.55	0.76	1.00	1.06	0.73
Control Delay	49.8	94.4	20.8	64.4	64.3	96.0	42.8
Queue Delay	359.8	335.2	149.5	0.0	120.4	151.5	0.0
Total Delay	409.6	429.7	170.3	64.4	184.7	247.5	42.8
Queue Length 50th (ft)	612	~830	412	145	~310	~324	268
Queue Length 95th (ft)	#744	m#766	m404	#252	#415	#445	321
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2251	1578	1102	242	1073	701	1424
Starvation Cap Reductn	0	638	647	0	0	0	0
Spillback Cap Reductn	1024	0	0	0	242	175	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.82	1.85	1.32	0.76	1.30	1.41	0.73

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1971	145	0	1656	572	175	962	62	704	990	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5033			3539	1583	1770	5039		3433	5085	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5033			3539	1583	1770	5039		3433	5085	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	2075	153	0	1743	602	184	1013	65	741	1042	1
RTOR Reduction (vph)	0	7	0	0	0	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	2221	0	0	1743	602	184	1076	0	741	1043	0
Turn Type						pm+ov	Prot			Prot		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		53.5			53.5	78.0	16.4	25.5		24.5	33.6	
Effective Green, g (s)		53.5			53.5	78.0	16.4	25.5		24.5	33.6	
Actuated g/C Ratio		0.45			0.45	0.65	0.14	0.21		0.20	0.28	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2244			1578	1102	242	1071		701	1424	
v/s Ratio Prot		0.44			c0.49	0.11	0.10	c0.21		c0.22	0.21	
v/s Ratio Perm						0.27						
v/c Ratio		0.99			1.10	0.55	0.76	1.00		1.06	0.73	
Uniform Delay, d1		33.0			33.2	11.4	49.9	47.2		47.8	39.1	
Progression Factor		1.00			1.52	2.22	0.89	0.75		1.00	1.00	
Incremental Delay, d2		16.5			48.1	0.1	19.0	27.8		50.1	3.4	
Delay (s)		49.4			98.8	25.3	63.4	63.5		97.8	42.5	
Level of Service		D			F	C	E	E		F	D	
Approach Delay (s)		49.4			79.9			63.5			65.5	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	64.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	447	2410	41	1852	685	105	383	794	653
v/c Ratio	1.05	0.86	0.55	1.10	1.03	0.38	1.01	0.78	0.88
Control Delay	80.8	34.2	81.4	71.6	91.3	22.5	101.3	45.6	30.2
Queue Delay	59.9	199.6	0.0	298.4	0.0	3.0	647.8	0.0	38.3
Total Delay	140.7	233.9	81.4	370.0	91.3	25.6	749.1	45.6	68.5
Queue Length 50th (ft)	~371	545	33	~574	~208	20	~156	297	208
Queue Length 95th (ft)	m#366	m542	m62	#671	m#294	m45	#259	373	#448
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		160
Base Capacity (vph)	425	2793	75	1690	665	273	380	1017	741
Starvation Cap Reductn	53	1124	0	0	0	0	0	0	0
Spillback Cap Reductn	0	484	0	640	0	95	380	0	133
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.20	1.44	0.55	1.76	1.03	0.59	383.00	0.78	1.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	425	2259	30	39	1611	148	0	651	100	364	754	620
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5075		1770	5021			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5075		1770	5021			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	447	2378	32	41	1696	156	0	685	105	383	794	653
RTOR Reduction (vph)	0	1	0	0	9	0	0	0	66	0	0	286
Lane Group Flow (vph)	447	2409	0	41	1843	0	0	685	39	383	794	367
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	29.9	64.9		4.1	39.1			15.7	15.7	13.3	34.5	34.5
Effective Green, g (s)	29.9	64.9		4.1	39.1			15.7	15.7	13.3	34.5	34.5
Actuated g/C Ratio	0.25	0.54		0.03	0.33			0.13	0.13	0.11	0.29	0.29
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	441	2745		60	1636			665	207	380	1017	455
v/s Ratio Prot	c0.25	0.47		0.02	c0.37			c0.13		c0.11	0.22	
v/s Ratio Perm									0.02			0.23
v/c Ratio	1.01	0.88		0.68	1.13			1.03	0.19	1.01	0.78	0.81
Uniform Delay, d1	45.0	24.1		57.3	40.5			52.1	46.5	53.4	39.3	39.7
Progression Factor	1.19	1.41		1.04	0.44			1.03	1.13	1.00	1.00	1.00
Incremental Delay, d2	16.4	0.4		24.1	64.4			39.2	1.6	48.2	5.9	14.2
Delay (s)	70.0	34.5		83.6	82.3			92.6	54.0	101.5	45.2	53.9
Level of Service	E	C		F	F			F	D	F	D	D
Approach Delay (s)		40.0			82.3			87.5			60.1	
Approach LOS		D			F			F			E	

Intersection Summary			
HCM Average Control Delay	60.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	175	846	85	1131	414	46	260	171	525	43
v/c Ratio	0.80	0.29	0.27	0.39	0.38	0.30	0.84	0.56	0.55	0.13
Control Delay	49.0	2.3	15.6	14.4	2.2	56.8	76.0	84.0	80.6	55.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.0	2.3	15.6	14.4	2.2	56.8	76.0	84.0	80.6	55.5
Queue Length 50th (ft)	68	13	31	166	0	34	104	158	161	26
Queue Length 95th (ft)	m#127	m17	65	198	42	73	#176	m203	m201	m34
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	220	2889	319	2924	1086	155	311	304	951	338
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.29	0.27	0.39	0.38	0.30	0.84	0.56	0.55	0.13

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	166	719	85	81	1074	393	44	234	13	275	387	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (prot)	1770	5005		1770	5085	1583	1770	3511		1522	4752	1583
Flt Permitted	0.21	1.00		0.30	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (perm)	383	5005		555	5085	1583	1770	3511		1522	4752	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	175	757	89	85	1131	414	46	246	14	289	407	43
RTOR Reduction (vph)	0	12	0	0	0	176	0	4	0	0	0	22
Lane Group Flow (vph)	175	834	0	85	1131	238	46	256	0	171	525	21
Turn Type	Perm			Perm		Perm	Split			Split		Perm
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	69.0	69.0		69.0	69.0	69.0	10.5	10.5		24.0	24.0	24.0
Effective Green, g (s)	69.0	69.0		69.0	69.0	69.0	10.5	10.5		24.0	24.0	24.0
Actuated g/C Ratio	0.58	0.58		0.58	0.58	0.58	0.09	0.09		0.20	0.20	0.20
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	220	2878		319	2924	910	155	307		304	950	317
v/s Ratio Prot		0.17			0.22		0.03	c0.07		c0.11	0.11	
v/s Ratio Perm	c0.46			0.15		0.15						0.01
v/c Ratio	0.80	0.29		0.27	0.39	0.26	0.30	0.84		0.56	0.55	0.07
Uniform Delay, d1	20.0	13.0		12.8	13.9	12.8	51.3	53.9		43.3	43.2	38.9
Progression Factor	1.43	0.17		1.00	1.00	1.00	1.00	1.00		1.80	1.82	2.68
Incremental Delay, d2	16.7	0.2		2.0	0.4	0.7	4.8	22.7		4.5	1.4	0.3
Delay (s)	45.2	2.3		14.8	14.3	13.5	56.1	76.6		82.5	80.1	104.6
Level of Service	D	A		B	B	B	E	E		F	F	F
Approach Delay (s)		9.7			14.1			73.5			82.1	
Approach LOS		A			B			E			F	

Intersection Summary			
HCM Average Control Delay	31.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	28	2700	119	306	1880	59	14	142	279	95	69
v/c Ratio	0.31	1.01	0.14	1.05	0.55	0.61	0.10	0.46	1.16	0.30	0.21
Control Delay	42.2	58.0	17.1	75.1	7.5	79.2	52.7	33.0	148.4	44.2	10.9
Queue Delay	0.0	67.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.2	125.7	17.1	75.1	7.5	79.2	52.7	33.0	148.4	44.2	10.9
Queue Length 50th (ft)	21	~873	55	~250	127	45	10	60	~215	63	0
Queue Length 95th (ft)	m24	m#950	m59	m#264	m130	#98	32	126	#407	113	40
Internal Link Dist (ft)		585			1015		352			692	
Turn Bay Length (ft)	270		180								
Base Capacity (vph)	91	2675	860	291	3437	108	155	306	241	373	372
Starvation Cap Reductn	0	374	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	1.17	0.14	1.05	0.55	0.55	0.09	0.46	1.16	0.25	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	2565	113	291	1746	40	56	13	135	265	90	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	1770	5068		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.70	1.00	1.00	0.49	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	1770	5068		1295	1863	1583	921	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	28	2700	119	306	1838	42	59	14	142	279	95	69
RTOR Reduction (vph)	0	0	30	0	2	0	0	0	45	0	0	56
Lane Group Flow (vph)	28	2700	89	306	1878	0	59	14	97	279	95	13
Turn Type	Prot		Perm	Prot			Perm		Over	pm+pt		Perm
Protected Phases	7	4		3	8			2	3	1	6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	3.7	59.8	59.8	21.9	78.0		7.8	7.8	21.9	21.8	21.8	21.8
Effective Green, g (s)	3.7	59.8	59.8	21.9	78.0		7.8	7.8	21.9	21.8	21.8	21.8
Actuated g/C Ratio	0.03	0.50	0.50	0.18	0.65		0.06	0.06	0.18	0.18	0.18	0.18
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	4.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	55	2534	789	323	3294		84	121	289	238	338	288
v/s Ratio Prot	0.02	c0.53		c0.17	0.37			0.01	0.06	c0.10	0.05	
v/s Ratio Perm			0.06				0.05			c0.12		0.01
v/c Ratio	0.51	1.07	0.11	0.95	0.57		0.70	0.12	0.34	1.17	0.28	0.04
Uniform Delay, d1	57.3	30.1	16.0	48.5	11.7		55.0	52.9	42.7	48.1	42.3	40.5
Progression Factor	0.68	1.58	1.98	0.60	0.64		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	34.2	0.1	15.5	0.2		23.3	0.4	0.7	112.9	0.5	0.1
Delay (s)	42.6	81.6	31.8	44.8	7.7		78.2	53.3	43.4	161.0	42.8	40.6
Level of Service	D	F	C	D	A		E	D	D	F	D	D
Approach Delay (s)		79.2			12.8			53.6			116.9	
Approach LOS		E			B			D			F	

Intersection Summary			
HCM Average Control Delay	55.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	100.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	32	3117	2431	507
v/c Ratio	0.20	1.13	0.98	0.49
Control Delay	34.4	73.0	25.3	37.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	34.4	73.0	25.3	37.3
Queue Length 50th (ft)	23	~1007	~745	173
Queue Length 95th (ft)	m24	m#974	#822	234
Internal Link Dist (ft)		1015	1000	632
Turn Bay Length (ft)				150
Base Capacity (vph)	413	2754	2488	1037
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.08	1.13	0.98	0.49

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	30	2961	2115	195	457	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5		5.5	
Lane Util. Factor	1.00	0.91	0.91		0.97	
Frt	1.00	1.00	0.99		0.99	
Flt Protected	0.95	1.00	1.00		0.95	
Satd. Flow (prot)	1770	5085	5021		3424	
Flt Permitted	0.95	1.00	1.00		0.95	
Satd. Flow (perm)	1770	5085	5021		3424	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	3117	2226	205	481	26
RTOR Reduction (vph)	0	0	9	0	3	0
Lane Group Flow (vph)	32	3117	2422	0	504	0
Turn Type	Prot					
Protected Phases	7 9	4	8		6	
Permitted Phases						
Actuated Green, G (s)	6.9	62.8	54.9		36.2	
Effective Green, g (s)	6.9	62.8	54.9		36.2	
Actuated g/C Ratio	0.06	0.52	0.46		0.30	
Clearance Time (s)		5.5	5.5		5.5	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)	102	2661	2297		1033	
v/s Ratio Prot	c0.02	c0.61	0.48		c0.15	
v/s Ratio Perm						
v/c Ratio	0.31	1.17	1.05		0.49	
Uniform Delay, d1	54.3	28.6	32.5		34.3	
Progression Factor	1.27	0.28	0.47		1.00	
Incremental Delay, d2	0.4	78.2	31.0		1.6	
Delay (s)	69.3	86.3	46.3		36.0	
Level of Service	E	F	D		D	
Approach Delay (s)		86.1	46.3		36.0	
Approach LOS		F	D		D	

Intersection Summary			
HCM Average Control Delay	66.0	HCM Level of Service	E
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	139	3437	23	73	2490	82	131	219
v/c Ratio	0.55	0.98	0.02	0.84	0.83	0.94	0.83	0.64
Control Delay	35.4	8.4	0.6	116.4	22.4	128.1	89.5	25.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.4	8.4	0.6	116.4	22.4	128.1	89.5	25.0
Queue Length 50th (ft)	102	137	0	57	529	56	100	44
Queue Length 95th (ft)	m99	m123	m0	#147	600	#162	#213	128
Internal Link Dist (ft)		1000			893	425		590
Turn Bay Length (ft)	150			300				
Base Capacity (vph)	255	3509	1098	87	3014	87	158	340
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.98	0.02	0.84	0.83	0.94	0.83	0.64

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	3265	22	69	2293	72	29	29	19	124	37	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91			1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00			0.97		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5062			1768		1770	1633	
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.35		0.69	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5062			625		1281	1633	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	139	3437	23	73	2414	76	31	31	20	131	39	180
RTOR Reduction (vph)	0	0	6	0	3	0	0	10	0	0	139	0
Lane Group Flow (vph)	139	3437	17	73	2487	0	0	72	0	131	80	0
Turn Type	Prot		Perm	Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4				2			6		
Actuated Green, G (s)	17.3	82.8	82.8	5.9	71.4			14.8		14.8	14.8	
Effective Green, g (s)	17.3	82.8	82.8	5.9	71.4			14.8		14.8	14.8	
Actuated g/C Ratio	0.14	0.69	0.69	0.05	0.60			0.12		0.12	0.12	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5			5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	255	3509	1092	87	3012			77		158	201	
v/s Ratio Prot	0.08	c0.68		0.04	c0.49						0.05	
v/s Ratio Perm			0.01					c0.12		0.10		
v/c Ratio	0.55	0.98	0.02	0.84	0.83			0.94		0.83	0.40	
Uniform Delay, d1	47.7	17.8	5.8	56.6	19.3			52.2		51.4	48.5	
Progression Factor	0.72	0.30	0.20	1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	0.2	1.8	0.0	47.4	2.7			86.8		28.7	1.3	
Delay (s)	34.4	7.2	1.2	104.0	22.1			138.9		80.0	49.8	
Level of Service	C	A	A	F	C			F		F	D	
Approach Delay (s)		8.2			24.4			138.9			61.1	
Approach LOS		A			C			F			E	

Intersection Summary			
HCM Average Control Delay	19.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	102.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
3: 7th St & Park Ave

2/20/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	32	1659	251	1195	79	272	315	27	308	20
v/c Ratio	0.14	0.91	0.84	0.51	0.68	0.66	0.68	0.19	0.74	0.05
Control Delay	14.3	28.8	43.8	8.4	58.6	37.5	24.0	29.0	41.8	12.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.3	28.8	43.8	8.4	58.6	37.5	24.0	29.0	41.8	12.9
Queue Length 50th (ft)	8	397	75	142	38	131	82	12	151	1
Queue Length 95th (ft)	29	#652	#226	236	#97	209	169	34	237	18
Internal Link Dist (ft)		588		707		495			498	
Turn Bay Length (ft)	70		180		30		30	100		90
Base Capacity (vph)	228	1818	306	2379	158	561	575	197	561	488
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.91	0.82	0.50	0.50	0.48	0.55	0.14	0.55	0.04

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												
Volume (vph)	30	1461	115	238	1103	32	75	258	299	26	293	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3500		1770	3524		1770	1863	1583	1770	1863	1583
Flt Permitted	0.24	1.00		0.09	1.00		0.28	1.00	1.00	0.35	1.00	1.00
Satd. Flow (perm)	439	3500		161	3524		526	1863	1583	654	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	1538	121	251	1161	34	79	272	315	27	308	20
RTOR Reduction (vph)	0	6	0	0	2	0	0	0	110	0	0	13
Lane Group Flow (vph)	32	1653	0	251	1193	0	79	272	205	27	308	7
Turn Type	Perm			pm+pt			Perm		Perm	Perm		Perm
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	43.2	43.2		55.8	55.8		18.5	18.5	18.5	18.5	18.5	18.5
Effective Green, g (s)	43.2	43.2		55.8	55.8		18.5	18.5	18.5	18.5	18.5	18.5
Actuated g/C Ratio	0.52	0.52		0.67	0.67		0.22	0.22	0.22	0.22	0.22	0.22
Clearance Time (s)	5.0	5.0		3.0	5.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	228	1815		293	2361		117	414	352	145	414	352
v/s Ratio Prot		c0.47		c0.10	0.34			0.15			c0.17	
v/s Ratio Perm	0.07			0.47			0.15		0.13	0.04		0.00
v/c Ratio	0.14	0.91		0.86	0.51		0.68	0.66	0.58	0.19	0.74	0.02
Uniform Delay, d1	10.4	18.3		22.9	6.9		29.7	29.5	29.0	26.3	30.2	25.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	7.3		21.0	0.2		14.3	3.7	2.5	0.6	7.1	0.0
Delay (s)	10.7	25.6		43.9	7.0		44.0	33.3	31.4	26.9	37.3	25.3
Level of Service	B	C		D	A		D	C	C	C	D	C
Approach Delay (s)		25.3			13.4			33.7			35.8	
Approach LOS		C			B			C			D	

Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	83.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues
25: I-405 SB Off Ramp & Studebaker Rd

11/21/2012

Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	347	1955	1231
v/c Ratio	0.59	0.76	0.48
Control Delay	23.9	5.6	4.8
Queue Delay	0.0	0.7	0.2
Total Delay	23.9	6.3	5.0
Queue Length 50th (ft)	53	64	154
Queue Length 95th (ft)	85	75	242
Internal Link Dist (ft)	342	302	370
Turn Bay Length (ft)	170		
Base Capacity (vph)	827	2589	2589
Starvation Cap Reductn	0	305	492
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.42	0.86	0.59

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	210	120	0	1857	1169	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.95			1.00	1.00	
Flt Protected	0.97			1.00	1.00	
Satd. Flow (prot)	3311			3539	3539	
Flt Permitted	0.97			1.00	1.00	
Satd. Flow (perm)	3311			3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	221	126	0	1955	1231	0
RTOR Reduction (vph)	77	0	0	0	0	0
Lane Group Flow (vph)	270	0	0	1955	1231	0
Turn Type						
Protected Phases	4			2	6	
Permitted Phases						
Actuated Green, G (s)	10.8			51.2	51.2	
Effective Green, g (s)	10.8			51.2	51.2	
Actuated g/C Ratio	0.15			0.73	0.73	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	511			2589	2589	
v/s Ratio Prot	c0.08			c0.55	0.35	
v/s Ratio Perm						
v/c Ratio	0.53			0.76	0.48	
Uniform Delay, d1	27.3			5.6	3.9	
Progression Factor	1.00			0.64	0.97	
Incremental Delay, d2	1.0			1.3	0.6	
Delay (s)	28.2			5.0	4.3	
Level of Service	C			A	A	
Approach Delay (s)	28.2			5.0	4.3	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
29: College Park Dr & SR-22 Ramps

11/21/2012

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	88	116	1861	84	291
v/c Ratio	0.51	0.48	1.42	0.57	0.19
Control Delay	56.5	19.7	215.1	55.7	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	56.5	19.7	215.1	55.7	6.2
Queue Length 50th (ft)	60	13	~1791	62	70
Queue Length 95th (ft)	107	65	#2059	m#133	m125
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	257	312	1308	148	1545
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.34	0.37	1.42	0.57	0.19

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	84	110	1600	168	80	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1839		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	1839		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	88	116	1684	177	84	291
RTOR Reduction (vph)	0	87	3	0	0	0
Lane Group Flow (vph)	88	29	1858	0	84	291
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	10.8	10.8	78.0		9.2	91.2
Effective Green, g (s)	10.8	10.8	78.0		9.2	91.2
Actuated g/C Ratio	0.10	0.10	0.71		0.08	0.83
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	174	155	1304		148	1545
v/s Ratio Prot	c0.05		c1.01		c0.05	0.16
v/s Ratio Perm		0.02				
v/c Ratio	0.51	0.19	1.42		0.57	0.19
Uniform Delay, d1	47.1	45.6	16.0		48.5	1.9
Progression Factor	1.00	1.00	1.00		0.79	2.73
Incremental Delay, d2	2.3	0.6	195.5		4.4	0.2
Delay (s)	49.4	46.2	211.5		42.5	5.4
Level of Service	D	D	F		D	A
Approach Delay (s)	47.6		211.5			13.7
Approach LOS	D		F			B

Intersection Summary			
HCM Average Control Delay	167.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	107.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
12: Willow St & Bellflower St

3/27/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	74	646	108	291	2692	187	1079	113	1089
v/c Ratio	1.16	0.67	0.28	0.26	1.12	1.16	0.73	0.90	0.91
Control Delay	208.8	44.6	8.5	21.3	73.5	145.6	22.0	101.4	42.2
Queue Delay	0.0	0.0	0.0	0.0	85.6	0.0	0.9	0.0	0.0
Total Delay	208.8	44.6	8.5	21.3	159.1	145.6	22.9	101.4	42.2
Queue Length 50th (ft)	~62	156	0	79	~212	~159	102	42	275
Queue Length 95th (ft)	#159	187	44	m93	m#325	#296	183	#98	#157
Internal Link Dist (ft)		1129			409		285		200
Turn Bay Length (ft)	140			110		150		120	
Base Capacity (vph)	64	1937	670	1125	2406	161	1481	125	1201
Starvation Cap Reductn	0	0	0	0	353	0	171	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	1.16	0.33	0.16	0.26	1.31	1.16	0.82	0.90	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	614	103	276	1884	674	178	1006	19	107	914	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	0.91		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	4884		1770	5071		3433	4996	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	4884		1770	5071		3433	4996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	646	108	291	1983	709	187	1059	20	113	962	127
RTOR Reduction (vph)	0	0	87	0	59	0	0	1	0	0	15	0
Lane Group Flow (vph)	74	646	21	291	2633	0	187	1078	0	113	1074	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	4.0	20.9	20.9	36.0	52.9		10.0	32.1		4.0	26.1	
Effective Green, g (s)	4.0	20.9	20.9	36.0	52.9		10.0	32.1		4.0	26.1	
Actuated g/C Ratio	0.04	0.19	0.19	0.33	0.48		0.09	0.29		0.04	0.24	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	64	966	301	1124	2349		161	1480		125	1185	
v/s Ratio Prot	c0.04	0.13		0.08	c0.54		c0.11	0.21		0.03	c0.21	
v/s Ratio Perm			0.01									
v/c Ratio	1.16	0.67	0.07	0.26	1.12		1.16	0.73		0.90	0.91	
Uniform Delay, d1	53.0	41.3	36.6	27.2	28.6		50.0	35.0		52.8	40.8	
Progression Factor	1.00	1.00	1.00	0.75	0.56		0.65	0.56		0.84	0.77	
Incremental Delay, d2	161.1	1.8	0.1	0.0	56.4		112.3	2.4		48.8	10.7	
Delay (s)	214.1	43.1	36.7	20.3	72.4		144.7	21.9		93.4	42.2	
Level of Service	F	D	D	C	E		F	C		F	D	
Approach Delay (s)		57.6			67.3			40.0			47.0	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM Average Control Delay	56.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
12: Willow St & Bellflower St

3/27/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	109	1894	171	233	1199	139	2149	158	1663
v/c Ratio	0.56	1.10	0.28	1.02	0.80	0.94	1.05	0.92	0.89
Control Delay	64.4	93.7	11.7	111.7	24.5	51.6	42.2	97.9	32.6
Queue Delay	0.0	0.0	0.0	0.0	0.1	0.0	99.7	0.0	0.0
Total Delay	64.4	93.7	11.7	111.7	24.6	51.6	141.9	97.9	32.6
Queue Length 50th (ft)	82	~611	30	~102	295	112	~479	68	290
Queue Length 95th (ft)	#176	#707	83	#189	345	m98	m250	m#121	343
Internal Link Dist (ft)		1129			409		285		200
Turn Bay Length (ft)	140			110		150		120	
Base Capacity (vph)	193	1716	610	229	1621	148	2047	172	1878
Starvation Cap Reductn	0	0	0	0	24	0	366	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	0.56	1.10	0.28	1.02	0.75	0.94	1.28	0.92	0.89

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	104	1799	162	221	844	295	132	1958	84	150	1517	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	0.91		0.97	0.91	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	4887		1770	5054		3433	5055	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	4887		1770	5054		3433	5055	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	109	1894	171	233	888	311	139	2061	88	158	1597	66
RTOR Reduction (vph)	0	0	76	0	55	0	0	4	0	0	4	0
Lane Group Flow (vph)	109	1894	95	233	1144	0	139	2145	0	158	1659	0
Turn Type	Prot		Perm	Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	13.1	40.5	40.5	8.0	35.4		10.0	48.5		6.0	44.5	
Effective Green, g (s)	13.1	40.5	40.5	8.0	35.4		10.0	48.5		6.0	44.5	
Actuated g/C Ratio	0.11	0.34	0.34	0.07	0.29		0.08	0.40		0.05	0.37	
Clearance Time (s)	4.0	4.5	4.5	4.0	4.5		4.0	4.5		4.0	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	193	1716	534	229	1442		148	2043		172	1875	
v/s Ratio Prot	0.06	c0.37		c0.07	0.23		c0.08	c0.42		0.05	0.33	
v/s Ratio Perm			0.06									
v/c Ratio	0.56	1.10	0.18	1.02	0.79		0.94	1.05		0.92	0.88	
Uniform Delay, d1	50.7	39.8	28.0	56.0	38.9		54.7	35.8		56.8	35.4	
Progression Factor	1.00	1.00	1.00	0.92	0.57		0.67	0.45		0.99	0.77	
Incremental Delay, d2	3.8	56.0	0.2	60.3	2.7		10.8	24.1		37.4	5.0	
Delay (s)	54.5	95.7	28.2	111.7	24.7		47.5	40.4		93.5	32.3	
Level of Service	D	F	C	F	C		D	D		F	C	
Approach Delay (s)		88.4			38.9			40.8			37.6	
Approach LOS		F			D			D			D	

Intersection Summary			
HCM Average Control Delay	53.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	99.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
16: Willow St & Los Coyotes Diagonal

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	88	735	367	2955	108	607	477	98	854
v/c Ratio	0.26	0.35	0.83	1.00	0.11	0.79	0.66	0.71	0.74
Control Delay	33.9	7.4	54.7	39.8	4.2	34.1	19.1	68.7	38.2
Queue Delay	0.0	0.0	0.0	91.3	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	7.4	54.7	131.0	4.2	34.1	19.1	68.7	38.3
Queue Length 50th (ft)	34	39	244	~833	8	238	223	32	176
Queue Length 95th (ft)	m57	m230	331	#922	33	287	333	#78	225
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	375	2102	547	2968	958	772	718	138	1149
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	542	0	0	0	0	4
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.35	0.67	1.22	0.11	0.79	0.66	0.71	0.75

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	698	0	349	2807	103	0	577	453	93	497	314
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.91		1.00	0.91	1.00		0.95	1.00	0.97	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085		1770	5085	1583		3539	1583	3433	4790	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.17	1.00	
Satd. Flow (perm)	3433	5085		1770	5085	1583		3539	1583	632	4790	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	88	735	0	367	2955	108	0	607	477	98	523	331
RTOR Reduction (vph)	0	0	0	0	0	34	0	0	373	0	104	0
Lane Group Flow (vph)	88	735	0	367	2955	74	0	607	104	98	750	0
Turn Type	Prot			Prot		Perm			Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8			2	6		
Actuated Green, G (s)	9.6	45.5		27.5	63.4	63.4		24.0	24.0	24.0	24.0	
Effective Green, g (s)	9.6	45.5		27.5	63.4	63.4		24.0	24.0	24.0	24.0	
Actuated g/C Ratio	0.09	0.41		0.25	0.58	0.58		0.22	0.22	0.22	0.22	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	300	2103		443	2931	912		772	345	138	1045	
v/s Ratio Prot	0.03	c0.14		0.21	c0.58			c0.17			0.16	
v/s Ratio Perm						0.05			0.07	0.16		
v/c Ratio	0.29	0.35		0.83	1.01	0.08		0.79	0.30	0.71	0.72	
Uniform Delay, d1	47.0	22.1		39.0	23.3	10.4		40.6	36.0	39.8	39.9	
Progression Factor	0.71	0.30		1.00	1.00	1.00		0.67	4.22	1.00	1.00	
Incremental Delay, d2	0.5	0.4		12.1	18.6	0.2		6.4	1.8	26.6	4.2	
Delay (s)	33.9	7.1		51.1	41.9	10.5		33.7	153.5	66.3	44.1	
Level of Service	C	A		D	D	B		C	F	E	D	
Approach Delay (s)		9.9			41.9			86.4			46.4	
Approach LOS		A			D			F			D	

Intersection Summary			
HCM Average Control Delay	46.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
16: Willow St & Los Coyotes Diagonal

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	167	2026	528	1329	315	739	844	254	612
v/c Ratio	0.58	1.11	1.23	0.51	0.34	1.04	1.20	1.27	0.42
Control Delay	20.2	61.3	163.1	19.8	7.1	67.2	130.1	199.8	32.6
Queue Delay	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.2	68.0	163.1	19.8	7.1	67.2	130.1	199.8	32.6
Queue Length 50th (ft)	53	~628	~506	238	45	~331	~813	~127	129
Queue Length 95th (ft)	m50	m#97	#722	279	102	m#377	m#906	#214	166
Internal Link Dist (ft)		409		995		363			581
Turn Bay Length (ft)	140		160					120	
Base Capacity (vph)	286	1822	428	2627	914	708	706	200	1474
Starvation Cap Reductn	0	25	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	0.58	1.13	1.23	0.51	0.34	1.04	1.20	1.27	0.42

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	159	1925	0	502	1263	299	0	702	802	241	472	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.0	4.0	4.5	
Lane Util. Factor	0.97	0.91		1.00	0.91	1.00		0.95	1.00	0.97	0.91	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085		1770	5085	1583		3539	1583	3433	4942	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085		1770	5085	1583		3539	1583	3433	4942	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	167	2026	0	528	1329	315	0	739	844	254	497	115
RTOR Reduction (vph)	0	0	0	0	0	96	0	0	1	0	32	0
Lane Group Flow (vph)	167	2026	0	528	1329	219	0	739	843	254	580	0
Turn Type	Prot			Prot		Perm			pm+ov	Prot		
Protected Phases	7	4		3	8			2	3	1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	10.0	43.0		29.0	62.0	62.0		24.0	53.0	7.0	35.0	
Effective Green, g (s)	10.0	43.0		29.0	62.0	62.0		24.0	53.0	7.0	35.0	
Actuated g/C Ratio	0.08	0.36		0.24	0.52	0.52		0.20	0.44	0.06	0.29	
Clearance Time (s)	4.0	4.5		4.0	4.5	4.5		4.5	4.0	4.0	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	286	1822		428	2627	818		708	699	200	1441	
v/s Ratio Prot	0.05	c0.40		c0.30	0.26			0.21	c0.29	c0.07	0.12	
v/s Ratio Perm						0.14			0.24			
v/c Ratio	0.58	1.11		1.23	0.51	0.27		1.04	1.21	1.27	0.40	
Uniform Delay, d1	53.0	38.5		45.5	19.0	16.3		48.0	33.5	56.5	34.1	
Progression Factor	0.36	0.13		1.00	1.00	1.00		0.64	1.49	1.00	1.00	
Incremental Delay, d2	0.3	51.3		124.0	0.7	0.8		35.5	99.6	154.7	0.8	
Delay (s)	19.6	56.3		169.5	19.7	17.1		66.0	149.5	211.2	34.9	
Level of Service	B	E		F	B	B		E	F	F	C	
Approach Delay (s)		53.5			55.7			110.6			86.7	
Approach LOS		D			E			F			F	

Intersection Summary			
HCM Average Control Delay	71.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	105.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
17: Willow St & Woodruff Ave

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	200	1760	120	3069	689	194	51	901	317
v/c Ratio	1.50	0.88	0.71	1.45	1.61	0.34	0.13	1.09	0.65
Control Delay	299.6	39.3	76.1	234.8	317.9	45.0	36.1	102.3	28.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	299.6	39.3	76.1	234.8	317.9	45.0	36.1	102.3	28.2
Queue Length 50th (ft)	~215	446	92	~1196	~394	68	30	~414	115
Queue Length 95th (ft)	#367	516	#187	#1282	#513	104	66	#543	218
Internal Link Dist (ft)		631		1090		191		644	
Turn Bay Length (ft)	200		180		140		120		120
Base Capacity (vph)	133	2009	169	2116	429	1066	389	826	486
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	1.50	0.88	0.71	1.45	1.61	0.18	0.13	1.09	0.65

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	190	1404	268	114	2883	32	655	152	32	48	856	301
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		0.97	0.95		1.00	0.95	1.00
Frt	1.00	0.98		1.00	1.00		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	4963		1770	5077		3433	3446		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	4963		1770	5077		3433	3446		1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	1478	282	120	3035	34	689	160	34	51	901	317
RTOR Reduction (vph)	0	24	0	0	1	0	0	18	0	0	0	117
Lane Group Flow (vph)	200	1736	0	120	3068	0	689	176	0	51	901	200
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	9.0	47.6		11.4	50.0		15.8	19.2		24.6	28.0	28.0
Effective Green, g (s)	9.0	47.6		11.4	50.0		15.8	19.2		24.6	28.0	28.0
Actuated g/C Ratio	0.07	0.39		0.09	0.41		0.13	0.16		0.20	0.23	0.23
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	132	1956		167	2101		449	548		360	820	367
v/s Ratio Prot	c0.11	0.35		0.07	c0.60		c0.20	0.05		0.03	c0.25	
v/s Ratio Perm												0.13
v/c Ratio	1.52	0.89		0.72	1.46		1.53	0.32		0.14	1.10	0.55
Uniform Delay, d1	55.9	34.1		53.1	35.4		52.5	45.0		39.4	46.4	40.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	266.7	5.3		13.8	209.8		251.5	0.3		0.2	62.0	1.7
Delay (s)	322.6	39.4		66.9	245.2		304.0	45.4		39.6	108.4	42.5
Level of Service	F	D		E	F		F	D		D	F	D
Approach Delay (s)		68.3			238.5			247.2			89.1	
Approach LOS		E			F			F			F	

Intersection Summary			
HCM Average Control Delay	167.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	120.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	124.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Queues
17: Willow St & Woodruff Ave

3/27/2013

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	366	2161	60	1366	346	261	15	442	216
v/c Ratio	1.05	1.03	0.78	1.02	0.66	0.21	0.19	0.66	0.45
Control Delay	100.6	55.5	101.1	66.3	43.6	21.2	51.2	39.5	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	100.6	55.5	101.1	66.3	43.6	21.2	51.2	39.5	7.9
Queue Length 50th (ft)	~236	~485	35	~315	98	51	9	126	0
Queue Length 95th (ft)	#455	#666	#116	#466	152	88	31	182	58
Internal Link Dist (ft)		631		1090		191		644	
Turn Bay Length (ft)	200		180		140		120		120
Base Capacity (vph)	349	2092	77	1333	639	1390	77	891	560
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	1.05	1.03	0.78	1.02	0.54	0.19	0.19	0.50	0.39

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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												
Volume (vph)	348	1423	630	57	1252	46	329	241	7	14	420	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		0.97	0.95		1.00	0.95	1.00
Frt	1.00	0.95		1.00	0.99		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	4851		1770	5058		3433	3525		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	4851		1770	5058		3433	3525		1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	366	1498	663	60	1318	48	346	254	7	15	442	216
RTOR Reduction (vph)	0	77	0	0	4	0	0	2	0	0	0	170
Lane Group Flow (vph)	366	2084	0	60	1362	0	346	259	0	15	442	46
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	18.1	38.2		4.0	24.1		14.1	32.6		1.5	20.0	20.0
Effective Green, g (s)	18.1	38.2		4.0	24.1		14.1	32.6		1.5	20.0	20.0
Actuated g/C Ratio	0.19	0.41		0.04	0.26		0.15	0.35		0.02	0.21	0.21
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	340	1965		75	1293		513	1219		28	751	336
v/s Ratio Prot	c0.21	c0.43		0.03	0.27		c0.10	0.07		0.01	c0.12	
v/s Ratio Perm												0.03
v/c Ratio	1.08	1.06		0.80	1.05		0.67	0.21		0.54	0.59	0.14
Uniform Delay, d1	38.1	28.0		44.8	35.1		37.9	21.8		46.1	33.4	30.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	70.7	38.6		43.9	40.4		3.5	0.1		18.3	1.2	0.2
Delay (s)	108.8	66.7		88.6	75.5		41.4	21.9		64.3	34.6	30.3
Level of Service	F	E		F	E		D	C		E	C	C
Approach Delay (s)		72.8			76.1			33.0			33.9	
Approach LOS		E			E			C			C	

Intersection Summary			
HCM Average Control Delay	64.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	94.3	Sum of lost time (s)	13.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	200	168	916	42	316
v/c Ratio	0.60	0.39	0.43	0.25	0.24
Control Delay	33.3	6.9	10.0	34.4	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	33.3	6.9	10.0	34.4	3.4
Queue Length 50th (ft)	80	0	115	15	27
Queue Length 95th (ft)	130	42	189	38	37
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	455	532	2113	182	1302
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.44	0.32	0.43	0.23	0.24

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	190	160	800	70	40	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3496		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3496		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	168	842	74	42	316
RTOR Reduction (vph)	0	137	8	0	0	0
Lane Group Flow (vph)	200	31	908	0	42	316
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	13.1	13.1	40.5		4.4	48.9
Effective Green, g (s)	13.1	13.1	40.5		4.4	48.9
Actuated g/C Ratio	0.19	0.19	0.58		0.06	0.70
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	331	296	2023		111	1301
v/s Ratio Prot	c0.11		c0.26		c0.02	0.17
v/s Ratio Perm		0.02				
v/c Ratio	0.60	0.11	0.45		0.38	0.24
Uniform Delay, d1	26.1	23.6	8.4		31.5	3.8
Progression Factor	1.00	1.00	1.00		1.06	0.69
Incremental Delay, d2	3.1	0.2	0.7		2.1	0.4
Delay (s)	29.2	23.8	9.1		35.5	3.1
Level of Service	C	C	A		D	A
Approach Delay (s)	26.7		9.1			6.9
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Queues
29: College Park Dr & SR-22 Ramps

12/6/2012

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	88	116	1861	84	291
v/c Ratio	1.49	0.72	0.64	1.42	0.17
Control Delay	330.8	35.3	4.6	305.8	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	330.8	35.3	4.6	305.8	0.9
Queue Length 50th (ft)	~94	2	197	~88	14
Queue Length 95th (ft)	#204	#89	240	#194	21
Internal Link Dist (ft)	864		215		720
Turn Bay Length (ft)					
Base Capacity (vph)	59	162	2915	59	1677
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.49	0.72	0.64	1.42	0.17

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	84	110	1600	168	80	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3489		1770	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3489		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	88	116	1684	177	84	291
RTOR Reduction (vph)	0	109	7	0	0	0
Lane Group Flow (vph)	88	7	1854	0	84	291
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	4.0	4.0	100.0		4.0	108.0
Effective Green, g (s)	4.0	4.0	100.0		4.0	108.0
Actuated g/C Ratio	0.03	0.03	0.83		0.03	0.90
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	59	53	2908		59	1677
v/s Ratio Prot	c0.05		c0.53		c0.05	0.16
v/s Ratio Perm		0.00				
v/c Ratio	1.49	0.13	0.64		1.42	0.17
Uniform Delay, d1	58.0	56.3	3.6		58.0	0.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	291.4	1.1	1.1		264.6	0.2
Delay (s)	349.4	57.4	4.6		322.6	0.9
Level of Service	F	E	A		F	A
Approach Delay (s)	183.4		4.6			73.0
Approach LOS	F		A			E

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: 7th St & PCH

3/26/2013

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2591	1705	597	119	1145	520	689
v/c Ratio	1.03	0.97	0.61	0.54	1.01	0.99	0.54
Control Delay	59.9	14.9	0.7	46.0	49.8	91.3	44.0
Queue Delay	15.4	19.1	1.4	0.0	0.0	11.0	0.0
Total Delay	75.3	34.0	2.2	46.0	49.8	102.3	44.0
Queue Length 50th (ft)	~857	117	2	107	~364	228	185
Queue Length 95th (ft)	#947	m124	m0	m172	#468	#344	228
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2506	1756	983	222	1131	526	1279
Starvation Cap Reductn	0	123	207	0	0	0	0
Spillback Cap Reductn	90	0	0	0	0	21	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.07	1.04	0.77	0.54	1.01	1.03	0.54

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	2317	144	0	1620	567	113	1025	63	494	654	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5041			3539	1583	1770	5041		3433	5084	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5041			3539	1583	1770	5041		3433	5084	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	2439	152	0	1705	597	119	1079	66	520	688	1
RTOR Reduction (vph)	0	5	0	0	0	198	0	2	0	0	0	0
Lane Group Flow (vph)	0	2586	0	0	1705	399	119	1143	0	520	689	0
Turn Type						Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		64.5			64.5	64.5	16.3	29.1		19.9	32.7	
Effective Green, g (s)		64.5			64.5	64.5	16.3	29.1		19.9	32.7	
Actuated g/C Ratio		0.50			0.50	0.50	0.13	0.22		0.15	0.25	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2501			1756	785	222	1128		526	1279	
v/s Ratio Prot		c0.51			0.48		0.07	c0.23		c0.15	0.14	
v/s Ratio Perm						0.25						
v/c Ratio		1.03			0.97	0.51	0.54	1.01		0.99	0.54	
Uniform Delay, d1		32.8			31.8	22.1	53.3	50.5		54.9	42.1	
Progression Factor		1.00			0.23	0.00	0.72	0.41		1.00	1.00	
Incremental Delay, d2		27.5			5.7	0.1	7.4	27.4		35.9	1.6	
Delay (s)		60.2			13.1	0.2	45.5	48.0		90.8	43.8	
Level of Service		E			B	A	D	D		F	D	
Approach Delay (s)		60.2			9.7			47.8			64.0	
Approach LOS		E			A			D			E	

Intersection Summary			
HCM Average Control Delay	42.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	97.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	508	2468	36	2318	806	179	241	484	424
v/c Ratio	0.98	0.85	0.53	1.05	0.99	0.57	0.91	0.49	0.71
Control Delay	73.4	11.0	87.3	47.3	86.3	43.3	96.3	41.1	27.0
Queue Delay	0.0	10.7	0.0	9.8	0.0	0.0	0.0	0.0	0.0
Total Delay	73.4	21.7	87.3	57.1	86.3	43.3	96.3	41.1	27.0
Queue Length 50th (ft)	220	283	32	~753	258	94	105	179	159
Queue Length 95th (ft)	m213	m276	m40	#851	#351	170	#186	234	286
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		
Base Capacity (vph)	520	2900	68	2212	818	314	264	991	600
Starvation Cap Reductn	0	450	0	50	0	0	0	0	0
Spillback Cap Reductn	0	0	0	20	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.98	1.01	0.53	1.07	0.99	0.57	0.91	0.49	0.71

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	483	2328	16	34	1822	380	0	766	170	229	460	403
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	0.97	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.97			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5080		1770	4954			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5080		1770	4954			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	508	2451	17	36	1918	400	0	806	179	241	484	424
RTOR Reduction (vph)	0	0	0	0	25	0	0	0	60	0	0	157
Lane Group Flow (vph)	508	2468	0	36	2293	0	0	806	119	241	484	267
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	19.7	73.1		4.0	57.4			20.9	20.9	10.0	36.4	36.4
Effective Green, g (s)	19.7	73.1		4.0	57.4			20.9	20.9	10.0	36.4	36.4
Actuated g/C Ratio	0.15	0.56		0.03	0.44			0.16	0.16	0.08	0.28	0.28
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	520	2857		54	2187			818	254	264	991	443
v/s Ratio Prot	c0.15	0.49		0.02	c0.46			c0.16		c0.07	0.14	
v/s Ratio Perm									0.08			0.17
v/c Ratio	0.98	0.86		0.67	1.05			0.99	0.47	0.91	0.49	0.60
Uniform Delay, d1	54.9	24.2		62.3	36.3			54.4	49.5	59.6	39.0	40.5
Progression Factor	1.22	0.44		1.17	0.47			1.14	1.22	1.00	1.00	1.00
Incremental Delay, d2	7.4	0.4		15.8	29.2			25.0	5.0	36.8	1.7	6.0
Delay (s)	74.3	11.0		88.9	46.2			87.0	65.6	96.4	40.8	46.5
Level of Service	E	B		F	D			F	E	F	D	D
Approach Delay (s)		21.8			46.8			83.1			54.5	
Approach LOS		C			D			F			D	

Intersection Summary			
HCM Average Control Delay	42.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	82	701	47	1163	487	73	480	180	354	14
v/c Ratio	0.40	0.34	0.20	0.63	0.56	0.20	0.67	0.54	0.34	0.04
Control Delay	13.6	4.5	28.2	35.8	6.7	44.8	51.6	77.2	69.3	49.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.6	4.5	28.2	35.8	6.7	44.8	51.6	77.2	69.3	49.8
Queue Length 50th (ft)	14	31	25	293	21	52	193	187	122	8
Queue Length 95th (ft)	m39	m36	52	343	109	97	254	m274	m160	m20
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	205	2033	231	1858	863	361	717	334	1027	356
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.34	0.20	0.63	0.56	0.20	0.67	0.54	0.34	0.04

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	78	653	13	45	1105	463	69	391	65	343	164	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (prot)	1770	5070		1770	5085	1583	1770	3464		1522	4686	1583
Flt Permitted	0.16	1.00		0.27	1.00	1.00	0.95	1.00		0.95	0.98	1.00
Satd. Flow (perm)	305	5070		510	5085	1583	1770	3464		1522	4686	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	82	687	14	47	1163	487	73	412	68	361	173	14
RTOR Reduction (vph)	0	2	0	0	0	288	0	10	0	0	0	9
Lane Group Flow (vph)	82	699	0	47	1163	199	73	470	0	180	354	5
Turn Type	pm+pt			pm+pt		Perm	Split			Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	52.8	51.3		46.7	46.7	46.7	26.5	26.5		28.5	28.5	28.5
Effective Green, g (s)	52.8	51.3		46.7	46.7	46.7	26.5	26.5		28.5	28.5	28.5
Actuated g/C Ratio	0.41	0.39		0.36	0.36	0.36	0.20	0.20		0.22	0.22	0.22
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	212	2001		214	1827	569	361	706		334	1027	347
v/s Ratio Prot	c0.02	0.14		0.01	c0.23		0.04	c0.14		c0.12	0.08	
v/s Ratio Perm	0.13			0.07		0.13						0.00
v/c Ratio	0.39	0.35		0.22	0.64	0.35	0.20	0.67		0.54	0.34	0.01
Uniform Delay, d1	38.8	27.6		28.0	34.6	30.5	43.0	47.7		44.9	42.9	39.7
Progression Factor	0.26	0.15		1.00	1.00	1.00	1.00	1.00		1.57	1.59	2.44
Incremental Delay, d2	0.9	0.4		0.5	1.7	1.7	1.3	4.9		5.4	0.8	0.1
Delay (s)	10.9	4.5		28.5	36.3	32.2	44.2	52.6		75.9	69.0	97.0
Level of Service	B	A		C	D	C	D	D		E	E	F
Approach Delay (s)		5.2			34.9			51.5			72.0	
Approach LOS		A			C			D			E	

Intersection Summary			
HCM Average Control Delay	36.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	108	2701	39	138	2698	98	95	176	49	55
v/c Ratio	0.89	0.78	0.04	0.86	0.82	0.92	0.85	0.73	0.24	0.40
Control Delay	86.5	4.0	0.4	88.7	6.2	129.3	111.8	26.2	60.3	34.7
Queue Delay	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Total Delay	86.5	4.1	0.4	88.7	6.4	129.3	111.8	26.2	60.3	34.7
Queue Length 50th (ft)	96	131	0	63	381	84	81	0	20	15
Queue Length 95th (ft)	m#122	143	m1	m#85	298	#198	#184	#96	41	57
Internal Link Dist (ft)		585			1015		352			692
Turn Bay Length (ft)	270			275		100		350		
Base Capacity (vph)	121	3465	1087	161	3287	106	112	242	634	339
Starvation Cap Reductn	0	80	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	130	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.80	0.04	0.86	0.85	0.92	0.85	0.73	0.08	0.16

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	103	2566	37	131	2143	420	93	90	167	47	17	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	1.00	1.00	0.97	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	4960		1770	1863	1583	3433	1675	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	4960		1770	1863	1583	3433	1675	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	108	2701	39	138	2256	442	98	95	176	49	18	37
RTOR Reduction (vph)	0	0	9	0	16	0	0	0	168	0	35	0
Lane Group Flow (vph)	108	2701	31	138	2682	0	98	95	8	49	20	0
Turn Type	Prot		Perm	Prot			Split		Over	Split		
Protected Phases	7	4		3	8		2	2	3	6	6	
Permitted Phases			4									
Actuated Green, G (s)	8.9	87.5	87.5	6.1	84.7		7.8	7.8	6.1	6.6	6.6	
Effective Green, g (s)	8.9	87.5	87.5	6.1	84.7		7.8	7.8	6.1	6.6	6.6	
Actuated g/C Ratio	0.07	0.67	0.67	0.05	0.65		0.06	0.06	0.05	0.05	0.05	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	121	3423	1065	161	3232		106	112	74	174	85	
v/s Ratio Prot	c0.06	0.53		0.04	c0.54		c0.06	0.05	0.01	c0.01	0.01	
v/s Ratio Perm			0.02									
v/c Ratio	0.89	0.79	0.03	0.86	0.83		0.92	0.85	0.11	0.28	0.23	
Uniform Delay, d1	60.1	14.8	7.1	61.5	17.2		60.8	60.5	59.4	59.4	59.3	
Progression Factor	0.81	0.20	0.10	1.00	0.27		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.7	1.0	0.0	21.9	1.5		63.3	41.5	0.7	0.9	1.4	
Delay (s)	80.5	4.0	0.7	83.6	6.2		124.1	102.1	60.0	60.3	60.7	
Level of Service	F	A	A	F	A		F	F	E	E	E	
Approach Delay (s)		6.8			10.0			87.9			60.5	
Approach LOS		A			B			F			E	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Group Flow (vph)	102	2722	2873	622	159
v/c Ratio	0.61	0.64	0.80	0.51	0.53
Control Delay	49.3	7.8	5.2	0.8	42.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	49.3	7.8	5.2	0.8	42.6
Queue Length 50th (ft)	80	380	275	14	41
Queue Length 95th (ft)	m102	442	m253	m22	78
Internal Link Dist (ft)		1015	1000		632
Turn Bay Length (ft)	400			150	150
Base Capacity (vph)	206	4275	3580	1221	302
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.64	0.80	0.51	0.53

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	97	2586	2729	591	94	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	0.91	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.94	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1770	5085	5085	1583	3306	
Flt Permitted	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	1770	5085	5085	1583	3306	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	102	2722	2873	622	99	60
RTOR Reduction (vph)	0	0	0	107	56	0
Lane Group Flow (vph)	102	2722	2873	515	103	0
Turn Type	Prot			Perm		
Protected Phases	7	4	8		6	
Permitted Phases				8		
Actuated Green, G (s)	12.3	109.3	91.5	91.5	9.7	
Effective Green, g (s)	12.3	109.3	91.5	91.5	9.7	
Actuated g/C Ratio	0.09	0.84	0.70	0.70	0.07	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	167	4275	3579	1114	247	
v/s Ratio Prot	0.06	c0.54	c0.56		c0.03	
v/s Ratio Perm				0.33		
v/c Ratio	0.61	0.64	0.80	0.46	0.42	
Uniform Delay, d1	56.5	3.5	13.1	8.5	57.5	
Progression Factor	0.70	2.03	0.36	0.18	1.00	
Incremental Delay, d2	4.1	0.5	0.2	0.1	5.2	
Delay (s)	43.8	7.7	4.9	1.6	62.6	
Level of Service	D	A	A	A	E	
Approach Delay (s)		9.0	4.3		62.6	
Approach LOS		A	A		E	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	156	2585	71	47	3644	231	187	53	121
v/c Ratio	1.09	0.74	0.06	0.42	1.10	0.22	1.14	0.29	0.38
Control Delay	145.6	11.0	1.9	69.9	75.2	5.7	161.7	54.8	16.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	145.6	11.0	1.9	69.9	75.2	5.7	161.7	54.8	16.2
Queue Length 50th (ft)	~145	494	3	39	~1276	41	~183	41	13
Queue Length 95th (ft)	#291	463	m6	80	#1345	75	#340	83	70
Internal Link Dist (ft)		1000			893		425		590
Turn Bay Length (ft)	150		150	300		150			
Base Capacity (vph)	143	3481	1097	121	3305	1063	164	182	320
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	1.09	0.74	0.06	0.39	1.10	0.22	1.14	0.29	0.38

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	148	2456	67	45	3462	219	126	39	12	50	16	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.99		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583		1782		1770	1623	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.62		0.69	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583		1136		1282	1623	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	156	2585	71	47	3644	231	133	41	13	53	17	104
RTOR Reduction (vph)	0	0	14	0	0	34	0	2	0	0	89	0
Lane Group Flow (vph)	156	2585	57	47	3644	197	0	185	0	53	32	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	10.5	87.9	87.9	7.1	84.5	84.5		18.5		18.5	18.5	
Effective Green, g (s)	10.5	87.9	87.9	7.1	84.5	84.5		18.5		18.5	18.5	
Actuated g/C Ratio	0.08	0.68	0.68	0.05	0.65	0.65		0.14		0.14	0.14	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	143	3438	1070	97	3305	1029		162		182	231	
v/s Ratio Prot	c0.09	0.51		0.03	c0.72						0.02	
v/s Ratio Perm			0.04			0.12		c0.16		0.04		
v/c Ratio	1.09	0.75	0.05	0.48	1.10	0.19		1.14		0.29	0.14	
Uniform Delay, d1	59.8	13.9	7.1	59.7	22.8	9.1		55.8		49.9	48.8	
Progression Factor	0.97	0.70	0.51	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	92.5	1.2	0.1	3.8	51.4	0.4		114.6		0.9	0.3	
Delay (s)	150.4	10.9	3.6	63.4	74.2	9.5		170.3		50.8	49.0	
Level of Service	F	B	A	E	E	A		F		D	D	
Approach Delay (s)		18.5			70.2			170.3			49.6	
Approach LOS		B			E			F			D	

Intersection Summary			
HCM Average Control Delay	51.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	105.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: 7th St & PCH

3/26/2013

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2228	1743	602	184	1078	694	1090
v/c Ratio	0.95	1.06	0.64	0.76	1.01	1.03	0.79
Control Delay	43.2	48.8	1.9	48.3	60.9	93.7	48.8
Queue Delay	37.1	0.0	1.0	0.0	0.0	36.4	0.0
Total Delay	80.3	48.8	2.9	48.3	60.9	130.1	48.8
Queue Length 50th (ft)	642	~837	8	154	~345	~322	313
Queue Length 95th (ft)	#736	m#921	m10	#267	#447	#445	369
Internal Link Dist (ft)	1037	280			562		836
Turn Bay Length (ft)				330		290	
Base Capacity (vph)	2349	1647	937	241	1069	673	1381
Starvation Cap Reductn	0	0	140	0	0	0	0
Spillback Cap Reductn	293	0	0	0	0	57	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.08	1.06	0.76	0.76	1.01	1.13	0.79

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1971	145	0	1656	572	175	962	62	659	1035	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Lane Util. Factor		0.91			0.95	1.00	1.00	0.91		0.97	0.91	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5033			3539	1583	1770	5039		3433	5085	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5033			3539	1583	1770	5039		3433	5085	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	2075	153	0	1743	602	184	1013	65	694	1089	1
RTOR Reduction (vph)	0	6	0	0	0	200	0	3	0	0	0	0
Lane Group Flow (vph)	0	2222	0	0	1743	402	184	1075	0	694	1090	0
Turn Type						Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		60.5			60.5	60.5	17.7	27.5		25.5	35.3	
Effective Green, g (s)		60.5			60.5	60.5	17.7	27.5		25.5	35.3	
Actuated g/C Ratio		0.47			0.47	0.47	0.14	0.21		0.20	0.27	
Clearance Time (s)		5.5			5.5	5.5	5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2342			1647	737	241	1066		673	1381	
v/s Ratio Prot		0.44			c0.49		0.10	c0.21		c0.20	0.21	
v/s Ratio Perm						0.25						
v/c Ratio		0.95			1.06	0.55	0.76	1.01		1.03	0.79	
Uniform Delay, d1		33.3			34.8	24.9	54.1	51.2		52.2	43.9	
Progression Factor		1.00			0.42	0.08	0.54	0.63		1.00	1.00	
Incremental Delay, d2		9.2			31.7	0.3	17.9	27.7		42.9	4.7	
Delay (s)		42.4			46.5	2.3	46.9	59.9		95.2	48.6	
Level of Service		D			D	A	D	E		F	D	
Approach Delay (s)		42.4			35.1			58.0			66.7	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	48.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	98.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	440	2370	41	1852	693	145	383	794	653
v/c Ratio	0.91	0.91	0.67	0.94	0.81	0.45	0.85	0.66	0.95
Control Delay	72.3	15.8	99.4	39.6	50.9	23.4	73.0	39.4	50.9
Queue Delay	0.0	29.4	0.0	0.6	0.0	0.0	0.0	0.0	4.4
Total Delay	72.3	45.3	99.4	40.2	50.9	23.4	73.0	39.4	55.3
Queue Length 50th (ft)	186	353	36	285	217	37	164	297	386
Queue Length 95th (ft)	m193	m496	m#72	#513	268	91	#244	368	#643
Internal Link Dist (ft)		280		585	326			720	
Turn Bay Length (ft)	200		200			130	160		
Base Capacity (vph)	489	2597	61	1963	857	322	452	1211	690
Starvation Cap Reductn	0	365	0	2	0	0	0	0	0
Spillback Cap Reductn	0	107	0	18	0	1	0	0	21
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.90	1.06	0.67	0.95	0.81	0.45	0.85	0.66	0.98

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	418	2221	30	39	1611	148	0	658	138	364	754	620
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	0.97	0.91		1.00	0.91			0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5075		1770	5021			5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5075		1770	5021			5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	440	2338	32	41	1696	156	0	693	145	383	794	653
RTOR Reduction (vph)	0	1	0	0	9	0	0	0	55	0	0	148
Lane Group Flow (vph)	440	2369	0	41	1843	0	0	693	90	383	794	505
Turn Type	Prot			Prot					Perm	Prot		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	18.4	65.4		3.6	50.6			21.9	21.9	17.1	44.5	44.5
Effective Green, g (s)	18.4	65.4		3.6	50.6			21.9	21.9	17.1	44.5	44.5
Actuated g/C Ratio	0.14	0.50		0.03	0.39			0.17	0.17	0.13	0.34	0.34
Clearance Time (s)	5.5	5.5		5.5	5.5			5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	486	2553		49	1954			857	267	452	1211	542
v/s Ratio Prot	c0.13	c0.47		0.02	0.37			0.14		0.11	0.22	
v/s Ratio Perm									0.06			c0.32
v/c Ratio	0.91	0.93		0.84	0.94			0.81	0.34	0.85	0.66	0.93
Uniform Delay, d1	54.9	30.1		62.9	38.3			52.0	47.7	55.2	36.3	41.3
Progression Factor	1.17	0.45		0.97	0.79			0.84	0.73	1.00	1.00	1.00
Incremental Delay, d2	7.2	2.4		61.2	9.2			7.0	2.9	17.6	2.8	25.0
Delay (s)	71.3	15.9		122.0	39.4			50.6	37.8	72.8	39.0	66.3
Level of Service	E	B		F	D			D	D	E	D	E
Approach Delay (s)		24.6			41.2			48.4			55.8	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM Average Control Delay	39.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	222	846	85	1131	414	46	260	171	525	43
v/c Ratio	0.73	0.36	0.29	0.57	0.49	0.22	0.62	0.55	0.54	0.13
Control Delay	31.3	24.9	32.7	33.0	6.6	54.8	60.5	28.8	24.9	13.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.3	24.9	32.7	33.0	6.6	54.8	60.5	28.8	24.9	13.8
Queue Length 50th (ft)	177	247	44	267	20	36	109	163	167	26
Queue Length 95th (ft)	m223	m289	89	350	108	76	157	m253	m211	m38
Internal Link Dist (ft)		562		597			652		326	
Turn Bay Length (ft)	110		120		200	280		240		60
Base Capacity (vph)	395	2378	296	1996	849	211	422	310	969	343
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.36	0.29	0.57	0.49	0.22	0.62	0.55	0.54	0.13

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	211	719	85	81	1074	393	44	234	13	275	387	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	0.95		0.86	0.86	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (prot)	1770	5005		1770	5085	1583	1770	3511		1522	4752	1583
Flt Permitted	0.12	1.00		0.32	1.00	1.00	0.95	1.00		0.95	0.99	1.00
Satd. Flow (perm)	227	5005		599	5085	1583	1770	3511		1522	4752	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	222	757	89	85	1131	414	46	246	14	289	407	43
RTOR Reduction (vph)	0	11	0	0	0	228	0	4	0	0	0	20
Lane Group Flow (vph)	222	835	0	85	1131	186	46	256	0	171	525	23
Turn Type	pm+pt			pm+pt		Perm	Split			Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	61.5	61.5		52.5	51.0	51.0	15.5	15.5		26.5	26.5	26.5
Effective Green, g (s)	61.5	61.5		52.5	51.0	51.0	15.5	15.5		26.5	26.5	26.5
Actuated g/C Ratio	0.47	0.47		0.40	0.39	0.39	0.12	0.12		0.20	0.20	0.20
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5	5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	303	2368		296	1995	621	211	419		310	969	323
v/s Ratio Prot	c0.09	0.17		0.01	c0.22		0.03	c0.07		c0.11	0.11	
v/s Ratio Perm	c0.25			0.10		0.12						0.01
v/c Ratio	0.73	0.35		0.29	0.57	0.30	0.22	0.61		0.55	0.54	0.07
Uniform Delay, d1	24.4	21.7		26.9	30.9	27.2	51.8	54.4		46.4	46.3	41.8
Progression Factor	0.97	1.16		1.00	1.00	1.00	1.00	1.00		0.50	0.50	0.58
Incremental Delay, d2	5.1	0.2		0.5	1.2	1.2	2.4	6.5		5.1	1.6	0.3
Delay (s)	28.7	25.5		27.5	32.0	28.4	54.1	60.9		28.4	24.8	24.6
Level of Service	C	C		C	C	C	D	E		C	C	C
Approach Delay (s)		26.1			30.9			59.9			25.6	
Approach LOS		C			C			E			C	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	28	2700	119	306	1880	59	14	142	279	164
v/c Ratio	0.30	0.93	0.13	0.97	0.58	0.86	0.19	0.59	0.62	0.66
Control Delay	85.1	14.8	1.7	77.8	2.7	134.5	66.7	29.7	59.2	57.5
Queue Delay	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	85.1	15.7	1.7	77.8	2.7	134.5	66.7	29.7	59.2	57.5
Queue Length 50th (ft)	26	160	4	135	32	50	12	32	117	114
Queue Length 95th (ft)	m27	#959	m5	m#229	30	#137	35	103	154	180
Internal Link Dist (ft)		585			1015		352			692
Turn Bay Length (ft)	270			275		100		350		
Base Capacity (vph)	96	2894	934	317	3265	69	73	239	634	343
Starvation Cap Reductn	0	59	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.95	0.13	0.97	0.58	0.86	0.19	0.59	0.44	0.48

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	2565	113	291	1746	40	56	13	135	265	90	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	1.00	1.00	0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	5068		1770	1863	1583	3433	1745	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	5068		1770	1863	1583	3433	1745	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	28	2700	119	306	1838	42	59	14	142	279	95	69
RTOR Reduction (vph)	0	0	34	0	1	0	0	0	91	0	22	0
Lane Group Flow (vph)	28	2700	85	306	1879	0	59	14	51	279	142	0
Turn Type	Prot		Perm	Prot			Split		Over	Split		
Protected Phases	7	4		3	8		2	2	3	6	6	
Permitted Phases			4									
Actuated Green, G (s)	4.5	71.8	71.8	14.2	81.5		5.1	5.1	14.2	16.9	16.9	
Effective Green, g (s)	4.5	71.8	71.8	14.2	81.5		5.1	5.1	14.2	16.9	16.9	
Actuated g/C Ratio	0.03	0.55	0.55	0.11	0.63		0.04	0.04	0.11	0.13	0.13	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	61	2808	874	375	3177		69	73	173	446	227	
v/s Ratio Prot	0.02	c0.53		c0.09	0.37		c0.03	0.01	0.03	0.08	c0.08	
v/s Ratio Perm			0.05									
v/c Ratio	0.46	0.96	0.10	0.82	0.59		0.86	0.19	0.30	0.63	0.63	
Uniform Delay, d1	61.6	27.8	13.8	56.6	14.4		62.1	60.5	53.3	53.6	53.6	
Progression Factor	1.37	0.38	0.27	0.69	0.15		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	5.5	0.1	9.8	0.6		60.6	1.3	1.0	2.7	5.3	
Delay (s)	86.8	15.9	3.8	48.8	2.7		122.7	61.7	54.3	56.3	58.9	
Level of Service	F	B	A	D	A		F	E	D	E	E	
Approach Delay (s)		16.1			9.2			73.5			57.2	
Approach LOS		B			A			E			E	

Intersection Summary			
HCM Average Control Delay	18.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Group Flow (vph)	32	3117	2226	205	507
v/c Ratio	0.36	0.85	0.66	0.19	0.75
Control Delay	44.7	4.8	2.3	0.2	56.8
Queue Delay	0.0	0.2	0.0	0.0	0.0
Total Delay	44.7	5.1	2.3	0.2	56.8
Queue Length 50th (ft)	26	23	36	0	208
Queue Length 95th (ft)	m30	157	46	m0	271
Internal Link Dist (ft)		1015	1000		632
Turn Bay Length (ft)	400			150	150
Base Capacity (vph)	91	3657	3371	1093	675
Starvation Cap Reductn	0	26	0	0	0
Spillback Cap Reductn	0	107	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.88	0.66	0.19	0.75

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	30	2961	2115	195	457	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	
Lane Util. Factor	1.00	0.91	0.91	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (prot)	1770	5085	5085	1583	3424	
Flt Permitted	0.95	1.00	1.00	1.00	0.95	
Satd. Flow (perm)	1770	5085	5085	1583	3424	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	3117	2226	205	481	26
RTOR Reduction (vph)	0	0	0	46	3	0
Lane Group Flow (vph)	32	3117	2226	159	504	0
Turn Type	Prot			Perm		
Protected Phases	7	4	8		6	
Permitted Phases				8		
Actuated Green, G (s)	4.0	93.5	84.0	84.0	25.5	
Effective Green, g (s)	4.0	93.5	84.0	84.0	25.5	
Actuated g/C Ratio	0.03	0.72	0.65	0.65	0.20	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	54	3657	3286	1023	672	
v/s Ratio Prot	0.02	c0.61	0.44		c0.15	
v/s Ratio Perm				0.10		
v/c Ratio	0.59	0.85	0.68	0.16	0.75	
Uniform Delay, d1	62.2	13.2	14.5	9.0	49.2	
Progression Factor	0.65	0.26	0.12	0.00	1.00	
Incremental Delay, d2	8.0	1.3	0.7	0.2	7.5	
Delay (s)	48.5	4.7	2.4	0.2	56.8	
Level of Service	D	A	A	A	E	
Approach Delay (s)		5.2	2.2		56.8	
Approach LOS		A	A		E	

Intersection Summary			
HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	139	3437	23	73	2414	76	82	131	219
v/c Ratio	0.57	0.97	0.02	0.82	0.78	0.08	0.90	0.82	0.65
Control Delay	53.8	21.2	4.9	116.1	21.4	5.5	119.6	91.3	29.0
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.8	21.5	4.9	116.1	21.4	5.5	119.6	91.3	29.0
Queue Length 50th (ft)	105	550	2	62	526	11	61	109	57
Queue Length 95th (ft)	m130	#727	m4	#154	588	31	#166	#223	146
Internal Link Dist (ft)		1000			893		425		590
Turn Bay Length (ft)	150		150	300		150			
Base Capacity (vph)	245	3540	1106	89	3090	978	91	160	335
Starvation Cap Reductn	0	9	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	0.57	0.97	0.02	0.82	0.78	0.08	0.90	0.82	0.65

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	3265	22	69	2293	72	29	29	19	124	37	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.97		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583		1768		1770	1633	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.36		0.67	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583		652		1257	1633	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	139	3437	23	73	2414	76	31	31	20	131	39	180
RTOR Reduction (vph)	0	0	4	0	0	16	0	9	0	0	127	0
Lane Group Flow (vph)	139	3437	19	73	2414	60	0	73	0	131	92	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	18.0	90.5	90.5	6.5	79.0	79.0		16.5		16.5	16.5	
Effective Green, g (s)	18.0	90.5	90.5	6.5	79.0	79.0		16.5		16.5	16.5	
Actuated g/C Ratio	0.14	0.70	0.70	0.05	0.61	0.61		0.13		0.13	0.13	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5		5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	245	3540	1102	89	3090	962		83		160	207	
v/s Ratio Prot	0.08	c0.68		0.04	c0.47						0.06	
v/s Ratio Perm			0.01			0.04		c0.11		0.10		
v/c Ratio	0.57	0.97	0.02	0.82	0.78	0.06		0.88		0.82	0.44	
Uniform Delay, d1	52.4	18.5	6.1	61.2	19.0	10.4		55.8		55.3	52.5	
Progression Factor	0.92	0.79	1.27	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.6	6.0	0.0	42.9	2.0	0.1		70.1		26.7	1.5	
Delay (s)	49.8	20.7	7.8	104.1	21.1	10.5		125.9		82.0	54.0	
Level of Service	D	C	A	F	C	B		F		F	D	
Approach Delay (s)		21.7			23.1			125.9			64.5	
Approach LOS		C			C			F			E	

Intersection Summary			
HCM Average Control Delay	25.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	102.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Appendix B

Freeway Analyses

Appendix B Includes:

B1. Year 2020 Alternative 2 Freeway Peak Hour LOS Worksheets

B2. Year 2040 Alternative 2 Freeway Peak Hour LOS Worksheets

This page intentionally left blank.

Appendix B1

Year 2020 Alternative 2
Freeway Level of Service (LOS) Worksheets

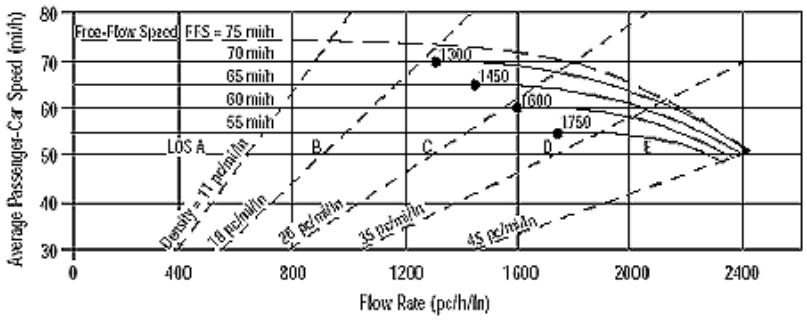
This page intentionally left blank.

2020 Alternative 2

Freeway Mainline, Ramps, and Ramp-Freeway Junctions and Weaving Level of Service Analysis Worksheets

AM Peak Hour

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	To Lakewood Blvd off ramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 1

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9660 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	72.6	mi/h	FFS	72.6	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2190	pc/h/ln	Design LOS		
S	61.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	35.9	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 2

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 70.0 mph S_{FR} = 30.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9660	0.90	Level	4	0	0.980	1.00	10948
Ramp	1120	0.90	Level	4	0	0.980	1.00	1269
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3216 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8759	9600	No
V_{12}	3216	4400:All	No
V_{FO} = V_F - V_R	7490	9600	No
V_R	1269	3800	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.5 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.607 (Exhibit 25-19)

S_R= 53.0 mph (Exhibit 25-19)

S_0= 69.9 mph (Exhibit 25-19)

S = 62.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Lakewood on - Willow St off
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	930	Weaving ratio, R	0.48
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	340	0.90	4	0	1.5	1.2	0.980	1.00	385
Vw2	320	0.90	4	0	1.5	1.2	0.980	1.00	362
Vw				747	Vnw				0
V									747

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.12	0.42
Weaving and non-weaving speeds, Si (mi/h)			23.01	32.61

Number of lanes required for unconstrained operation, Nw 1.70
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	23.01
Weaving segment density, D (pc/mi/ln)	16.23
Level of service, LOS	B
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 8

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 69.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8540	0.90	Level	4	0	0.980	1.00	9679
Ramp	300	0.90	Level	4	0	0.980	1.00	340
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.558 using Equation 4

V_{12}= 5397 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10019	See Exhibit 25-7	Yes
V_{R12}	5737	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 42.5 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.447 (Exibit 25-19)

S_R= 29.6 mph (Exhibit 25-19)

S_0= 63.9 mph (Exhibit 25-19)

S= 38.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Willow ONR - L Coyotes OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.19
Weaving seg length, L (ft)	1200	Weaving ratio, R	0.23
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	7491	0.90	4	0	1.5	1.2	0.980	1.00	8489
Vo2	71	0.90	4	0	1.5	1.2	0.980	1.00	80
Vw1	1349	0.90	4	0	1.5	1.2	0.980	1.00	1528
Vw2	399	0.90	4	0	1.5	1.2	0.980	1.00	452
Vw				1980	Vnw				8569
V									10549

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.95	0.41
Weaving and non-weaving speeds, Si (mi/h)			28.93	54.03

Number of lanes required for unconstrained operation, Nw 1.50
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	46.46
Weaving segment density, D (pc/mi/ln)	45.41
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10034
Capacity as a 15-minute flow rate, c (veh/h)	9837
Capacity as a full-hour volume, c_h (veh/h)	8853

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Copyright © 2003 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - BellFl OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	650	Weaving ratio, R	0.46
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	110	0.90	4	0	1.5	1.2	0.980	1.00	124
Vw2	130	0.90	4	0	1.5	1.2	0.980	1.00	147
Vw				271	Vnw				0
V									271

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			1.06	0.15
Weaving and non-weaving speeds, Si (mi/h)			27.15	36.80

Number of lanes required for unconstrained operation, Nw 1.47
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	27.15
Weaving segment density, D (pc/mi/ln)	4.99
Level of service, LOS	A
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - Woodruff OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	68	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.18
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.44
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	7178	0.90	4	0	1.5	1.2	0.980	1.00	8135
Vo2	38	0.90	4	0	1.5	1.2	0.980	1.00	43
Vw1	712	0.90	4	0	1.5	1.2	0.980	1.00	806
Vw2	892	0.90	4	0	1.5	1.2	0.980	1.00	1010
Vw				1816	Vnw				8178
V									9994

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.97	0.40
Weaving and non-weaving speeds, Si (mi/h)			29.62	56.46

Number of lanes required for unconstrained operation, Nw 1.42
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	48.48
Weaving segment density, D (pc/mi/ln)	41.23
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	10215
Capacity as a 15-minute flow rate, c (veh/h)	10015
Capacity as a full-hour volume, c_h (veh/h)	9013

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 22

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 69.2 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8070	0.90	Level	4	0	0.980	1.00	9146
Ramp	660	0.90	Level	4	0	0.980	1.00	748
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.188 using Equation 4

V_{12}= 1720 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9894	See Exhibit 25-7	Yes
V_{R12}	2468	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.1 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.353 (Exibit 25-19)

S_R= 59.6 mph (Exhibit 25-19)

S_0= 54.2 mph (Exhibit 25-19)

S= 55.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

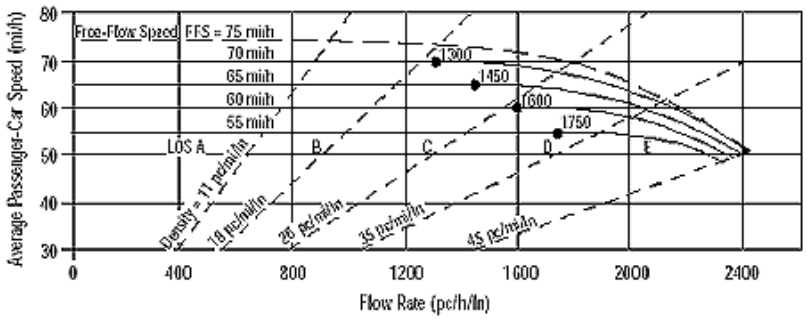
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Woodruff ONR to Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 23

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8730 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.2	mi/h	FFS	68.2	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2474	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB
Weaving Seg Location	Stearns ONR to Studebaker OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	69	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.09
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.50
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	8331	0.90	4	0	1.5	1.2	0.980	1.00	9441
Vo2	21	0.90	4	0	1.5	1.2	0.980	1.00	23
Vw1	399	0.90	4	0	1.5	1.2	0.980	1.00	452
Vw2	399	0.90	4	0	1.5	1.2	0.980	1.00	452
Vw				904	Vnw				9464
V									10368

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.61	0.21		
Weaving and non-weaving speeds, Si (mi/h)	51.69	63.90		

Number of lanes required for unconstrained operation, Nw 0.70
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

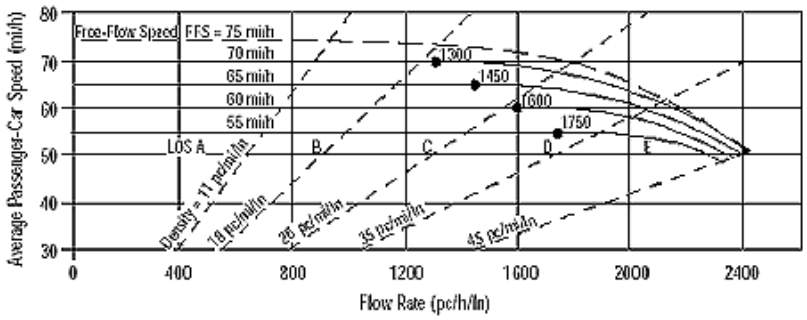
Weaving segment speed, S (mi/h)	62.61
Weaving segment density, D (pc/mi/ln)	33.12
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	11850
Capacity as a 15-minute flow rate, c (veh/h)	11618
Capacity as a full-hour volume, c_h (veh/h)	10456

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Studebaker OFR to 605NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 25

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8740 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1981	pc/h/ln	Design LOS		
S	64.5	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	30.7	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 26

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 68.9 mph S_{FR} = 50.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8740	0.90	Level	4	0	0.980	1.00	9905
Ramp	1250	0.90	Level	4	0	0.980	1.00	1417
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3109 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7924	9556	No
V_{12}	3109	4400:All	No
V_{FO} = V_F - V_R	6507	9556	No
V_R	1417	4100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 4.9 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.361 (Exhibit 25-19)

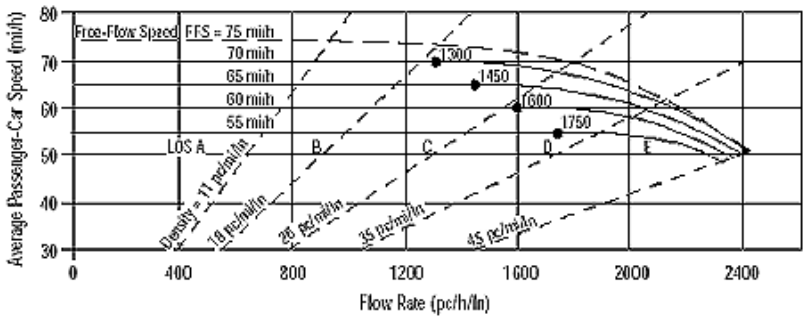
S_R= 59.2 mph (Exhibit 25-19)

S_0= 70.1 mph (Exhibit 25-19)

S = 65.4 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 27

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7480 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

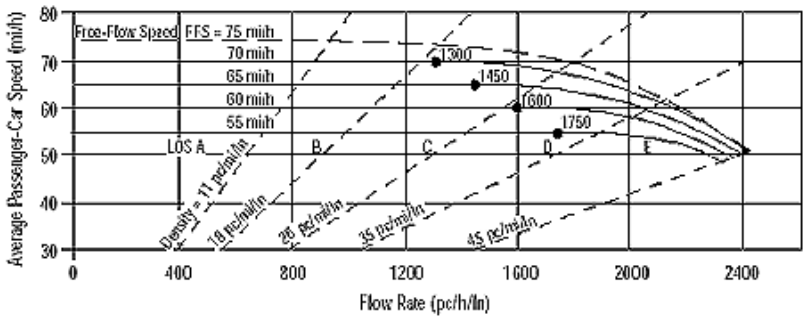
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2119	pc/h/ln	Design LOS		
S	61.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	34.4	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB OFR to I-605 Sb ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 29

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7390 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2094	pc/h/ln	Design LOS		
S	62.2	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	33.7	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 30

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.9 mph S_{FR} = 35.0 mph	VD = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	7390	0.90	Level	4	0	0.980	1.00	8375
Ramp	3320	0.90	Level	4	0	0.980	1.00	3763
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.209 using Equation 0

V_{12}= 1750 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	12138	See Exhibit 25-7	Yes
V_{R12}	5513	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.6 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.085 (Exibit 25-19)

S_R= 39.7 mph (Exhibit 25-19)

S_0= 56.3 mph (Exhibit 25-19)

S= 47.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

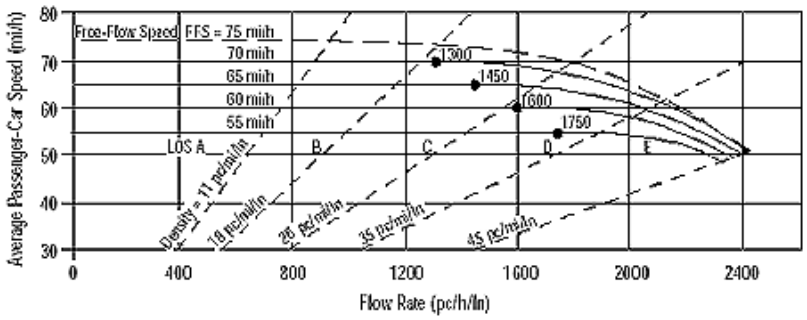
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB ONR to 7th St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 31

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10710 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

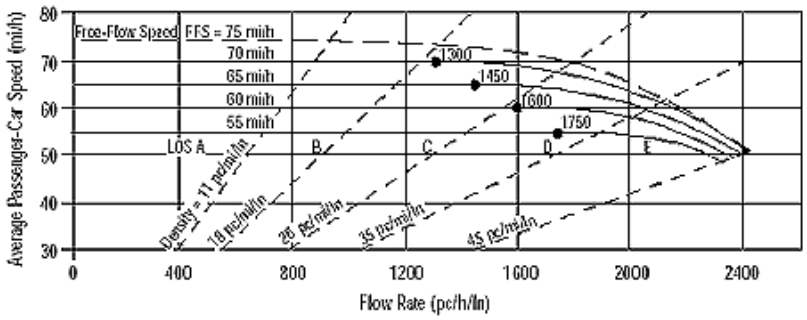
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2428	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	to I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 32

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	11140 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2525	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 33

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	11140	0.90	Level	4	0	0.980	1.00	12625
Ramp	3800	0.90	Level	4	0	0.980	1.00	4307
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 5813 pc/h

Capacity Checks

	Actual	Maximum	LOS F?		Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7		V_{FI}=V_F	10100	9000	Yes
				V_{12}	5813	4400:All	Yes
V_{R12}		4600:All		V_{FO} = V_F - V_R	5793	9000	No
				V_R	4307	4100	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 11.0 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.621 (Exhibit 25-19)

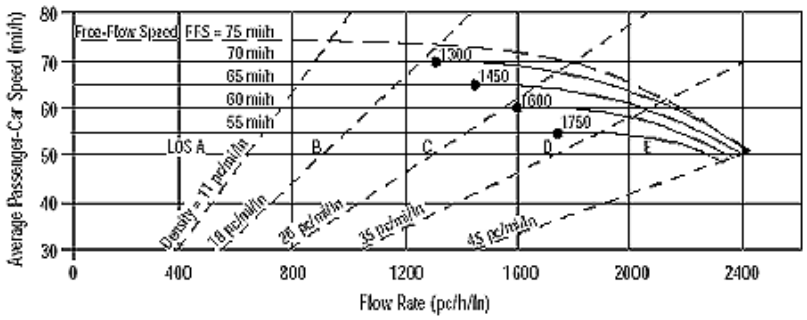
S_R= 46.9 mph (Exhibit 25-19)

S_0= 55.9 mph (Exhibit 25-19)

S = 50.4 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 Sb OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 34

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7340 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2080	pc/h/ln	Design LOS		
S	53.3	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	39.0	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB/NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 35

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7340	0.90	Level	4	0	0.980	1.00	8319
Ramp	1500	0.90	Level	4	0	0.980	1.00	1700
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.388 using Equation 4

V_{12}= 3224 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10019	See Exhibit 25-7	Yes
V_{R12}	4924	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 35.6 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.773 (Exibit 25-19)

S_R= 46.9 mph (Exhibit 25-19)

S_0= 55.8 mph (Exhibit 25-19)

S= 51.1 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

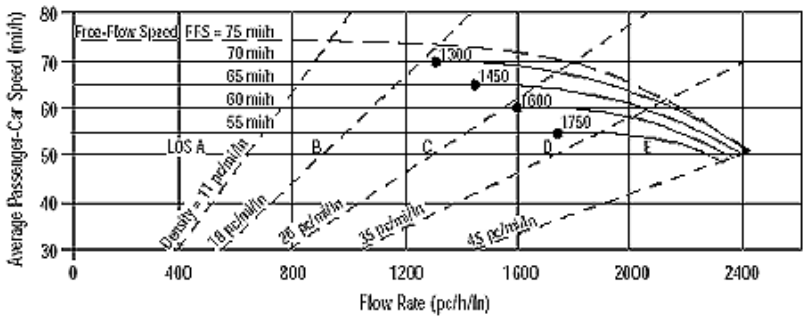
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB/SB ONR to Studeba ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 36

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8850 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2508	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Studeb ONR - Palo Verde OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	55	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.10
Weaving seg length, L (ft)	1700	Weaving ratio, R	0.34
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	33	0.90	4	0	1.5	1.2	0.980	1.00	37
Vo2	8233	0.90	4	0	1.5	1.2	0.980	1.00	9330
Vw1	317	0.90	4	0	1.5	1.2	0.980	1.00	359
Vw2	617	0.90	4	0	1.5	1.2	0.980	1.00	699
Vw				1058	Vnw				9367
V									10425

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.80	0.40		
Weaving and non-weaving speeds, Si (mi/h)	39.99	47.10		

Number of lanes required for unconstrained operation, Nw 1.14
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	46.27
Weaving segment density, D (pc/mi/ln)	45.06
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10027
Capacity as a 15-minute flow rate, c (veh/h)	9830
Capacity as a full-hour volume, c_h (veh/h)	8847

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Palo Verde ONR to Woodruff OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	47	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.08
Weaving seg length, L (ft)	1750	Weaving ratio, R	0.16
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	fHV	fp	v
Vo1	33	0.90	4	0	1.5	1.2	0.980	1.00	37
Vo2	7923	0.90	4	0	1.5	1.2	0.980	1.00	8979
Vw1	117	0.90	4	0	1.5	1.2	0.980	1.00	132
Vw2	617	0.90	4	0	1.5	1.2	0.980	1.00	699
Vw				831	Vnw				9016
V									9847

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.72	0.34		
Weaving and non-weaving speeds, Si (mi/h)	36.57	42.55		

Number of lanes required for unconstrained operation, Nw 1.07
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.97
Weaving segment density, D (pc/mi/ln)	46.92
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10070
Capacity as a 15-minute flow rate, c (veh/h)	9873
Capacity as a full-hour volume, c_h (veh/h)	8886

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Woodruff ONR to Bellflower OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	46	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.11
Weaving seg length, L (ft)	890	Weaving ratio, R	0.45
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	27	0.90	4	0	1.5	1.2	0.980	1.00	30
Vo2	7537	0.90	4	0	1.5	1.2	0.980	1.00	8541
Vw1	413	0.90	4	0	1.5	1.2	0.980	1.00	468
Vw2	503	0.90	4	0	1.5	1.2	0.980	1.00	570
Vw				1038	Vnw				8571
V									9609

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.26	0.60		
Weaving and non-weaving speeds, Si (mi/h)	30.94	37.48		

Number of lanes required for unconstrained operation, Nw 1.13
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	36.65
Weaving segment density, D (pc/mi/ln)	52.44
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	9137
Capacity as a 15-minute flow rate, c (veh/h)	8958
Capacity as a full-hour volume, c_h (veh/h)	8062

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Bellflower ONR to Lakewood OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	52	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.23
Weaving seg length, L (ft)	1300	Weaving ratio, R	0.44
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	49	0.90	4	0	1.5	1.2	0.980	1.00	55
Vo2	7029	0.90	4	0	1.5	1.2	0.980	1.00	7966
Vw1	1171	0.90	4	0	1.5	1.2	0.980	1.00	1327
Vw2	921	0.90	4	0	1.5	1.2	0.980	1.00	1043
Vw				2370	Vnw				8021
V									10391

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.73	0.40		
Weaving and non-weaving speeds, Si (mi/h)	39.24	45.10		

Number of lanes required for unconstrained operation, Nw 1.60
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.61
Weaving segment density, D (pc/mi/ln)	47.65
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	9903
Capacity as a 15-minute flow rate, c (veh/h)	9709
Capacity as a full-hour volume, c_h (veh/h)	8738

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 46

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9010	0.90	Level	4	0	0.980	1.00	10211
Ramp	590	0.90	Level	4	0	0.980	1.00	669
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.293 using Equation 4

V_{12}= 2263 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8380	See Exhibit 25-7	No
V_{R12}	2932	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.9 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.359 (Exibit 25-19)

S_R= 50.3 mph (Exhibit 25-19)

S_0= 45.9 mph (Exhibit 25-19)

S= 47.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

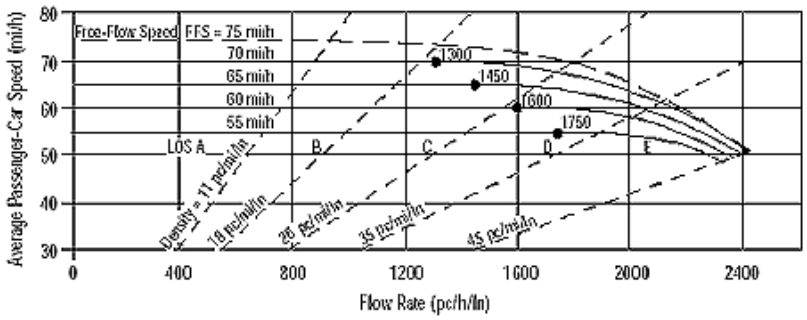
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	Lakewood ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 47

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9600 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

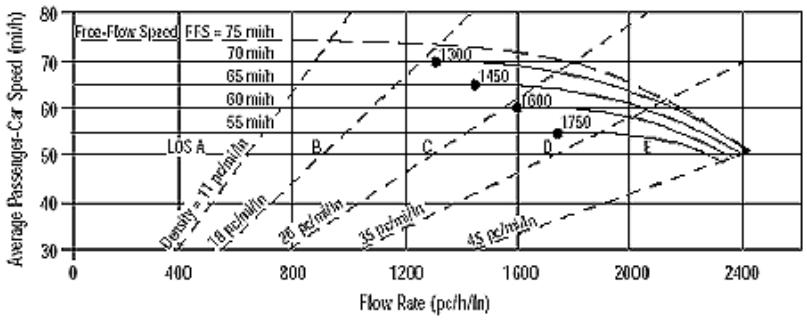
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2176	pc/h/ln	Design LOS		
S	51.7	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	42.1	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	to I-40 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 48

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4350 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2441	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 49

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4350	0.90	Level	5	0	0.976	1.00	4954
Ramp	3550	0.90	Level	5	0	0.976	1.00	4043
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 4954 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	4954	4500	Yes
V_{12}	4954	4400:All	Yes
$V_{FO} = V_F - V_R$	911	4500	No
V_R	4043	3800	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.0 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.792 (Exhibit 25-19)

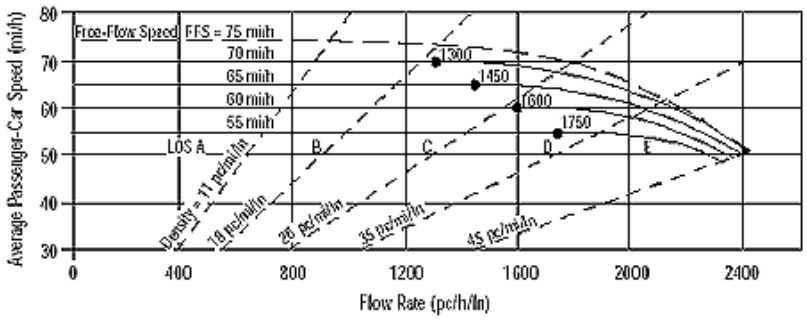
S_R= 44.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 44.7 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 50

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	510 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	60.0	mi/h	FFS	60.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	290	pc/h/ln	Design LOS		
S	60.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	4.8	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 51

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 68.8 mph S_{FR} = 50.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	510	0.90	Level	5	0	0.976	1.00	581
Ramp	720	0.90	Level	5	0	0.976	1.00	820
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =1.000 using Equation 0
V_{12}= pc/h	V_{12} = 581 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	581	4775	No
V_{12}	581	4400:All	No
V_{FO} = V_F - V_R	-239	4775	No
V_R	820	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -0.7 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.307 (Exhibit 25-19)

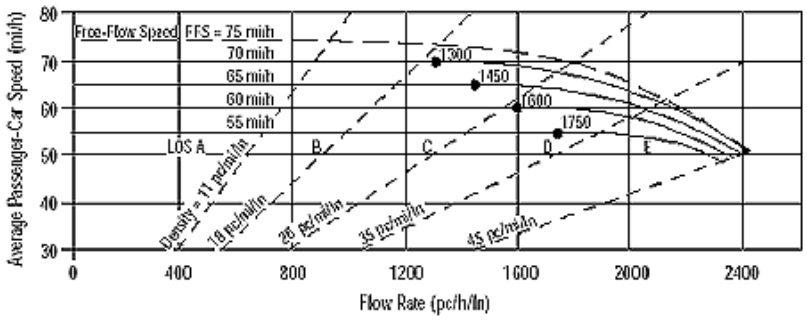
S_R= 60.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 52

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	450 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	68.8	mi/h	FFS	68.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

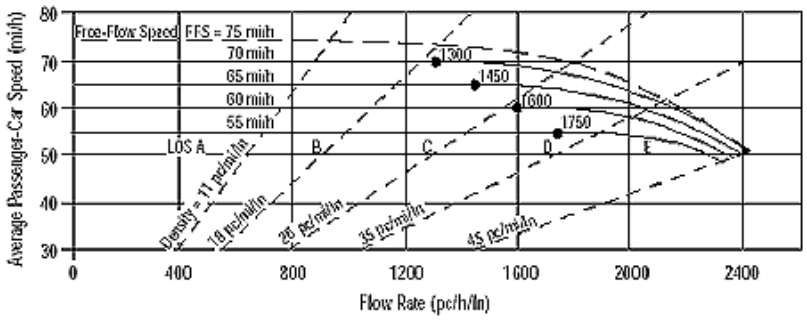
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	256	pc/h/ln	Design LOS		
S	68.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	3.7	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB ONR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 54

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3800 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.8	mi/h	FFS	68.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

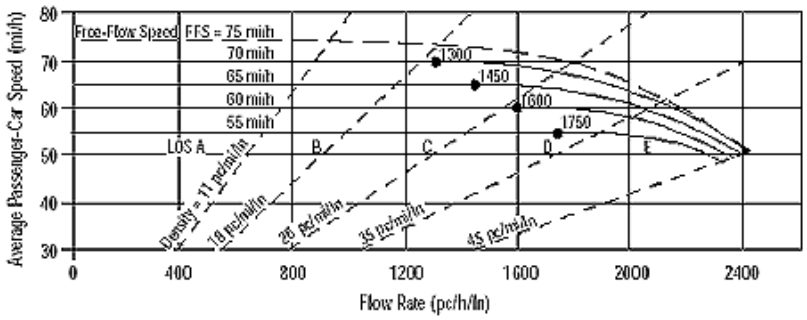
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1082	pc/h/ln	Design LOS		
S	68.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	15.7	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB ONR to Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 56

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4810 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.8	mi/h	FFS	68.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1096	pc/h/ln	Design LOS		
S	68.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	15.9	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 57

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.8 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4810	0.90	Level	5	0	0.976	1.00	5478
Ramp	1060	0.90	Level	5	0	0.976	1.00	1207
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 2831 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	4931	9552	No
V_{12}	2831	4400:All	No
V_{FO} = V_F - V_R	3724	9552	No
V_R	1207	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -0.2 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.472 (Exhibit 25-19)

S_R= 56.2 mph (Exhibit 25-19)

S_0= 75.3 mph (Exhibit 25-19)

S = 63.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 59

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	3750	0.90	Level	5	0	0.976	1.00	4271
Ramp	1060	0.90	Level	5	0	0.976	1.00	1207
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.250 using Equation 4

V_{12}= 1068 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	5478	See Exhibit 25-7	No
V_{R12}	2275	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.1 (pc/ m/ln)

LOS = B (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.319 (Exibit 25-19)

S_R= 61.1 mph (Exhibit 25-19)

S_0= 66.0 mph (Exhibit 25-19)

S= 63.9 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

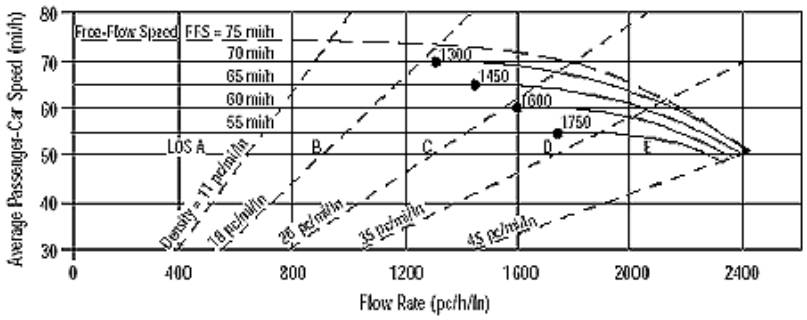
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Willow St ONR to Cerritos ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 60

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4810 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1370	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	19.6	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Cerritos Ave ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 61

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 66.1 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4810	0.90	Level	5	0	0.976	1.00	5478
Ramp	720	0.90	Level	5	0	0.976	1.00	820
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.179 using Equation 4

V_{12}= 981 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6298	See Exhibit 25-7	No
V_{R12}	1801	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 17.9 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.331 (Exibit 25-19)

S_R= 58.1 mph (Exhibit 25-19)

S_0= 59.8 mph (Exhibit 25-19)

S= 59.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

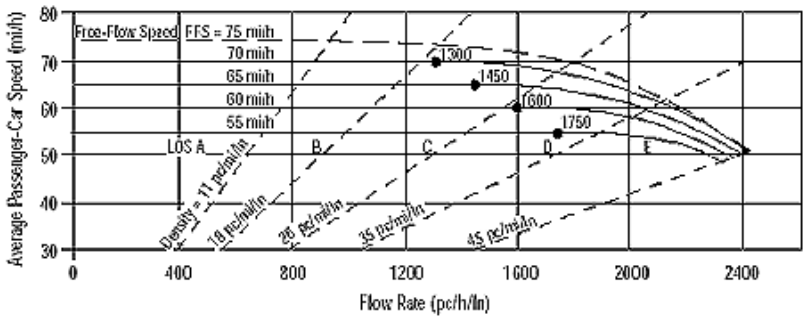
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Cerritos ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 62

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5540 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	65.5	mi/h	FFS	65.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1577	pc/h/ln	Design LOS		
S	65.4	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	24.1	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 63

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 65.5 mph S_{FR} = 35.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5540	0.90	Level	5	0	0.976	1.00	6309
Ramp	1030	0.90	Level	5	0	0.976	1.00	1173
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3412 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	6309	9420	No
V_{12}	3412	4400:All	No
V_{FO} = V_F - V_R	5136	9420	No
V_R	1173	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.9 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.534 (Exhibit 25-19)

S_R= 53.0 mph (Exhibit 25-19)

S_0= 70.1 mph (Exhibit 25-19)

S = 59.7 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 65

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 61.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4510	0.90	Level	5	0	0.976	1.00	5136
Ramp	490	0.90	Level	5	0	0.976	1.00	558
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.331 using Equation 4

V_{12}= 1701 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	5694	See Exhibit 25-7	No
V_{R12}	2259	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.2 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.318 (Exibit 25-19)

S_R= 55.0 mph (Exhibit 25-19)

S_0= 56.6 mph (Exhibit 25-19)

S= 55.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 68

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 67.6 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7170	0.90	Level	5	0	0.976	1.00	8166
Ramp	560	0.90	Level	5	0	0.976	1.00	638
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.218 using Equation 4

V_{12}= 1778 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8804	See Exhibit 25-7	No
V_{R12}	2416	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.5 (pc/ m/ln)

LOS = C (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.347 (Exibit 25-19)

S_R= 58.7 mph (Exhibit 25-19)

S_0= 55.7 mph (Exhibit 25-19)

S= 56.5 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 70

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.1 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7730	0.90	Level	5	0	0.976	1.00	8804
Ramp	270	0.90	Level	5	0	0.976	1.00	308
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.243 using Equation 4

V_{12}= 2139 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9112	See Exhibit 25-7	No
V_{R12}	2447	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.2 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.352 (Exibit 25-19)

S_R= 57.6 mph (Exhibit 25-19)

S_0= 53.4 mph (Exhibit 25-19)

S= 54.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

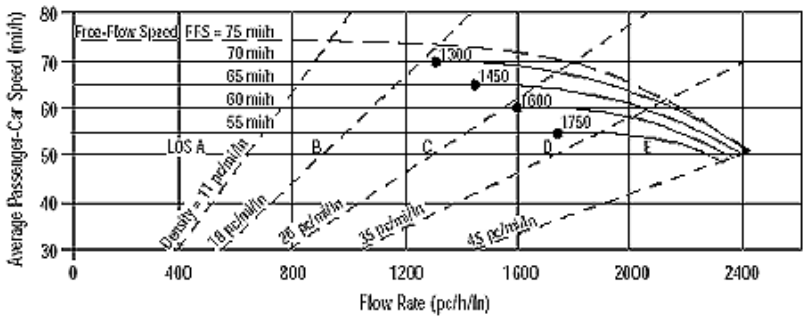
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Carson ONR to 5 lane section
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 71

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8000 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	67.9	mi/h	FFS	67.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

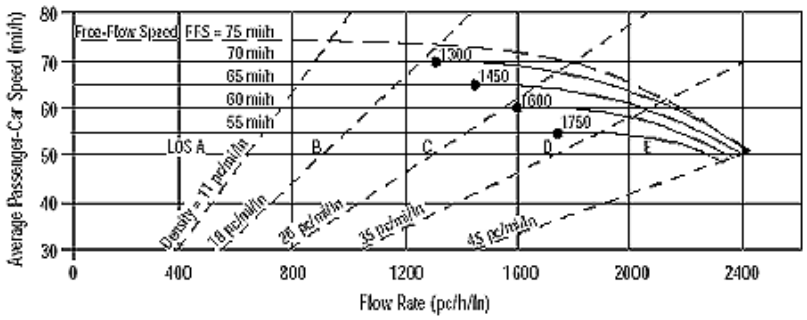
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2278	pc/h/ln	Design LOS		
S	56.4	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	40.4	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	5 lane section to Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 72

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8000 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	67.9	mi/h	FFS	67.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1822	pc/h/ln	Design LOS		
S	66.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	27.6	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 73

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 67.9 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8000	0.90	Level	5	0	0.976	1.00	9111
Ramp	1050	0.90	Level	5	0	0.976	1.00	1196
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3853 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7289	9516	No
V_{12}	3853	4400:All	No
$V_{FO} = V_F - V_R$	6093	9516	No
V_R	1196	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.6 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.601 (Exhibit 25-19)

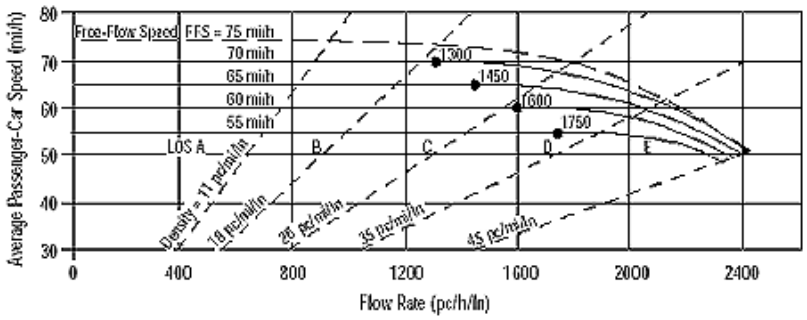
S_R= 52.3 mph (Exhibit 25-19)

S_0= 71.7 mph (Exhibit 25-19)

S = 60.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Spring OFR to Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 74

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	6960 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1982	pc/h/ln	Design LOS		
S	65.2	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	30.4	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 75

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 66.2 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6960	0.90	Level	5	0	0.976	1.00	7927
Ramp	550	0.90	Level	5	0	0.976	1.00	626
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3809 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7927	9447	No
V_{12}	3809	4400:All	No
$V_{FO} = V_F - V_R$	7301	9447	No
V_R	626	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.0 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.549 (Exhibit 25-19)

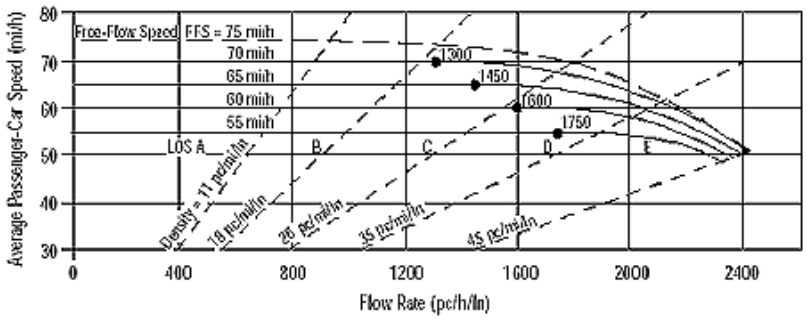
S_R= 52.9 mph (Exhibit 25-19)

S_0= 68.5 mph (Exhibit 25-19)

S = 60.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow OFR to Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 76

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	6410 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	66.2	mi/h	FFS	66.2	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1825	pc/h/ln	Design LOS		
S	64.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	28.2	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 77

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 63.9 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6410	0.90	Level	5	0	0.976	1.00	7300
Ramp	1120	0.90	Level	5	0	0.976	1.00	1276
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3902 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7300	9356	No
V_{12}	3902	4400:All	No
$V_{FO} = V_F - V_R$	6024	9356	No
V_R	1276	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.8 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.608 (Exhibit 25-19)

S_R= 50.6 mph (Exhibit 25-19)

S_0= 67.4 mph (Exhibit 25-19)

S = 57.2 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 79

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.9 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	5290	0.90	Level	5	0	0.976	1.00	6025
Ramp	620	0.90	Level	5	0	0.976	1.00	706
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.416 using Equation 4

V_{12}= 2508 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6731	See Exhibit 25-7	No
V_{R12}	3214	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.6 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.355 (Exibit 25-19)

S_R= 56.1 mph (Exhibit 25-19)

S_0= 59.4 mph (Exhibit 25-19)

S= 57.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

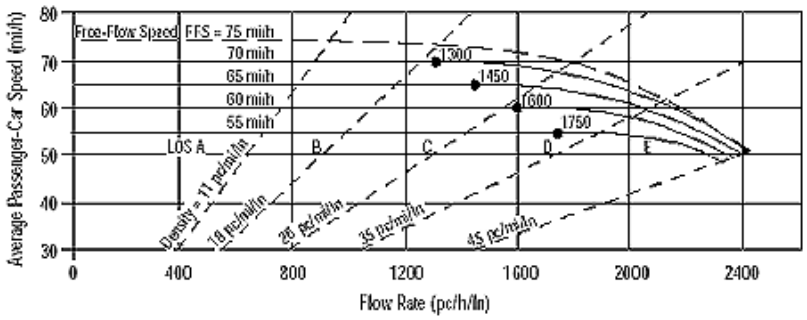
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow ONR CD to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 84

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5910 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	66.5	mi/h	FFS	66.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1683	pc/h/ln	Design LOS		
S	65.9	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	25.5	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 85

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 66.5 mph S_{FR} = 50.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5910	0.90	Level	5	0	0.976	1.00	6731
Ramp	790	0.90	Level	5	0	0.976	1.00	900
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3442 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	6731	9460	No
V_{12}	3442	4400:All	No
$V_{FO} = V_F - V_R$	5831	9460	No
V_R	900	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.4 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.314 (Exhibit 25-19)

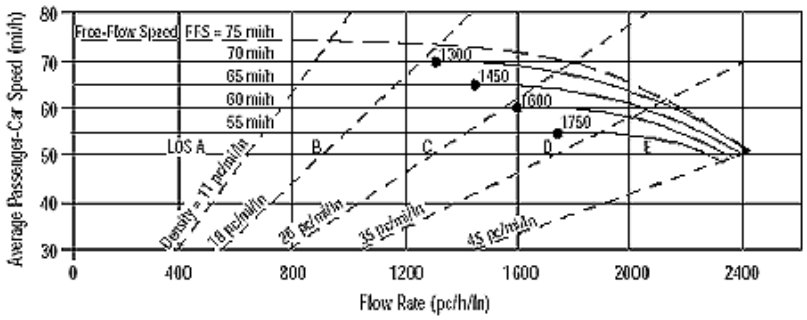
S_R= 58.8 mph (Exhibit 25-19)

S_0= 70.4 mph (Exhibit 25-19)

S = 64.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 86

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5120 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1458	pc/h/ln	Design LOS		
S	69.9	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	20.9	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 87

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 66.5 mph S_{FR} = 66.5 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5120	0.90	Level	5	0	0.976	1.00	5831
Ramp	3320	0.90	Level	5	0	0.976	1.00	3781
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 4314 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	5831	9460	No
V_{12}	4314	4400:All	No
V_{FO} = V_F - V_R	2050	9460	No
V_R	3781	4400	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -45.0 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.359 (Exhibit 25-19)

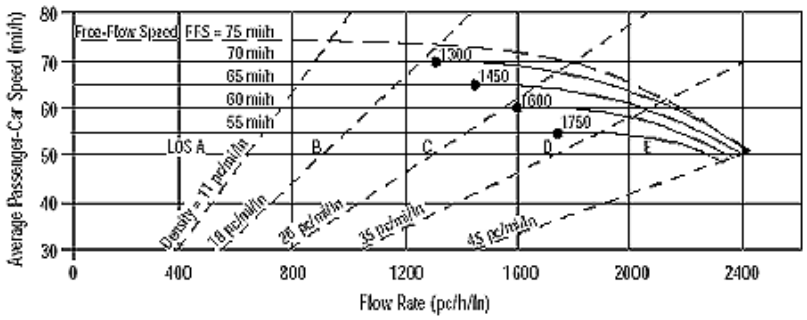
S_R= 57.7 mph (Exhibit 25-19)

S_0= 73.0 mph (Exhibit 25-19)

S = 61.0 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 88 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3900 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	66.5	mi/h	FFS	66.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2221	pc/h/ln	Design LOS		
S	57.4	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	38.7	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 89 coded as 2 lanes, double volume

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.5 mph S_{FR} = 50.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	3900	0.90	Level	5	0	0.976	1.00	4442
Ramp	90	0.90	Level	5	0	0.976	1.00	103
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 4442 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4545	See Exhibit 25-7	No
V_{R12}	4545	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 38.7 (pc/ m/ln)

LOS = E (Exhibit 25-4)

Speed Estimation

M_S = 0.653 (Exibit 25-19)

S_R= 50.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 50.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

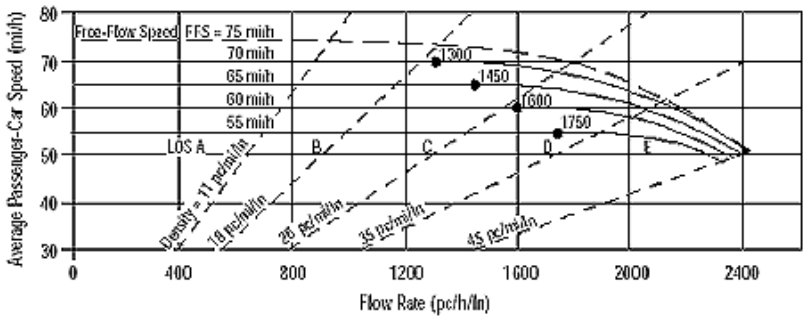
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB ONR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 90 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4100 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	66.5	mi/h	FFS	66.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2335	pc/h/ln	Design LOS		
S	53.7	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	43.5	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 91 coded for ramp being the mainline

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 55.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1990	0.90	Level	2	0	0.990	1.00	2233
Ramp	2050	0.90	Level	2	0	0.990	1.00	2301
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2233 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4534	See Exhibit 25-7	Yes
V_{R12}	4534	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 38.2 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.657 (Exibit 25-19)

S_R= 46.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 46.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

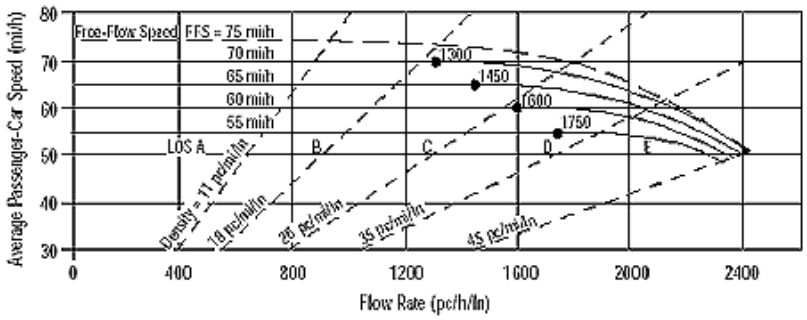
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	I-405 NB ONR to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 92

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4200 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2357	pc/h/ln	Design LOS		
S	55.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	42.9	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 95

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	3320	0.90	Level	2	0	0.990	1.00	3726
Ramp	630	0.90	Level	2	0	0.990	1.00	707
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 3726 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4433	See Exhibit 25-7	No
V_{R12}	4433	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 30.3 (pc/ m/ln)

LOS = D (Exhibit 25-4)

Speed Estimation

M_S = 0.544 (Exibit 25-19)

S_R= 47.9 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 47.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

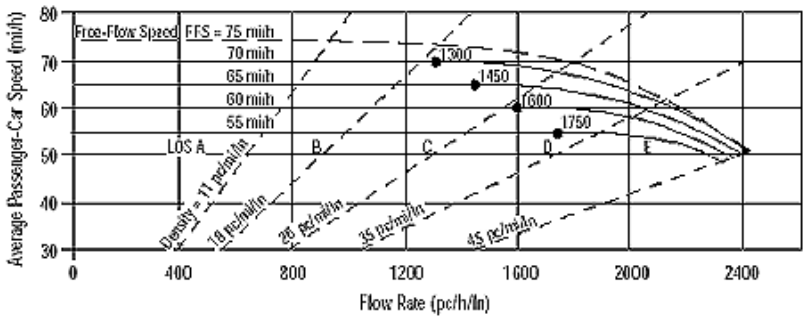
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	StudeB ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 96

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4010 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

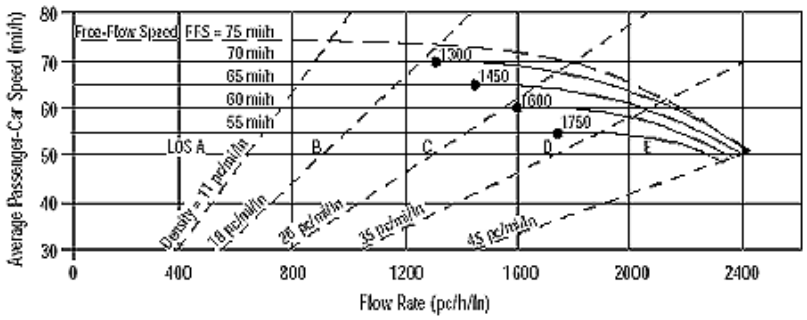
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1500	pc/h/ln	Design LOS		
S	69.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	21.5	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St EB
Agency or Company	Parsons	From/To	to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 97

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3180 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1190	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	17.0	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 98

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 30.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	3180	0.90	Level	5	0	0.976	1.00	3622
Ramp	200	0.90	Level	5	0	0.976	1.00	228
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 3622 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	3622	4500	No
V_{12}	3622	4400:All	No
$V_{FO} = V_F - V_R$	3394	4500	No
V_R	228	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.3 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.514 (Exhibit 25-19)

S_R= 48.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 48.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 100

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2970	0.90	Level	2	0	0.990	1.00	3333
Ramp	1280	0.90	Level	2	0	0.990	1.00	1436
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 3333 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4769	See Exhibit 25-7	Yes
V_{R12}	4769	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 39.5 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.752 (Exibit 25-19)

S_R= 45.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 45.2 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 101

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 20.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9170	0.90	Level	4	0	0.980	1.00	10393
Ramp	970	0.90	Level	4	0	0.980	1.00	1099
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 2975 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8315	9000	No
V_{12}	2975	4400:All	No
V_{FO} = V_F - V_R	7216	9000	No
V_R	1099	3500	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 13.6 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.722 (Exhibit 25-19)

S_R= 45.6 mph (Exhibit 25-19)

S_0= 53.8 mph (Exhibit 25-19)

S = 50.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 102

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 45.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8690	0.90	Level	4	0	0.980	1.00	9849
Ramp	650	0.90	Level	4	0	0.980	1.00	737
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3851 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7880	9000	No
V_{12}	3851	4400:All	No
$V_{FO} = V_F - V_R$	7143	9000	No
V_R	737	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.9 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.364 (Exhibit 25-19)

S_R= 50.3 mph (Exhibit 25-19)

S_0= 56.4 mph (Exhibit 25-19)

S = 53.2 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 103

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.0 mph S_{FR} = 25.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8820	0.90	Level	4	0	0.980	1.00	9996
Ramp	750	0.90	Level	4	0	0.980	1.00	850
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3966 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7997	9520	No
V_{12}	3966	4400:All	No
V_{FO} = V_F - V_R	7147	9520	No
V_R	850	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.4 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.635 (Exhibit 25-19)

S_R= 51.5 mph (Exhibit 25-19)

S_0= 70.6 mph (Exhibit 25-19)

S = 59.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 104

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 20.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8480	0.90	Level	4	0	0.980	1.00	9611
Ramp	530	0.90	Level	4	0	0.980	1.00	601
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3691 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7689	9000	No
V_{12}	3691	4400:All	No
V_{FO} = V_F - V_R	7088	9000	No
V_R	601	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.0 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.677 (Exhibit 25-19)

S_R= 46.2 mph (Exhibit 25-19)

S_0= 56.4 mph (Exhibit 25-19)

S = 51.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 105

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 65.3 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9310	0.90	Level	4	0	0.980	1.00	10551
Ramp	1420	0.90	Level	4	0	0.980	1.00	1609
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.260 using Equation 0

V_{12} = 3385 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	8441	9412	No
V_{12}	3385	4400:All	No
$V_{FO} = V_F - V_R$	6832	9412	No
V_R	1609	3800	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.2 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.573 (Exhibit 25-19)

S_R= 52.0 mph (Exhibit 25-19)

S_0= 65.7 mph (Exhibit 25-19)

S = 59.4 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 106

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 20.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9200	0.90	Level	4	0	0.980	1.00	10427
Ramp	650	0.90	Level	4	0	0.980	1.00	737
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4053 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	8342	9000	No
V_{12}	4053	4400:All	No
$V_{FO} = V_F - V_R$	7605	9000	No
V_R	737	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.7 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.689 (Exhibit 25-19)

S_R= 46.0 mph (Exhibit 25-19)

S_0= 55.9 mph (Exhibit 25-19)

S = 50.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Studebaker Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 107

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 68.5 mph S_{FR} = 25.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9150	0.90	Level	4	0	0.980	1.00	10370
Ramp	420	0.90	Level	4	0	0.980	1.00	476
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3886 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8296	9540	No
V_{12}	3886	4400:All	No
V_{FO} = V_F - V_R	7820	9540	No
V_R	476	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.4 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.601 (Exhibit 25-19)

S_R= 52.6 mph (Exhibit 25-19)

S_0= 70.4 mph (Exhibit 25-19)

S = 60.8 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	7th Street OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 108

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 68.9 mph S_{FR} = 45.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	7480	0.90	Level	4	0	0.980	1.00	8477
Ramp	90	0.90	Level	4	0	0.980	1.00	102
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3753 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8477	9556	No
V_{12}	3753	4400:All	No
V_{FO} = V_F - V_R	8375	9556	No
V_R	102	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.7 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.307 (Exhibit 25-19)

S_R= 60.6 mph (Exhibit 25-19)

S_0= 70.3 mph (Exhibit 25-19)

S = 65.7 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 109

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 67.6 mph S_{FR} = 25.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8400	0.90	Level	5	0	0.976	1.00	9567
Ramp	1230	0.90	Level	5	0	0.976	1.00	1401
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3027 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7654	9503	No
V_{12}	3027	4400:All	No
V_{FO} = V_F - V_R	6253	9503	No
V_R	1401	3500	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 14.1 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.684 (Exhibit 25-19)

S_R= 50.1 mph (Exhibit 25-19)

S_0= 69.0 mph (Exhibit 25-19)

S = 60.1 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 110

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4200	0.90	Level	5	0	0.976	1.00	4783
Ramp	810	0.90	Level	5	0	0.976	1.00	923
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 4783 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	4783	4500	Yes
V_{12}	4783	4400:All	Yes
$V_{FO} = V_F - V_R$	3860	4500	No
V_R	923	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.4 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.576 (Exhibit 25-19)

S_R= 47.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 47.5 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 111

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 61.6 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8840	0.90	Level	4	0	0.980	1.00	10019
Ramp	470	0.90	Level	4	0	0.980	1.00	533
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.247 using Equation 4

V_{12}= 1855 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8052	See Exhibit 25-7	No
V_{R12}	2388	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.0 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.342 (Exibit 25-19)

S_R= 54.9 mph (Exhibit 25-19)

S_0= 51.9 mph (Exhibit 25-19)

S= 52.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 112

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8210	0.90	Level	4	0	0.980	1.00	9305
Ramp	800	0.90	Level	4	0	0.980	1.00	907
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.582 using Equation 4

V_{12}= 5418 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10212	See Exhibit 25-7	Yes
V_{R12}	6325	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 45.0 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 2.394 (Exibit 25-19)

S_R= 23.9 mph (Exhibit 25-19)

S_0= 49.8 mph (Exhibit 25-19)

S= 29.8 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 113

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7950	0.90	Level	4	0	0.980	1.00	9010
Ramp	1220	0.90	Level	4	0	0.980	1.00	1383
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.209 using Equation 0

V_{12}= 1883 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10393	See Exhibit 25-7	Yes
V_{R12}	3266	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 14.0 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.241 (Exibit 25-19)

S_R= 51.9 mph (Exhibit 25-19)

S_0= 40.9 mph (Exhibit 25-19)

S= 43.8 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 114

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 66.7 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7890	0.90	Level	4	0	0.980	1.00	8942
Ramp	930	0.90	Level	4	0	0.980	1.00	1054
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.405 using Equation 4

V_{12}= 3618 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9996	See Exhibit 25-7	Yes
V_{R12}	4672	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 35.2 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.668 (Exibit 25-19)

S_R= 50.2 mph (Exhibit 25-19)

S_0= 58.0 mph (Exhibit 25-19)

S= 54.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 115

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8040	0.90	Level	4	0	0.980	1.00	9112
Ramp	440	0.90	Level	4	0	0.980	1.00	499
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.442 using Equation 4

V_{12}= 4029 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9611	See Exhibit 25-7	Yes
V_{R12}	4528	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 34.9 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.619 (Exibit 25-19)

S_R= 47.0 mph (Exhibit 25-19)

S_0= 47.0 mph (Exhibit 25-19)

S= 47.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 116

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	VD = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8540	0.90	Level	4	0	0.980	1.00	9679
Ramp	150	0.90	Level	4	0	0.980	1.00	170
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.770 using Equation 4

V_{12}= 7453 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9849	See Exhibit 25-7	Yes
V_{R12}	7623	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 53.6 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 8.169 (Exibit 25-19)

S_R= -51.2 mph (Exhibit 25-19)

S_0= 52.8 mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 117

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 68.2 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8730	0.90	Level	4	0	0.980	1.00	9894
Ramp	420	0.90	Level	4	0	0.980	1.00	476
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.254 using Equation 4

V_{12}= 2512 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10370	See Exhibit 25-7	Yes
V_{R12}	2988	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.7 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.377 (Exibit 25-19)

S_R= 58.3 mph (Exhibit 25-19)

S_0= 53.3 mph (Exhibit 25-19)

S= 54.7 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Studebaker ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 118

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8850	0.90	Level	4	0	0.980	1.00	10030
Ramp	350	0.90	Level	4	0	0.980	1.00	397
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.742 using Equation 4

V_{12}= 7438 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10427	See Exhibit 25-7	Yes
V_{R12}	7835	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 55.1 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 10.052 (Exibit 25-19)

S_R= -75.7 mph (Exhibit 25-19)

S_0= 52.1 mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 119

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 59.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	5000	0.90	Level	5	0	0.976	1.00	5694
Ramp	770	0.90	Level	5	0	0.976	1.00	877
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.236 using Equation 4

V_{12}= 1342 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6571	See Exhibit 25-7	No
V_{R12}	2219	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.9 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.329 (Exibit 25-19)

S_R= 53.9 mph (Exhibit 25-19)

S_0= 53.8 mph (Exhibit 25-19)

S= 53.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

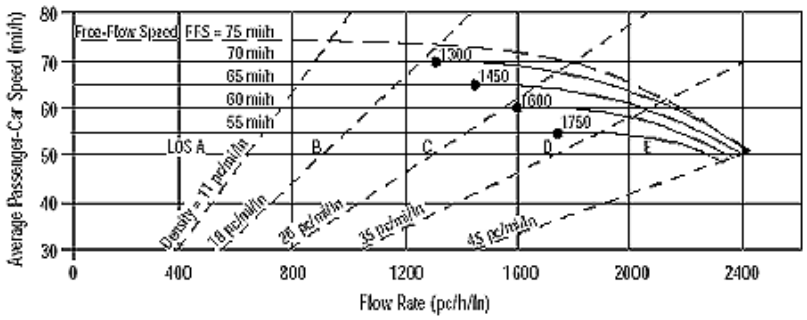
S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

PM Peak Hour

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	To Lakewood Blvd off ramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 1

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10030 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2273	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 2

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10030	0.90	Level	4	0	0.980	1.00	11367
Ramp	1380	0.90	Level	4	0	0.980	1.00	1564
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3522 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9094	9000	Yes
V_{12}	3522	4400:All	No
V_{FO} = V_F - V_R	7530	9000	No
V_R	1564	3800	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.1 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.634 (Exhibit 25-19)

S_R= 46.8 mph (Exhibit 25-19)

S_0= 53.4 mph (Exhibit 25-19)

S = 50.6 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Lakewood on - Willow St off
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	930	Weaving ratio, R	0.41
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	350	0.90	4	0	1.5	1.2	0.980	1.00	396
Vw2	510	0.90	4	0	1.5	1.2	0.980	1.00	578
Vw				974	Vnw				0
V									974

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.74	0.59
Weaving and non-weaving speeds, Si (mi/h)			21.68	30.70

Number of lanes required for unconstrained operation, Nw 1.74
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	21.68
Weaving segment density, D (pc/mi/ln)	22.47
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 8

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8650	0.90	Level	4	0	0.980	1.00	9803
Ramp	370	0.90	Level	4	0	0.980	1.00	419
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.548 using Equation 4

V_{12}= 5369 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10222	See Exhibit 25-7	Yes
V_{R12}	5788	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 42.9 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.510 (Exibit 25-19)

S_R= 35.4 mph (Exhibit 25-19)

S_0= 48.8 mph (Exhibit 25-19)

S= 40.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Willow ONR - L Coyotes OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	41	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.25
Weaving seg length, L (ft)	1200	Weaving ratio, R	0.23
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	7186	0.90	4	0	1.5	1.2	0.980	1.00	8144
Vo2	96	0.90	4	0	1.5	1.2	0.980	1.00	108
Vw1	1824	0.90	4	0	1.5	1.2	0.980	1.00	2067
Vw2	544	0.90	4	0	1.5	1.2	0.980	1.00	616
Vw				2683	Vnw				8252
V									10935

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			3.39	0.52
Weaving and non-weaving speeds, Si (mi/h)			22.06	35.42

Number of lanes required for unconstrained operation, Nw 2.04
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	30.84
Weaving segment density, D (pc/mi/ln)	70.92
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	9008
Capacity as a 15-minute flow rate, c (veh/h)	8831
Capacity as a full-hour volume, c_h (veh/h)	7948

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - BellFl OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	650	Weaving ratio, R	0.21
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	150	0.90	4	0	1.5	1.2	0.980	1.00	170
Vw2	40	0.90	4	0	1.5	1.2	0.980	1.00	45
Vw				215	Vnw				0
V									215

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			0.84	0.11
Weaving and non-weaving speeds, Si (mi/h)			28.56	37.55

Number of lanes required for unconstrained operation, Nw 1.45
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	28.56
Weaving segment density, D (pc/mi/ln)	3.76
Level of service, LOS	A
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - Woodruff OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	39	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.22
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.29
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	7141	0.90	4	0	1.5	1.2	0.980	1.00	8093
Vo2	31	0.90	4	0	1.5	1.2	0.980	1.00	35
Vw1	589	0.90	4	0	1.5	1.2	0.980	1.00	667
Vw2	1429	0.90	4	0	1.5	1.2	0.980	1.00	1619
Vw				2286	Vnw				8128
V									10414

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			3.31	0.48
Weaving and non-weaving speeds, Si (mi/h)			21.73	34.63

Number of lanes required for unconstrained operation, Nw 1.89
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	30.64
Weaving segment density, D (pc/mi/ln)	67.98
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	8904
Capacity as a 15-minute flow rate, c (veh/h)	8729
Capacity as a full-hour volume, c_h (veh/h)	7856

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 22

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8570	0.90	Level	4	0	0.980	1.00	9713
Ramp	350	0.90	Level	4	0	0.980	1.00	397
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.232 using Equation 4

V_{12}= 2252 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10110	See Exhibit 25-7	Yes
V_{R12}	2649	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.7 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.362 (Exibit 25-19)

S_R= 50.3 mph (Exhibit 25-19)

S_0= 39.9 mph (Exhibit 25-19)

S= 42.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

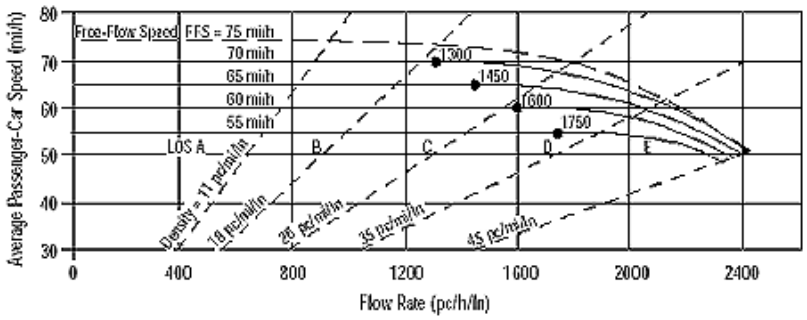
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Woodruff ONR to Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 23

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8920 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2527	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB
Weaving Seg Location	Stearns ONR to Studebaker OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	52	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.08
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.36
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	8635	0.90	4	0	1.5	1.2	0.980	1.00	9786
Vo2	15	0.90	4	0	1.5	1.2	0.980	1.00	17
Vw1	285	0.90	4	0	1.5	1.2	0.980	1.00	323
Vw2	515	0.90	4	0	1.5	1.2	0.980	1.00	583
Vw				906	Vnw				9803
V									10709

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.62	0.21		
Weaving and non-weaving speeds, Si (mi/h)	40.95	49.70		

Number of lanes required for unconstrained operation, Nw 1.00
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

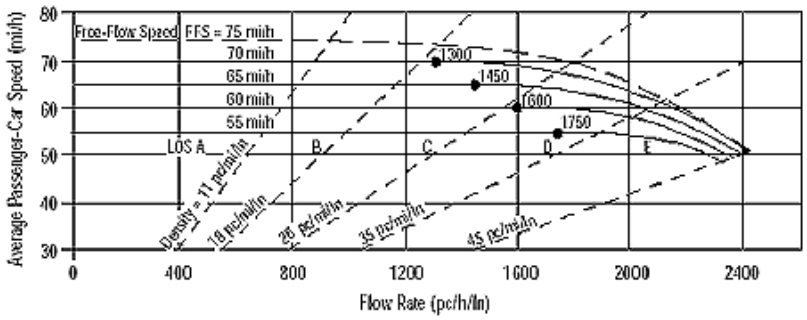
Weaving segment speed, S (mi/h)	48.82
Weaving segment density, D (pc/mi/ln)	43.87
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10836
Capacity as a 15-minute flow rate, c (veh/h)	10624
Capacity as a full-hour volume, c_h (veh/h)	9562

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Studebaker OFR to 605NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 25

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9150 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2074	pc/h/ln	Design LOS		
S	53.4	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	38.9	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 26

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 50.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9150	0.90	Level	4	0	0.980	1.00	10370
Ramp	980	0.90	Level	4	0	0.980	1.00	1111
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 2979 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8296	9000	No
V_{12}	2979	4400:All	No
V_{FO} = V_F - V_R	7185	9000	No
V_R	1111	4100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 3.8 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.333 (Exhibit 25-19)

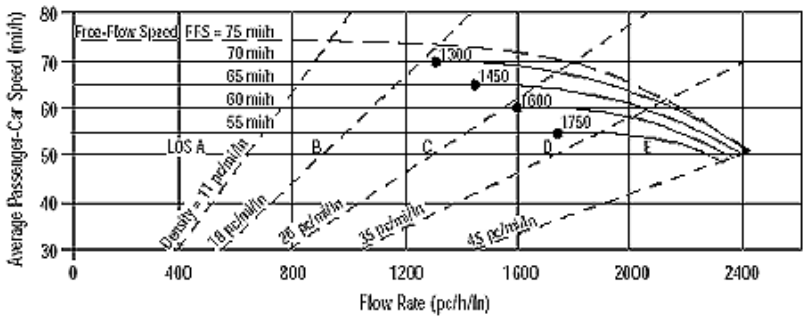
S_R= 50.7 mph (Exhibit 25-19)

S_0= 53.9 mph (Exhibit 25-19)

S = 52.7 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 27

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8160 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

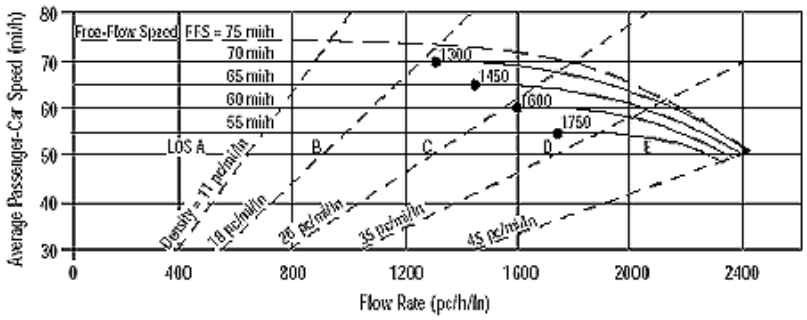
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2312	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB OFR to I-605 Sb ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 29

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8040 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2278	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 30

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8040	0.90	Level	4	0	0.980	1.00	9112
Ramp	3370	0.90	Level	4	0	0.980	1.00	3819
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.209 using Equation 0

V_{12}= 1904 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	12931	See Exhibit 25-7	Yes
V_{R12}	5723	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 30.2 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 1.311 (Exibit 25-19)

S_R= 38.0 mph (Exhibit 25-19)

S_0= 40.6 mph (Exhibit 25-19)

S= 39.4 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

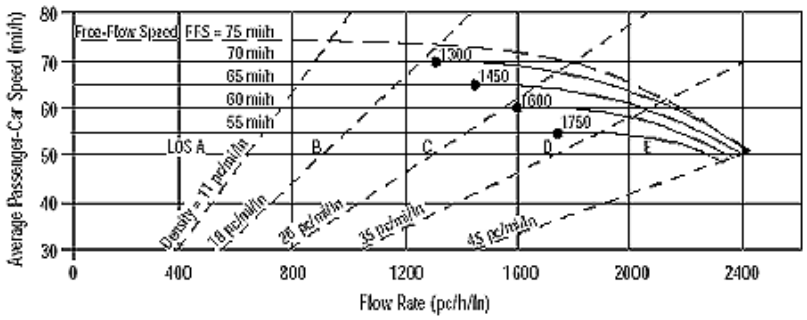
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB ONR to 7th St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 31

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	11410 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

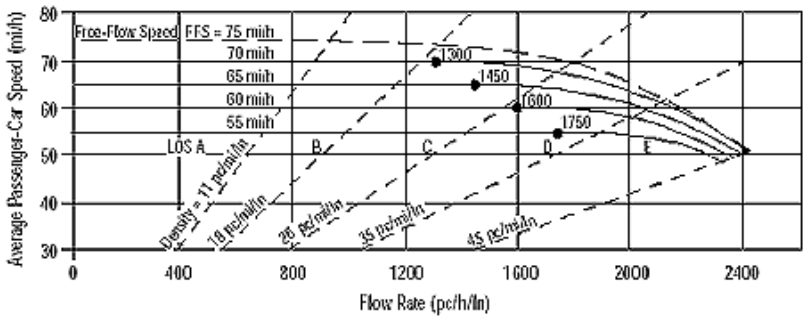
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2586	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	to I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 32

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	13000 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2947	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 33

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 63.8 mph S_{FR} = 50.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	13000	0.90	Level	4	0	0.980	1.00	14733
Ramp	4300	0.90	Level	4	0	0.980	1.00	4873
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 6671 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	11787	9351	Yes
V_{12}	6671	4400:All	Yes
V_{FO} = V_F - V_R	6914	9351	No
V_R	4873	4100	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.4 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.672 (Exhibit 25-19)

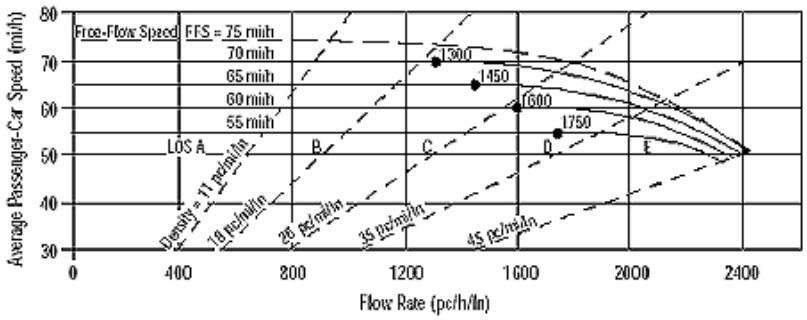
S_R= 49.2 mph (Exhibit 25-19)

S_0= 63.9 mph (Exhibit 25-19)

S = 54.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 Sb OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 34

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8700 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2465	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB/NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 35

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8700	0.90	Level	4	0	0.980	1.00	9860
Ramp	1440	0.90	Level	4	0	0.980	1.00	1632
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.396 using Equation 4

V_{12}= 3905 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11492	See Exhibit 25-7	Yes
V_{R12}	5537	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 40.4 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.227 (Exibit 25-19)

S_R= 37.0 mph (Exhibit 25-19)

S_0= 53.2 mph (Exhibit 25-19)

S= 44.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

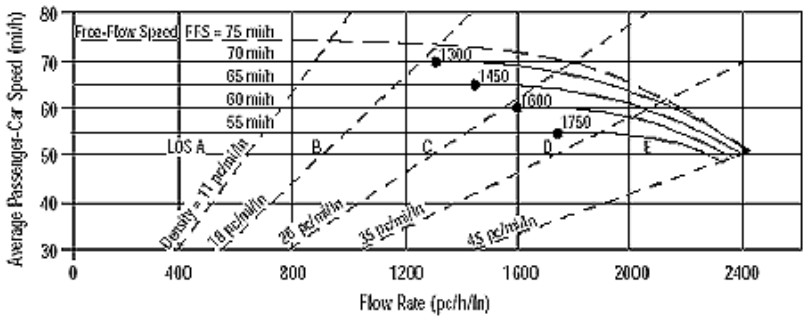
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB/SB ONR to Studeba ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 36

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10130 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2870	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Studeb ONR - Palo Verde OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.09
Weaving seg length, L (ft)	1700	Weaving ratio, R	0.25
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	38	0.90	4	0	1.5	1.2	0.980	1.00	43
Vo2	9418	0.90	4	0	1.5	1.2	0.980	1.00	10673
Vw1	232	0.90	4	0	1.5	1.2	0.980	1.00	262
Vw2	712	0.90	4	0	1.5	1.2	0.980	1.00	806
Vw				1068	Vnw				10716
V									11784

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.88	0.45		
Weaving and non-weaving speeds, Si (mi/h)	44.21	52.86		

Number of lanes required for unconstrained operation, Nw 1.02
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	51.94
Weaving segment density, D (pc/mi/ln)	45.38
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	11220
Capacity as a 15-minute flow rate, c (veh/h)	11000
Capacity as a full-hour volume, c_h (veh/h)	9900

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Palo Verde ONR to Woodruff OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	66	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.06
Weaving seg length, L (ft)	1750	Weaving ratio, R	0.44
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	fHV	fp	v
Vo1	18	0.90	4	0	1.5	1.2	0.980	1.00	20
Vo2	9328	0.90	4	0	1.5	1.2	0.980	1.00	10571
Vw1	262	0.90	4	0	1.5	1.2	0.980	1.00	296
Vw2	332	0.90	4	0	1.5	1.2	0.980	1.00	376
Vw				672	Vnw				10591
V									11263

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.77	0.37		
Weaving and non-weaving speeds, Si (mi/h)	46.55	55.81		

Number of lanes required for unconstrained operation, Nw 0.79
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	55.15
Weaving segment density, D (pc/mi/ln)	40.84
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	11339
Capacity as a 15-minute flow rate, c (veh/h)	11117
Capacity as a full-hour volume, c_h (veh/h)	10005

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Woodruff ONR to Bellflower OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.08
Weaving seg length, L (ft)	890	Weaving ratio, R	0.34
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	29	0.90	4	0	1.5	1.2	0.980	1.00	32
Vo2	9039	0.90	4	0	1.5	1.2	0.980	1.00	10244
Vw1	281	0.90	4	0	1.5	1.2	0.980	1.00	318
Vw2	541	0.90	4	0	1.5	1.2	0.980	1.00	613
Vw				931	Vnw				10276
V									11207

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.39	0.67		
Weaving and non-weaving speeds, Si (mi/h)	38.02	47.93		

Number of lanes required for unconstrained operation, Nw 0.89
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	46.91
Weaving segment density, D (pc/mi/ln)	47.78
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10148
Capacity as a 15-minute flow rate, c (veh/h)	9949
Capacity as a full-hour volume, c_h (veh/h)	8954

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Bellflower ONR to Lakewood OFR
Jurisdiction	
Analysis Year	2020 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	66	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.17
Weaving seg length, L (ft)	1300	Weaving ratio, R	0.46
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	fHV	fp	v
Vo1	48	0.90	4	0	1.5	1.2	0.980	1.00	54
Vo2	8418	0.90	4	0	1.5	1.2	0.980	1.00	9540
Vw1	762	0.90	4	0	1.5	1.2	0.980	1.00	863
Vw2	912	0.90	4	0	1.5	1.2	0.980	1.00	1033
Vw				1896	Vnw				9594
V									11490

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.70	0.32		
Weaving and non-weaving speeds, Si (mi/h)	47.94	57.47		

Number of lanes required for unconstrained operation, Nw 1.05
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	55.64
Weaving segment density, D (pc/mi/ln)	41.30
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	11557
Capacity as a 15-minute flow rate, c (veh/h)	11330
Capacity as a full-hour volume, c_h (veh/h)	10197

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 46

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 65.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9780	0.90	Level	4	0	0.980	1.00	11084
Ramp	280	0.90	Level	4	0	0.980	1.00	317
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.337 using Equation 4

V_{12}= 2897 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8901	See Exhibit 25-7	No
V_{R12}	3214	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 27.3 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.383 (Exibit 25-19)

S_R= 56.7 mph (Exhibit 25-19)

S_0= 56.0 mph (Exhibit 25-19)

S= 56.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

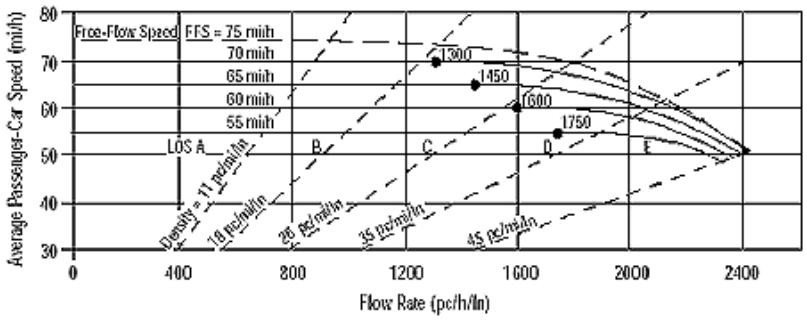
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	Lakewood ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 47

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10060 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	60.9	mi/h	FFS	60.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

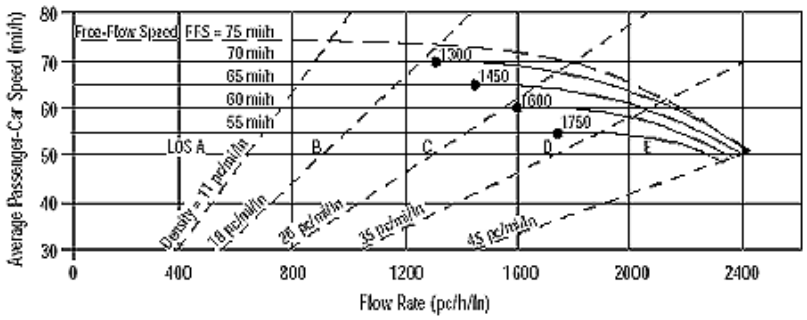
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2280	pc/h/ln	Design LOS		
S	52.3	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	43.6	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	to I-40 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 48

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3530 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1981	pc/h/ln	Design LOS		
S	65.2	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	30.4	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 49

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	3530	0.90	Level	5	0	0.976	1.00	4020
Ramp	2910	0.90	Level	5	0	0.976	1.00	3314
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 4020 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	4020	4500	No
V_{12}	4020	4400:All	No
$V_{FO} = V_F - V_R$	706	4500	No
V_R	3314	3800	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 19.9 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.726 (Exhibit 25-19)

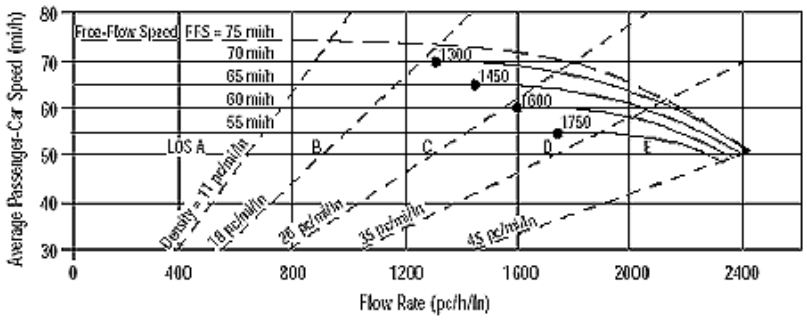
S_R= 45.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 45.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 50

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	380 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	60.0	mi/h	FFS	60.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	216	pc/h/ln	Design LOS		
S	60.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	3.6	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 51

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 62.8 mph S_{FR} = 50.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	380	0.90	Level	5	0	0.976	1.00	433
Ramp	420	0.90	Level	5	0	0.976	1.00	478
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 433 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	433	4655	No
V_{12}	433	4400:All	No
$V_{FO} = V_F - V_R$	-45	4655	No
V_R	478	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -1.9 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.276 (Exhibit 25-19)

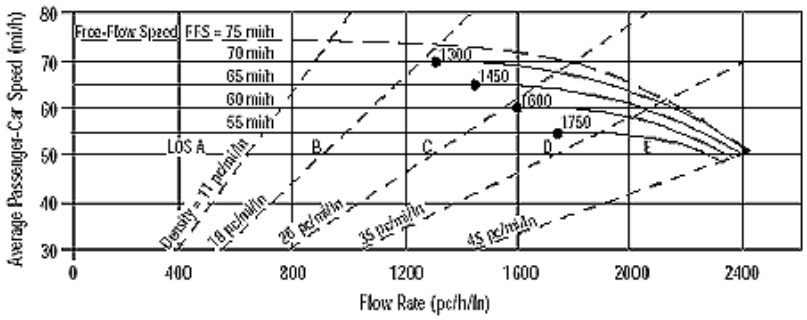
S_R= 57.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 52

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	890 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	62.8	mi/h	FFS	62.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

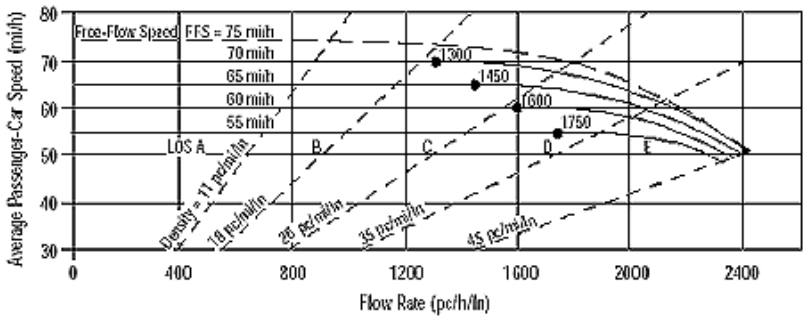
LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	507	pc/h/ln	Design LOS		
S	62.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	8.1	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB ONR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 54

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4300 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	62.8	mi/h	FFS	62.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

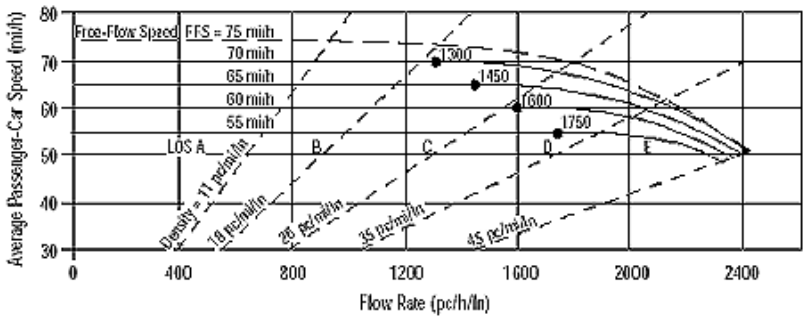
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1224	pc/h/ln	Design LOS		
S	62.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	19.5	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB ONR to Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 56

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5680 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	62.8	mi/h	FFS	62.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1294	pc/h/ln	Design LOS		
S	62.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	20.6	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 57

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 62.8 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5680	0.90	Level	5	0	0.976	1.00	6469
Ramp	1630	0.90	Level	5	0	0.976	1.00	1856
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3444 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	5499	9311	No
V_{12}	3444	4400:All	No
V_{FO} = V_F - V_R	3643	9311	No
V_R	1856	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 5.1 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.530 (Exhibit 25-19)

S_R= 51.8 mph (Exhibit 25-19)

S_0= 68.8 mph (Exhibit 25-19)

S = 57.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 59

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 67.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4050	0.90	Level	5	0	0.976	1.00	4613
Ramp	1400	0.90	Level	5	0	0.976	1.00	1594
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.202 using Equation 4

V_{12}= 931 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6207	See Exhibit 25-7	No
V_{R12}	2525	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.8 (pc/ m/ln)

LOS = C (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.329 (Exibit 25-19)

S_R= 59.3 mph (Exhibit 25-19)

S_0= 63.0 mph (Exhibit 25-19)

S= 61.4 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

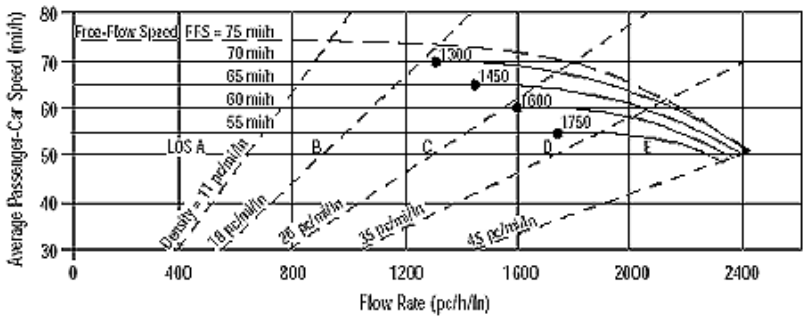
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Willow St ONR to Cerritos ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 60

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5450 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1552	pc/h/ln	Design LOS		
S	69.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	22.3	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Cerritos Ave ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 61

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 60.5 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5450	0.90	Level	5	0	0.976	1.00	6207
Ramp	1040	0.90	Level	5	0	0.976	1.00	1184
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.134 using Equation 4

V_{12}= 829 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7391	See Exhibit 25-7	No
V_{R12}	2013	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 19.4 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.336 (Exibit 25-19)

S_R= 54.3 mph (Exhibit 25-19)

S_0= 51.6 mph (Exhibit 25-19)

S= 52.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

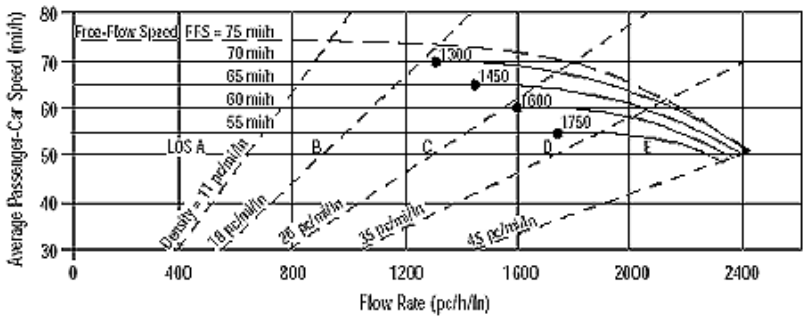
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Cerritos ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 62

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	6490 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	59.6	mi/h	FFS	59.6	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1848	pc/h/ln	Design LOS		
S	59.1	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	31.3	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 63

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 59.6 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6490	0.90	Level	5	0	0.976	1.00	7391
Ramp	980	0.90	Level	5	0	0.976	1.00	1116
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3852 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7391	9183	No
V_{12}	3852	4400:All	No
V_{FO} = V_F - V_R	6275	9183	No
V_R	1116	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.7 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.528 (Exhibit 25-19)

S_R= 50.3 mph (Exhibit 25-19)

S_0= 62.4 mph (Exhibit 25-19)

S = 55.4 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 65

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 58.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	5510	0.90	Level	5	0	0.976	1.00	6275
Ramp	540	0.90	Level	5	0	0.976	1.00	615
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.324 using Equation 4

V_{12}= 2034 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6890	See Exhibit 25-7	No
V_{R12}	2649	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.2 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.336 (Exibit 25-19)

S_R= 52.6 mph (Exhibit 25-19)

S_0= 52.2 mph (Exhibit 25-19)

S= 52.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 68

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 65.4 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	6630	0.90	Level	5	0	0.976	1.00	7551
Ramp	450	0.90	Level	5	0	0.976	1.00	513
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.233 using Equation 4

V_{12}= 1762 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8064	See Exhibit 25-7	No
V_{R12}	2275	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 21.4 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.341 (Exibit 25-19)

S_R= 57.4 mph (Exhibit 25-19)

S_0= 55.3 mph (Exhibit 25-19)

S= 55.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 70

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.5 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7080	0.90	Level	5	0	0.976	1.00	8063
Ramp	320	0.90	Level	5	0	0.976	1.00	364
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.236 using Equation 4

V_{12}= 1903 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8427	See Exhibit 25-7	No
V_{R12}	2267	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 21.7 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.345 (Exibit 25-19)

S_R= 56.1 mph (Exhibit 25-19)

S_0= 52.3 mph (Exhibit 25-19)

S= 53.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

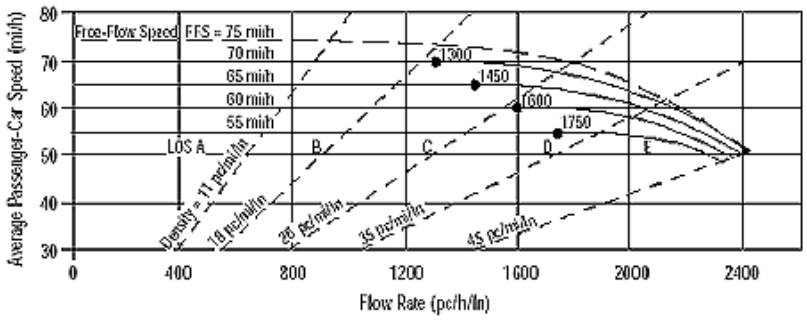
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Carson ONR to 5 lane section
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 71

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7400 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

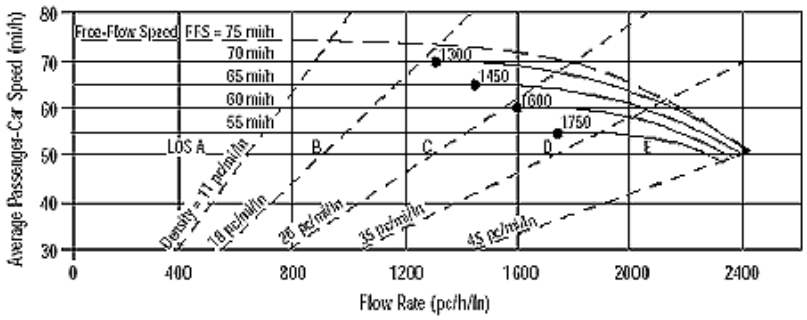
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2107	pc/h/ln	Design LOS		
S	58.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	36.0	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	5 lane section to Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 72

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7400 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1686	pc/h/ln	Design LOS		
S	63.5	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	26.5	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 73

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 63.8 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	7400	0.90	Level	5	0	0.976	1.00	8428
Ramp	1430	0.90	Level	5	0	0.976	1.00	1629
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3859 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	6743	9351	No
V_{12}	3859	4400:All	No
$V_{FO} = V_F - V_R$	5114	9351	No
V_R	1629	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.6 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.640 (Exhibit 25-19)

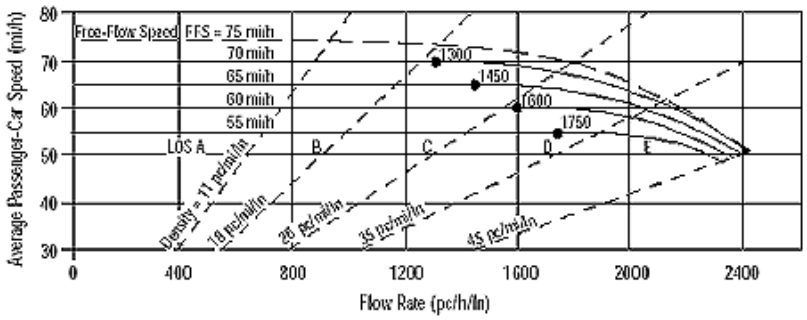
S_R= 49.9 mph (Exhibit 25-19)

S_0= 68.3 mph (Exhibit 25-19)

S = 56.4 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Spring OFR to Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 74

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5970 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1700	pc/h/ln	Design LOS		
S	68.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	24.7	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 75

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 61.4 mph S_{FR} = 30.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5970	0.90	Level	5	0	0.976	1.00	6799
Ramp	580	0.90	Level	5	0	0.976	1.00	661
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3337 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	6799	9256	No
V_{12}	3337	4400:All	No
$V_{FO} = V_F - V_R$	6138	9256	No
V_R	661	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.0 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.552 (Exhibit 25-19)

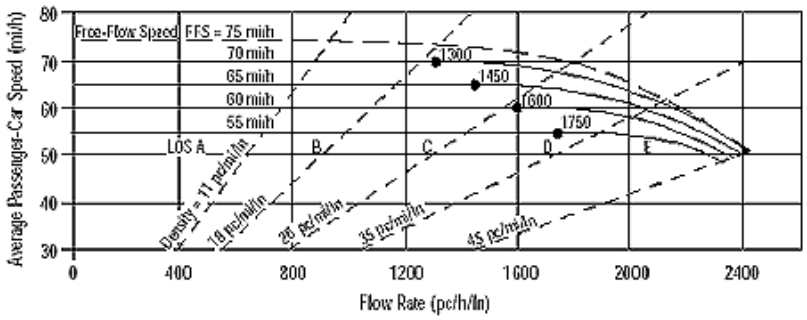
S_R= 50.7 mph (Exhibit 25-19)

S_0= 64.5 mph (Exhibit 25-19)

S = 56.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow OFR to Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 76

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5390 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	61.4	mi/h	FFS	61.4	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1535	pc/h/ln	Design LOS		
S	61.4	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	25.0	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 77

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5390	0.90	Level	5	0	0.976	1.00	6139
Ramp	1020	0.90	Level	5	0	0.976	1.00	1162
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3332 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	6139	9000	No
V_{12}	3332	4400:All	No
V_{FO} = V_F - V_R	4977	9000	No
V_R	1162	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.9 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.598 (Exhibit 25-19)

S_R= 47.2 mph (Exhibit 25-19)

S_0= 58.8 mph (Exhibit 25-19)

S = 51.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 79

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4370	0.90	Level	5	0	0.976	1.00	4977
Ramp	800	0.90	Level	5	0	0.976	1.00	911
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.391 using Equation 4

V_{12}= 1944 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	5888	See Exhibit 25-7	No
V_{R12}	2855	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 21.7 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.326 (Exibit 25-19)

S_R= 50.8 mph (Exhibit 25-19)

S_0= 51.3 mph (Exhibit 25-19)

S= 51.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

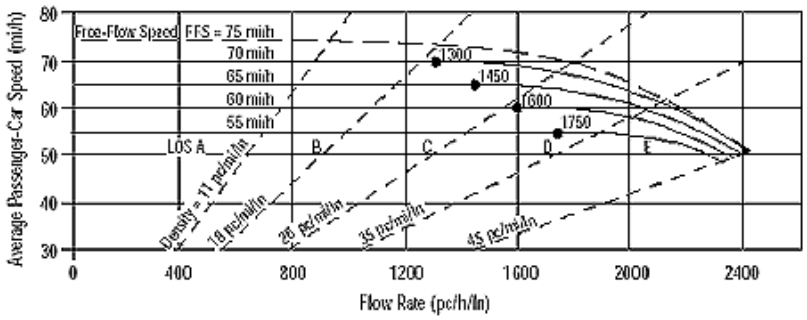
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow ONR CD to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 84

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5170 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	59.8	mi/h	FFS	59.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1472	pc/h/ln	Design LOS	
S	59.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	24.6	pc/mi/ln	S	mi/h
LOS	C		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 85

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 59.8 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5170	0.90	Level	5	0	0.976	1.00	5888
Ramp	960	0.90	Level	5	0	0.976	1.00	1093
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3184 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	5888	9191	No
V_{12}	3184	4400:All	No
V_{FO} = V_F - V_R	4795	9191	No
V_R	1093	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.2 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.331 (Exhibit 25-19)

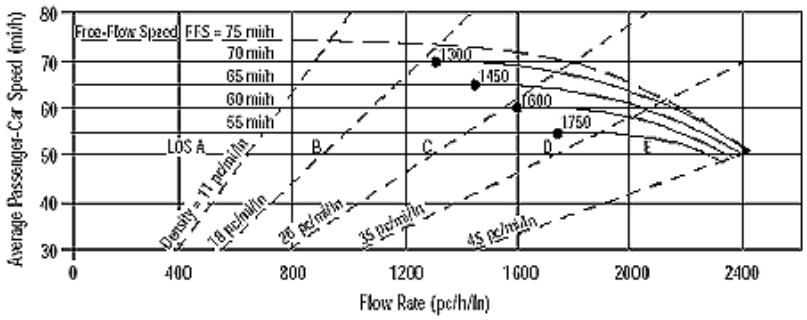
S_R= 53.9 mph (Exhibit 25-19)

S_0= 64.2 mph (Exhibit 25-19)

S = 58.2 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 86

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4210 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1199	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	17.1	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 87

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 59.8 mph S_{FR} = 59.8 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4210	0.90	Level	5	0	0.976	1.00	4795
Ramp	3370	0.90	Level	5	0	0.976	1.00	3838
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 4087 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	4795	9191	No
V_{12}	4087	4400:All	No
V_{FO} = V_F - V_R	957	9191	No
V_R	3838	4400	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -47.0 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.451 (Exhibit 25-19)

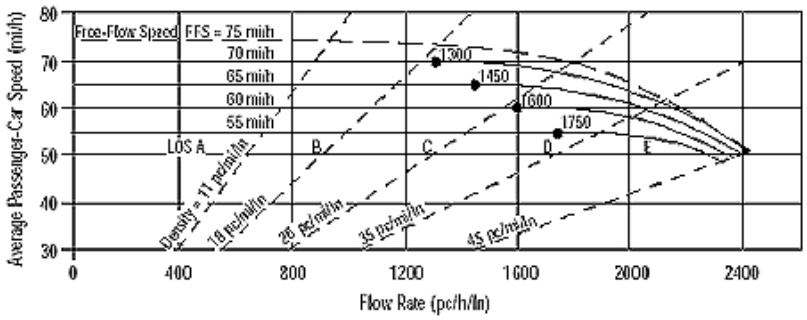
S_R= 51.8 mph (Exhibit 25-19)

S_0= 65.6 mph (Exhibit 25-19)

S = 53.4 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 88 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	1820 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	59.8	mi/h	FFS	59.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1036	pc/h/ln	Design LOS		
S	59.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	17.3	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 89 coded as 2 lanes, double volume

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 59.8 mph S_{FR} = 50.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1820	0.90	Level	5	0	0.976	1.00	2073
Ramp	120	0.90	Level	5	0	0.976	1.00	137
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2073 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2210	See Exhibit 25-7	No
V_{R12}	2210	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.5 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.322 (Exibit 25-19)

S_R= 54.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 54.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

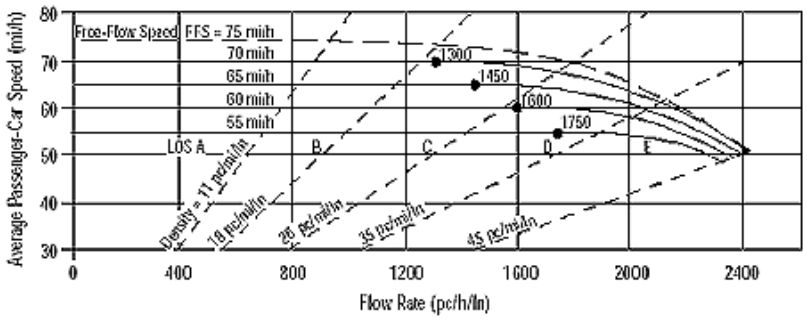
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB ONR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 90 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	2080 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	59.8	mi/h	FFS	59.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1184	pc/h/ln	Design LOS		
S	59.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	19.8	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 91 coded for ramp being the mainline

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 55.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	2850	0.90	Level	2	0	0.990	1.00	3198
Ramp	1040	0.90	Level	2	0	0.990	1.00	1167
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 3198 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4365	See Exhibit 25-7	No
V_{R12}	4365	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 37.4 (pc/ m/ln)

LOS = E (Exhibit 25-4)

Speed Estimation

M_S = 0.600 (Exibit 25-19)

S_R= 47.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 47.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

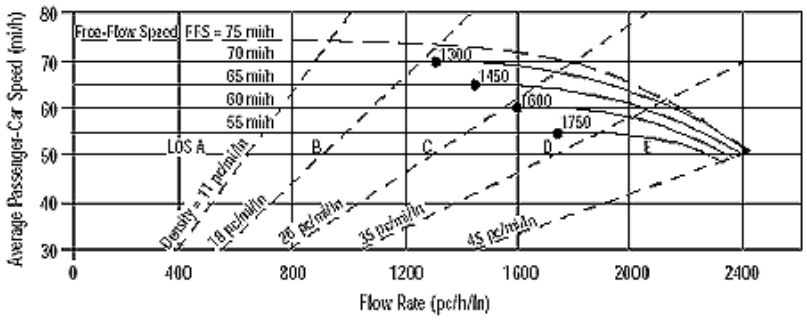
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	I-405 NB ONR to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 92

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4120 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2312	pc/h/ln	Design LOS		
S	56.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	40.9	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 95

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2530	0.90	Level	2	0	0.990	1.00	2839
Ramp	510	0.90	Level	2	0	0.990	1.00	572
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2839 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3411	See Exhibit 25-7	No
V_{R12}	3411	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.4 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.334 (Exibit 25-19)

S_R= 50.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 50.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

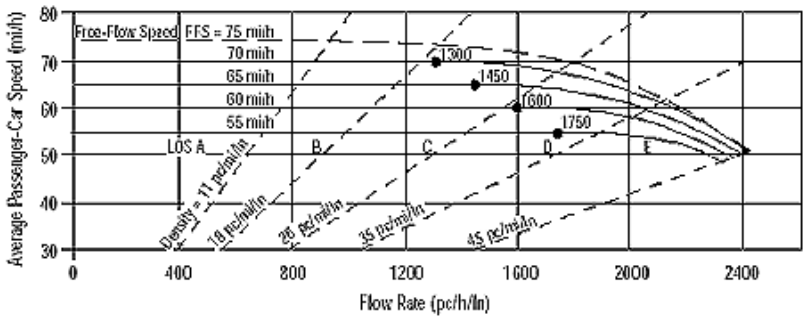
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	StudeB ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 96

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3080 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

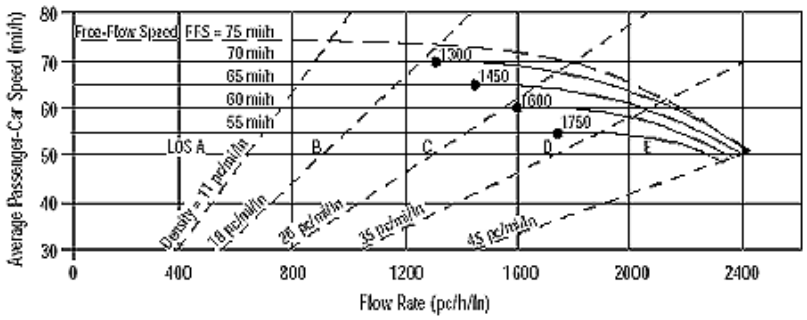
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1152	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	16.5	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St EB
Agency or Company	Parsons	From/To	to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 97

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	2770 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1036	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	14.8	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 98

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 30.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	2770	0.90	Level	5	0	0.976	1.00	3155
Ramp	730	0.90	Level	5	0	0.976	1.00	831
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 3155 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	3155	4500	No
V_{12}	3155	4400:All	No
$V_{FO} = V_F - V_R$	2324	4500	No
V_R	831	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.568 (Exhibit 25-19)

S_R= 47.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 47.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 100

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1990	0.90	Level	2	0	0.990	1.00	2233
Ramp	1430	0.90	Level	2	0	0.990	1.00	1605
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2233 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3838	See Exhibit 25-7	No
V_{R12}	3838	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 32.2 (pc/ m/ln)

LOS = D (Exhibit 25-4)

Speed Estimation

M_S = 0.474 (Exibit 25-19)

S_R= 48.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 48.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 101

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 66.2 mph S_{FR} = 20.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10130	0.90	Level	4	0	0.980	1.00	11481
Ramp	960	0.90	Level	4	0	0.980	1.00	1088
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3193 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9185	9447	No
V_{12}	3193	4400:All	No
V_{FO} = V_F - V_R	8097	9447	No
V_R	1088	3500	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 15.5 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.721 (Exhibit 25-19)

S_R= 48.8 mph (Exhibit 25-19)

S_0= 64.8 mph (Exhibit 25-19)

S = 58.2 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 102

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 65.8 mph S_{FR} = 45.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9930	0.90	Level	4	0	0.980	1.00	11254
Ramp	350	0.90	Level	4	0	0.980	1.00	397
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4150 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	9004	9432	No
V_{12}	4150	4400:All	No
$V_{FO} = V_F - V_R$	8607	9432	No
V_R	397	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 26.4 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

D_s = 0.334 (Exhibit 25-19)

S_R= 57.9 mph (Exhibit 25-19)

S_0= 66.6 mph (Exhibit 25-19)

S = 62.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 103

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 25.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9190	0.90	Level	4	0	0.980	1.00	10415
Ramp	620	0.90	Level	4	0	0.980	1.00	703
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4029 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8332	9000	No
V_{12}	4029	4400:All	No
V_{FO} = V_F - V_R	7629	9000	No
V_R	703	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.9 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.621 (Exhibit 25-19)

S_R= 46.9 mph (Exhibit 25-19)

S_0= 55.8 mph (Exhibit 25-19)

S = 51.1 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 104

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 64.7 mph S_{FR} = 20.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9900	0.90	Level	4	0	0.980	1.00	11220
Ramp	570	0.90	Level	4	0	0.980	1.00	646
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4278 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8976	9387	No
V_{12}	4278	4400:All	No
V_{FO} = V_F - V_R	8330	9387	No
V_R	646	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.0 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.681 (Exhibit 25-19)

S_R= 49.2 mph (Exhibit 25-19)

S_0= 65.7 mph (Exhibit 25-19)

S = 56.7 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 105

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9650	0.90	Level	4	0	0.980	1.00	10937
Ramp	1920	0.90	Level	4	0	0.980	1.00	2176
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3885 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8750	9000	No
V_{12}	3885	4400:All	No
V_{FO} = V_F - V_R	6574	9000	No
V_R	2176	3800	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 21.5 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.624 (Exhibit 25-19)

S_R= 46.9 mph (Exhibit 25-19)

S_0= 54.8 mph (Exhibit 25-19)

S = 51.0 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 106

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 65.0 mph S_{FR} = 20.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10410	0.90	Level	4	0	0.980	1.00	11798
Ramp	750	0.90	Level	4	0	0.980	1.00	850
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4595 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9439	9400	Yes
V_{12}	4595	4400:All	Yes
V_{FO} = V_F - V_R	8589	9400	No
V_R	850	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.4 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.700 (Exhibit 25-19)

S_R= 48.9 mph (Exhibit 25-19)

S_0= 65.8 mph (Exhibit 25-19)

S = 56.3 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Studebaker Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 107

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 25.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9450	0.90	Level	4	0	0.980	1.00	10710
Ramp	300	0.90	Level	4	0	0.980	1.00	340
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3927 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8568	9000	No
V_{12}	3927	4400:All	No
V_{FO} = V_F - V_R	8228	9000	No
V_R	340	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.8 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.589 (Exhibit 25-19)

S_R= 47.3 mph (Exhibit 25-19)

S_0= 55.2 mph (Exhibit 25-19)

S = 51.3 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	7th Street OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 108

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 45.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8160	0.90	Level	4	0	0.980	1.00	9248
Ramp	120	0.90	Level	4	0	0.980	1.00	136
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4109 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9248	9000	Yes
V_{12}	4109	4400:All	No
V_{FO} = V_F - V_R	9112	9000	Yes
V_R	136	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.8 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.310 (Exhibit 25-19)

S_R= 51.0 mph (Exhibit 25-19)

S_0= 54.2 mph (Exhibit 25-19)

S = 52.7 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 109

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 65.4 mph S_{FR} = 25.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8100	0.90	Level	5	0	0.976	1.00	9225
Ramp	1480	0.90	Level	5	0	0.976	1.00	1686
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3166 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7380	9416	No
V_{12}	3166	4400:All	No
V_{FO} = V_F - V_R	5694	9416	No
V_R	1686	3500	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 15.3 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.710 (Exhibit 25-19)

S_R= 48.8 mph (Exhibit 25-19)

S_0= 67.4 mph (Exhibit 25-19)

S = 57.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 110

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4120	0.90	Level	5	0	0.976	1.00	4692
Ramp	1460	0.90	Level	5	0	0.976	1.00	1663
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 4692 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	4692	4500	Yes
V_{12}	4692	4400:All	Yes
$V_{FO} = V_F - V_R$	3029	4500	No
V_R	1663	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 42.6 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.643 (Exhibit 25-19)

S_R= 46.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 46.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 111

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9010	0.90	Level	4	0	0.980	1.00	10211
Ramp	640	0.90	Level	4	0	0.980	1.00	725
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.223 using Equation 4

V_{12}= 1718 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8436	See Exhibit 25-7	No
V_{R12}	2443	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.3 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.345 (Exibit 25-19)

S_R= 50.5 mph (Exhibit 25-19)

S_0= 44.3 mph (Exhibit 25-19)

S= 45.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 112

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.2 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9170	0.90	Level	4	0	0.980	1.00	10393
Ramp	610	0.90	Level	4	0	0.980	1.00	691
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.609 using Equation 4

V_{12}= 6332 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11084	See Exhibit 25-7	Yes
V_{R12}	7023	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 50.5 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 4.592 (Exibit 25-19)

S_R= -44.9 mph (Exhibit 25-19)

S_0= 60.7 mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 113

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.4 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9330	0.90	Level	4	0	0.980	1.00	10574
Ramp	810	0.90	Level	4	0	0.980	1.00	918
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.209 using Equation 0

V_{12}= 2210 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11492	See Exhibit 25-7	Yes
V_{R12}	3128	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 13.1 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.228 (Exibit 25-19)

S_R= 58.5 mph (Exhibit 25-19)

S_0= 45.6 mph (Exhibit 25-19)

S= 48.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 114

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7730	0.90	Level	4	0	0.980	1.00	8761
Ramp	1460	0.90	Level	4	0	0.980	1.00	1655
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.329 using Equation 4

V_{12}= 2887 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10416	See Exhibit 25-7	Yes
V_{R12}	4542	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 33.9 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.617 (Exibit 25-19)

S_R= 47.0 mph (Exhibit 25-19)

S_0= 44.6 mph (Exhibit 25-19)

S= 45.6 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 115

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 66.0 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9580	0.90	Level	4	0	0.980	1.00	10857
Ramp	310	0.90	Level	4	0	0.980	1.00	351
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.461 using Equation 4

V_{12}= 5001 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11208	See Exhibit 25-7	Yes
V_{R12}	5352	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 41.4 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.081 (Exibit 25-19)

S_R= 40.1 mph (Exhibit 25-19)

S_0= 55.7 mph (Exhibit 25-19)

S= 46.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 116

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 65.6 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9660	0.90	Level	4	0	0.980	1.00	10948
Ramp	280	0.90	Level	4	0	0.980	1.00	317
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.752 using Equation 4

V_{12}= 8229 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11265	See Exhibit 25-7	Yes
V_{R12}	8546	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 60.7 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 20.265 (Exibit 25-19)

S_R= -412.7 mph (Exhibit 25-19)

S_0= 62.5 mph (Exhibit 25-19)

S= 494.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 117

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8920	0.90	Level	4	0	0.980	1.00	10109
Ramp	530	0.90	Level	4	0	0.980	1.00	601
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.238 using Equation 4

V_{12}= 2408 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10710	See Exhibit 25-7	Yes
V_{R12}	3009	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.8 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.379 (Exibit 25-19)

S_R= 50.1 mph (Exhibit 25-19)

S_0= 39.2 mph (Exhibit 25-19)

S= 41.7 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Studebaker ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 118

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	10130	0.90	Level	4	0	0.980	1.00	11481
Ramp	270	0.90	Level	4	0	0.980	1.00	306
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.753 using Equation 4

V_{12}= 8645 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11787	See Exhibit 25-7	Yes
V_{R12}	8951	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 63.9 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 30.286 (Exibit 25-19)

S_R= -596.4 mph (Exhibit 25-19)

S_0= 60.5 mph (Exhibit 25-19)

S= 369.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2020 Alt 2

Project Description Segment ID 119

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 57.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	6060	0.90	Level	5	0	0.976	1.00	6902
Ramp	690	0.90	Level	5	0	0.976	1.00	786
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.247 using Equation 4

V_{12}= 1705 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7688	See Exhibit 25-7	No
V_{R12}	2491	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.0 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.340 (Exibit 25-19)

S_R= 51.9 mph (Exhibit 25-19)

S_0= 48.7 mph (Exhibit 25-19)

S= 49.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

This page intentionally left blank.

Appendix B2

Year 2040 Alternative 2
Freeway Level of Service (LOS) Worksheets

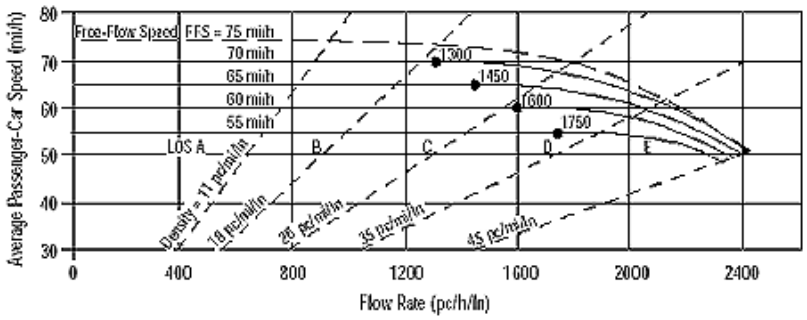
This page intentionally left blank.

2040 Alternative 2

Freeway Mainline, Ramps, and Ramp-Freeway Junctions and Weaving Level of Service Analysis Worksheets

AM Peak Hour

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	To Lakewood Blvd off ramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 1

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10440 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	72.6	mi/h	FFS	72.6	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2366	pc/h/ln	Design LOS		
S	54.7	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	43.2	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 2

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 70.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10440	0.90	Level	4	0	0.980	1.00	11832
Ramp	1210	0.90	Level	4	0	0.980	1.00	1371
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.260 using Equation 0

V_{12} = 3476 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	9466	9600	No
V_{12}	3476	4400:All	No
$V_{FO} = V_F - V_R$	8095	9600	No
V_R	1371	3800	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 19.7 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.616 (Exhibit 25-19)

S_R= 52.7 mph (Exhibit 25-19)

S_0= 69.0 mph (Exhibit 25-19)

S = 62.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Lakewood on - Willow St off
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	930	Weaving ratio, R	0.48
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	340	0.90	4	0	1.5	1.2	0.980	1.00	385
Vw2	320	0.90	4	0	1.5	1.2	0.980	1.00	362
Vw				747	Vnw				0
V									747

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.12	0.42
Weaving and non-weaving speeds, Si (mi/h)			23.01	32.61

Number of lanes required for unconstrained operation, Nw 1.70
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	23.01
Weaving segment density, D (pc/mi/ln)	16.23
Level of service, LOS	B
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 8

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 69.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9230	0.90	Level	4	0	0.980	1.00	10461
Ramp	330	0.90	Level	4	0	0.980	1.00	374
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.553 using Equation 4

V_{12}= 5788 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10835	See Exhibit 25-7	Yes
V_{R12}	6162	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 45.8 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 2.087 (Exibit 25-19)

S_R= 11.8 mph (Exhibit 25-19)

S_0= 63.1 mph (Exhibit 25-19)

S= 18.1 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Willow ONR - L Coyotes OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.19
Weaving seg length, L (ft)	1200	Weaving ratio, R	0.23
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	8107	0.90	4	0	1.5	1.2	0.980	1.00	9187
Vo2	77	0.90	4	0	1.5	1.2	0.980	1.00	87
Vw1	1453	0.90	4	0	1.5	1.2	0.980	1.00	1646
Vw2	433	0.90	4	0	1.5	1.2	0.980	1.00	490
Vw				2136	Vnw				9274
V									11410

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			3.18	0.45
Weaving and non-weaving speeds, Si (mi/h)			28.16	52.87

Number of lanes required for unconstrained operation, Nw 1.51
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	45.41
Weaving segment density, D (pc/mi/ln)	50.25
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10038
Capacity as a 15-minute flow rate, c (veh/h)	9841
Capacity as a full-hour volume, c_h (veh/h)	8857

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - BellFl OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	650	Weaving ratio, R	0.46
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	110	0.90	4	0	1.5	1.2	0.980	1.00	124
Vw2	130	0.90	4	0	1.5	1.2	0.980	1.00	147
Vw				271	Vnw				0
V									271

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			1.06	0.15
Weaving and non-weaving speeds, Si (mi/h)			27.15	36.80

Number of lanes required for unconstrained operation, Nw 1.47
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	27.15
Weaving segment density, D (pc/mi/ln)	4.99
Level of service, LOS	A
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - Woodruff OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	68	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.18
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.45
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	7751	0.90	4	0	1.5	1.2	0.980	1.00	8784
Vo2	41	0.90	4	0	1.5	1.2	0.980	1.00	46
Vw1	779	0.90	4	0	1.5	1.2	0.980	1.00	882
Vw2	969	0.90	4	0	1.5	1.2	0.980	1.00	1098
Vw				1980	Vnw				8830
V									10810

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			3.21	0.44
Weaving and non-weaving speeds, Si (mi/h)			28.78	55.16

Number of lanes required for unconstrained operation, Nw 1.45
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	47.23
Weaving segment density, D (pc/mi/ln)	45.77
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10204
Capacity as a 15-minute flow rate, c (veh/h)	10004
Capacity as a full-hour volume, c_h (veh/h)	9004

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 22

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 69.2 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8730	0.90	Level	4	0	0.980	1.00	9894
Ramp	710	0.90	Level	4	0	0.980	1.00	805
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.181 using Equation 4

V_{12}= 1790 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10699	See Exhibit 25-7	Yes
V_{R12}	2595	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.1 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.359 (Exibit 25-19)

S_R= 59.4 mph (Exhibit 25-19)

S_0= 52.2 mph (Exhibit 25-19)

S= 53.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

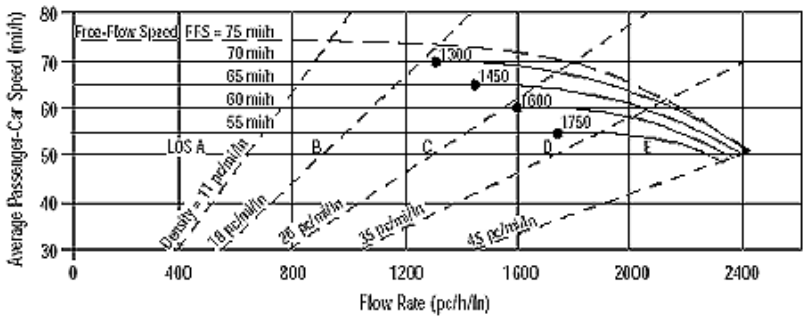
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Woodruff ONR to Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 23

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9440 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.2	mi/h	FFS	68.2	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2675	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 SB
Weaving Seg Location	Stearns ONR to Studebaker OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	69	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.09
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.49
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	9013	0.90	4	0	1.5	1.2	0.980	1.00	10214
Vo2	23	0.90	4	0	1.5	1.2	0.980	1.00	26
Vw1	427	0.90	4	0	1.5	1.2	0.980	1.00	483
Vw2	437	0.90	4	0	1.5	1.2	0.980	1.00	495
Vw				978	Vnw				10240
V									11218

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.64	0.22		
Weaving and non-weaving speeds, Si (mi/h)	50.92	63.23		

Number of lanes required for unconstrained operation, Nw 0.69
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

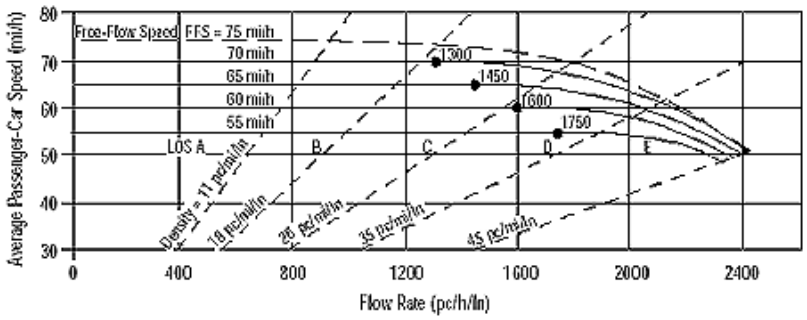
Weaving segment speed, S (mi/h)	61.92
Weaving segment density, D (pc/mi/ln)	36.23
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	11850
Capacity as a 15-minute flow rate, c (veh/h)	11618
Capacity as a full-hour volume, c_h (veh/h)	10456

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Studebaker OFR to 605NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 25

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9450 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2142	pc/h/ln	Design LOS		
S	61.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	35.1	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 26

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.9 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9450	0.90	Level	4	0	0.980	1.00	10710
Ramp	1350	0.90	Level	4	0	0.980	1.00	1530
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.260 using Equation 0

V_{12} = 3360 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	8568	9556	No
V_{12}	3360	4400:All	No
$V_{FO} = V_F - V_R$	7038	9556	No
V_R	1530	4100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 7.0 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.371 (Exhibit 25-19)

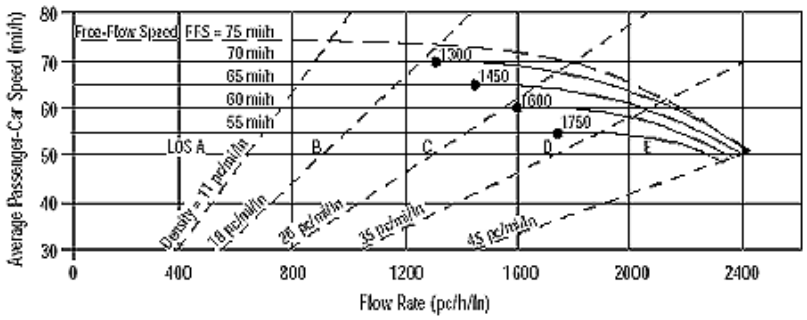
S_R= 58.9 mph (Exhibit 25-19)

S_0= 69.3 mph (Exhibit 25-19)

S = 64.8 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 27

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8090 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

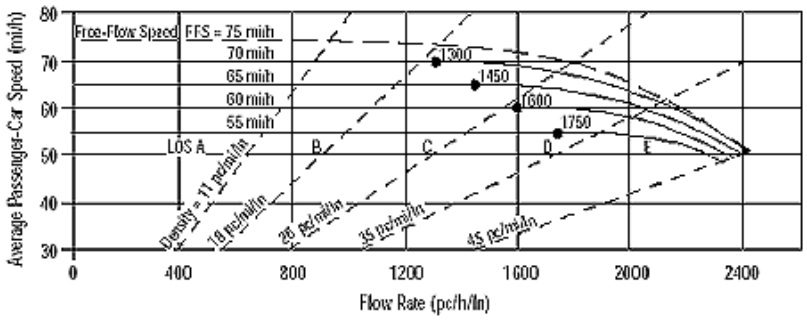
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2292	pc/h/ln	Design LOS		
S	56.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	40.5	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB OFR to I-605 Sb ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 29

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7990 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2264	pc/h/ln	Design LOS		
S	57.5	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	39.4	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 30

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 68.9 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7990	0.90	Level	4	0	0.980	1.00	9055
Ramp	3590	0.90	Level	4	0	0.980	1.00	4069
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.209 using Equation 0

V_{12}= 1892 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	13124	See Exhibit 25-7	Yes
V_{R12}	5961	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 31.9 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.631 (Exibit 25-19)

S_R= 25.0 mph (Exhibit 25-19)

S_0= 54.7 mph (Exhibit 25-19)

S= 35.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

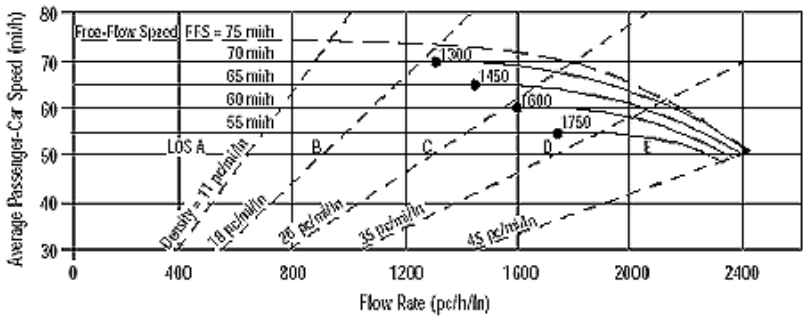
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB ONR to 7th St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 31

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	11580 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

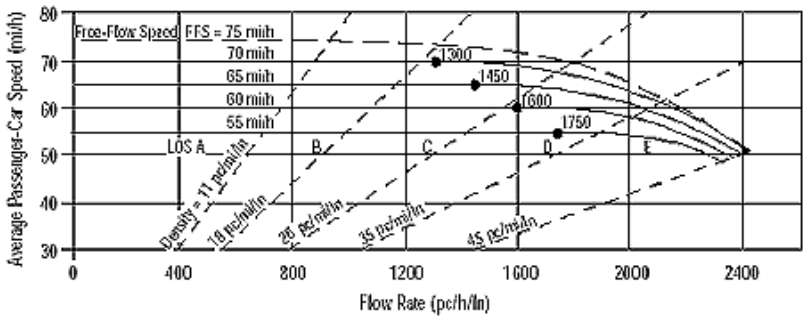
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2625	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	to I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 32

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	12050 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2731	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 33

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	12050	0.90	Level	4	0	0.980	1.00	13657
Ramp	4110	0.90	Level	4	0	0.980	1.00	4658
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 6288 pc/h

Capacity Checks

	Actual	Maximum	LOS F?		Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7		V_{FI}=V_F	10926	9000	Yes
				V_{12}	6288	4400:All	Yes
V_{R12}		4600:All		V_{FO} = V_F - V_R	6268	9000	No
				V_R	4658	4100	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 15.1 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.652 (Exhibit 25-19)

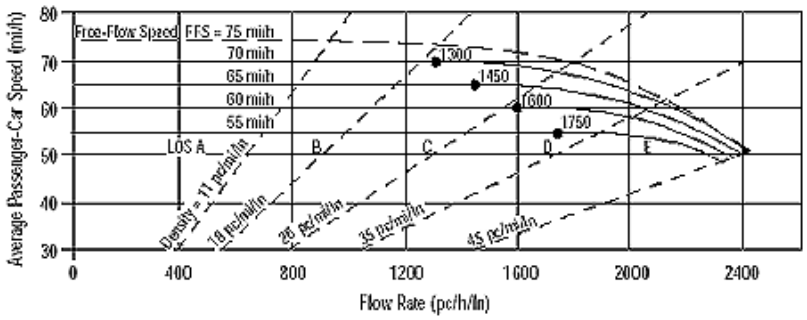
S_R= 46.5 mph (Exhibit 25-19)

S_0= 55.2 mph (Exhibit 25-19)

S = 49.8 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 Sb OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 34

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7940 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2250	pc/h/ln	Design LOS		
S	50.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	45.0	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB/NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 35

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7940	0.90	Level	4	0	0.980	1.00	8999
Ramp	1630	0.90	Level	4	0	0.980	1.00	1847
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.369 using Equation 4

V_{12}= 3323 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10846	See Exhibit 25-7	Yes
V_{R12}	5170	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 37.4 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.923 (Exibit 25-19)

S_R= 43.7 mph (Exhibit 25-19)

S_0= 54.0 mph (Exhibit 25-19)

S= 48.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

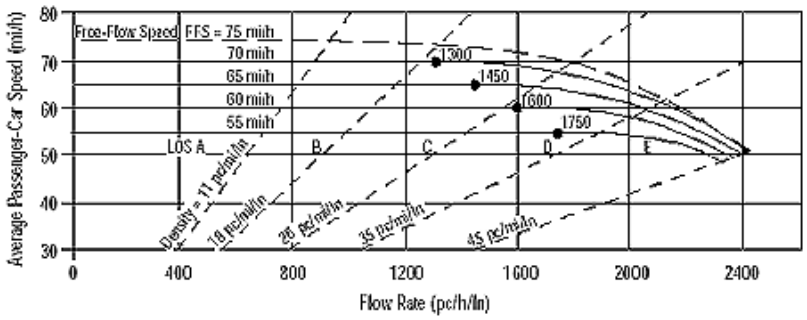
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB/SB ONR to Studeba ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 36

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9560 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2709	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h	S		mi/h
D = v_p / S		pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	F		Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Studeb ONR - Palo Verde OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	55	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.10
Weaving seg length, L (ft)	1700	Weaving ratio, R	0.34
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	36	0.90	4	0	1.5	1.2	0.980	1.00	40
Vo2	8886	0.90	4	0	1.5	1.2	0.980	1.00	10070
Vw1	344	0.90	4	0	1.5	1.2	0.980	1.00	389
Vw2	674	0.90	4	0	1.5	1.2	0.980	1.00	763
Vw				1152	Vnw				10110
V									11262

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.86	0.45		
Weaving and non-weaving speeds, Si (mi/h)	39.13	46.13		

Number of lanes required for unconstrained operation, Nw 1.15
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	45.30
Weaving segment density, D (pc/mi/ln)	49.72
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10023
Capacity as a 15-minute flow rate, c (veh/h)	9826
Capacity as a full-hour volume, c_h (veh/h)	8843

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Palo Verde ONR to Woodruff OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	47	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.08
Weaving seg length, L (ft)	1750	Weaving ratio, R	0.16
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	36	0.90	4	0	1.5	1.2	0.980	1.00	40
Vo2	8566	0.90	4	0	1.5	1.2	0.980	1.00	9708
Vw1	124	0.90	4	0	1.5	1.2	0.980	1.00	140
Vw2	674	0.90	4	0	1.5	1.2	0.980	1.00	763
Vw				903	Vnw				9748
V									10651

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.77	0.38		
Weaving and non-weaving speeds, Si (mi/h)	35.87	41.81		

Number of lanes required for unconstrained operation, Nw 1.08
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.23
Weaving segment density, D (pc/mi/ln)	51.67
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10070
Capacity as a 15-minute flow rate, c (veh/h)	9873
Capacity as a full-hour volume, c_h (veh/h)	8886

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Woodruff ONR to Bellflower OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	46	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.11
Weaving seg length, L (ft)	890	Weaving ratio, R	0.45
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	29	0.90	4	0	1.5	1.2	0.980	1.00	32
Vo2	8149	0.90	4	0	1.5	1.2	0.980	1.00	9235
Vw1	441	0.90	4	0	1.5	1.2	0.980	1.00	499
Vw2	541	0.90	4	0	1.5	1.2	0.980	1.00	613
Vw				1112	Vnw				9267
V									10379

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.35	0.66		
Weaving and non-weaving speeds, Si (mi/h)	30.30	36.65		

Number of lanes required for unconstrained operation, Nw 1.14
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	35.85
Weaving segment density, D (pc/mi/ln)	57.91
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	9142
Capacity as a 15-minute flow rate, c (veh/h)	8963
Capacity as a full-hour volume, c_h (veh/h)	8067

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Bellflower ONR to Lakewood OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	52	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.33
Weaving seg length, L (ft)	1300	Weaving ratio, R	0.44
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	52	0.90	4	0	1.5	1.2	0.980	1.00	58
Vo2	4612	0.90	4	0	1.5	1.2	0.980	1.00	5226
Vw1	1268	0.90	4	0	1.5	1.2	0.980	1.00	1437
Vw2	988	0.90	4	0	1.5	1.2	0.980	1.00	1119
Vw				2556	Vnw				5284
V									7840

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.71	0.47		
Weaving and non-weaving speeds, Si (mi/h)	39.53	43.52		

Number of lanes required for unconstrained operation, Nw 2.12
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.13
Weaving segment density, D (pc/mi/ln)	37.22
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	9159
Capacity as a 15-minute flow rate, c (veh/h)	8979
Capacity as a full-hour volume, c_h (veh/h)	8081

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 46

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9740	0.90	Level	4	0	0.980	1.00	11039
Ramp	640	0.90	Level	4	0	0.980	1.00	725
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.286 using Equation 4

V_{12}= 2446 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9264	See Exhibit 25-7	Yes
V_{R12}	3171	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.7 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.379 (Exibit 25-19)

S_R= 50.1 mph (Exhibit 25-19)

S_0= 44.0 mph (Exhibit 25-19)

S= 45.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

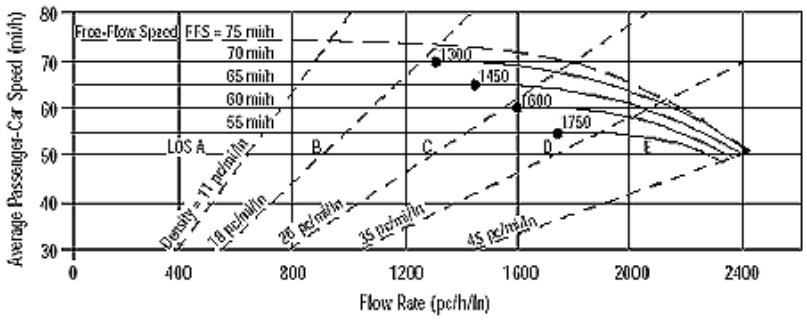
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	Lakewood ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 47

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10370 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

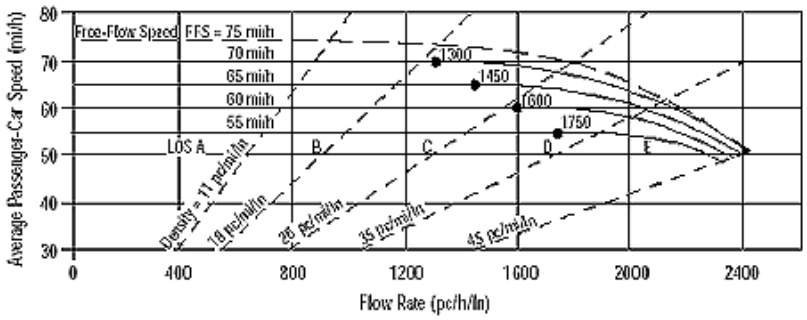
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2351	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	to I-40 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 48

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4350 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2441	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 49

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4350	0.90	Level	5	0	0.976	1.00	4954
Ramp	3840	0.90	Level	5	0	0.976	1.00	4373
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 4954 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	4954	4500	Yes
V_{12}	4954	4400:All	Yes
$V_{FO} = V_F - V_R$	581	4500	No
V_R	4373	3800	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.0 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.822 (Exhibit 25-19)

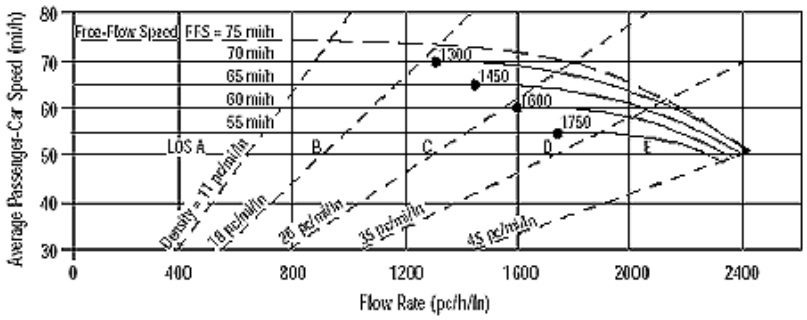
S_R= 44.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 44.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 50

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	510 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	60.0	mi/h	FFS	60.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	290	pc/h/ln	Design LOS		
S	60.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	4.8	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 51

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.8 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	1310	0.90	Level	5	0	0.976	1.00	1492
Ramp	830	0.90	Level	5	0	0.976	1.00	945
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 1492 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	1492	4775	No
V_{12}	1492	4400:All	No
$V_{FO} = V_F - V_R$	547	4775	No
V_R	945	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 7.2 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.318 (Exhibit 25-19)

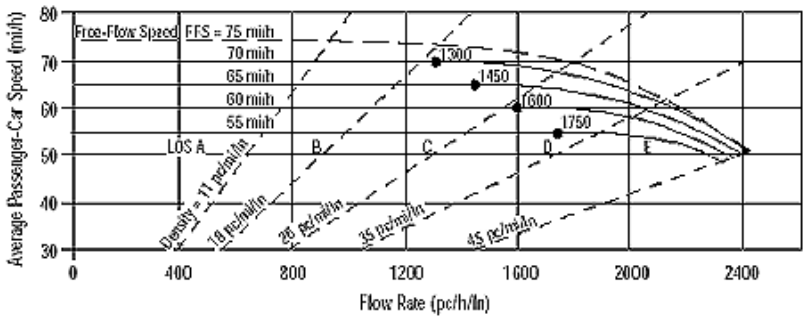
S_R= 60.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 52

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	490 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	68.8	mi/h	FFS	68.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

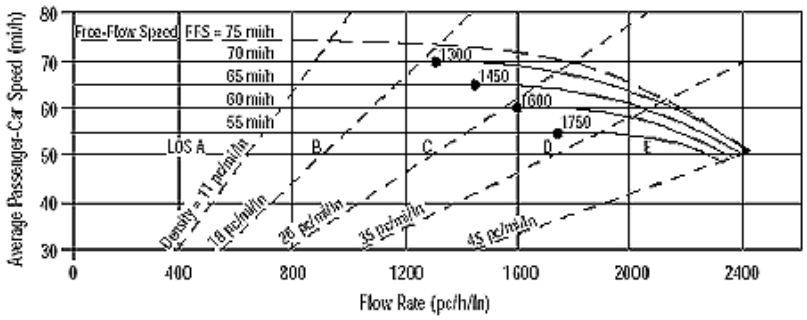
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	279	pc/h/ln	Design LOS		
S	68.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	4.1	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB ONR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 54

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4020 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	68.8	mi/h	FFS	68.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

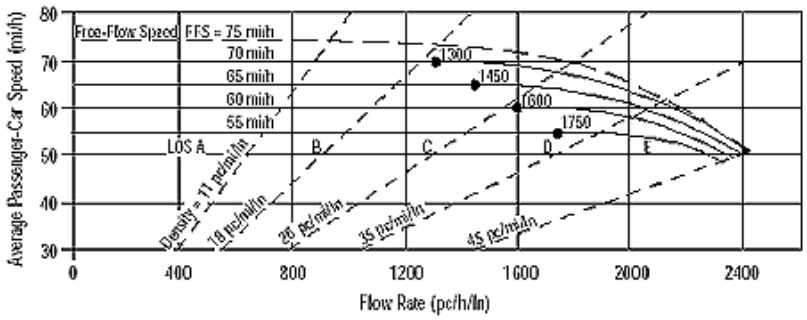
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1145	pc/h/ln	Design LOS		
S	68.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	16.6	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB ONR to Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 56

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5200 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.8	mi/h	FFS	68.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1184	pc/h/ln	Design LOS		
S	68.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	17.2	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 57

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.8 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5200	0.90	Level	5	0	0.976	1.00	5922
Ramp	1140	0.90	Level	5	0	0.976	1.00	1298
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 2927 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	5034	9552	No
V_{12}	2927	4400:All	No
V_{FO} = V_F - V_R	3736	9552	No
V_R	1298	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 0.6 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.480 (Exhibit 25-19)

S_R= 55.9 mph (Exhibit 25-19)

S_0= 75.3 mph (Exhibit 25-19)

S = 62.7 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 59

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4060	0.90	Level	5	0	0.976	1.00	4624
Ramp	1150	0.90	Level	5	0	0.976	1.00	1310
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.237 using Equation 4

V_{12}= 1097 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	5934	See Exhibit 25-7	No
V_{R12}	2407	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.0 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.324 (Exibit 25-19)

S_R= 60.9 mph (Exhibit 25-19)

S_0= 65.5 mph (Exhibit 25-19)

S= 63.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

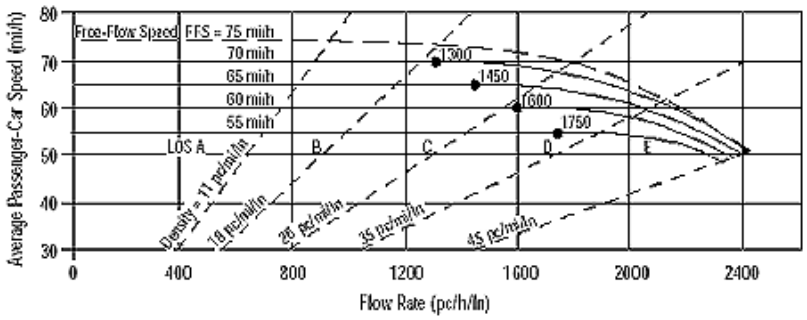
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Willow St ONR to Cerritos ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 60

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5210 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1483	pc/h/ln	Design LOS		
S	69.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	21.2	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Cerritos Ave ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 61

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.1 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	5210	0.90	Level	5	0	0.976	1.00	5934
Ramp	780	0.90	Level	5	0	0.976	1.00	888
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.171 using Equation 4

V_{12}= 1012 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6822	See Exhibit 25-7	No
V_{R12}	1900	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 18.6 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.333 (Exibit 25-19)

S_R= 58.1 mph (Exhibit 25-19)

S_0= 58.6 mph (Exhibit 25-19)

S= 58.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

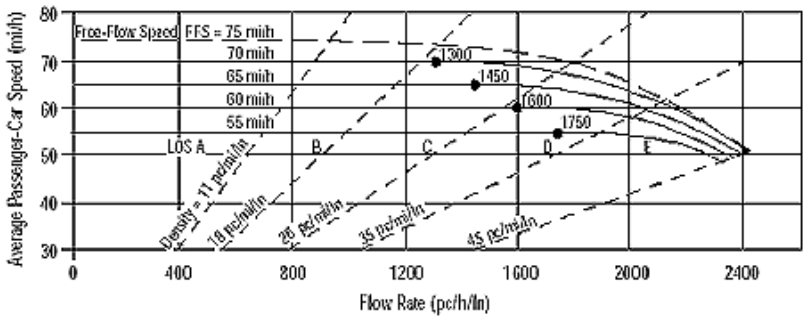
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Cerritos ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 62

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5990 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	65.5	mi/h	FFS	65.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1705	pc/h/ln	Design LOS	
S	65.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	26.2	pc/mi/ln	S	mi/h
LOS	D		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 63

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 65.5 mph S_{FR} = 35.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5990	0.90	Level	5	0	0.976	1.00	6822
Ramp	1110	0.90	Level	5	0	0.976	1.00	1264
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3687 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	6822	9420	No
V_{12}	3687	4400:All	No
$V_{FO} = V_F - V_R$	5558	9420	No
V_R	1264	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.3 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.542 (Exhibit 25-19)

S_R= 52.8 mph (Exhibit 25-19)

S_0= 69.6 mph (Exhibit 25-19)

S = 59.4 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 65

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 61.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4880	0.90	Level	5	0	0.976	1.00	5558
Ramp	530	0.90	Level	5	0	0.976	1.00	604
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.325 using Equation 4

V_{12}= 1809 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6162	See Exhibit 25-7	No
V_{R12}	2413	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.4 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.324 (Exibit 25-19)

S_R= 54.8 mph (Exhibit 25-19)

S_0= 56.1 mph (Exhibit 25-19)

S= 55.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 68

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 67.6 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7750	0.90	Level	5	0	0.976	1.00	8826
Ramp	600	0.90	Level	5	0	0.976	1.00	683
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.212 using Equation 4

V_{12}= 1872 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9509	See Exhibit 25-7	Yes
V_{R12}	2555	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.5 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.354 (Exibit 25-19)

S_R= 58.5 mph (Exhibit 25-19)

S_0= 54.0 mph (Exhibit 25-19)

S= 55.2 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 70

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.1 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8360	0.90	Level	5	0	0.976	1.00	9521
Ramp	300	0.90	Level	5	0	0.976	1.00	342
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.239 using Equation 4

V_{12}= 2273 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9863	See Exhibit 25-7	Yes
V_{R12}	2615	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.5 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.360 (Exibit 25-19)

S_R= 57.4 mph (Exhibit 25-19)

S_0= 51.6 mph (Exhibit 25-19)

S= 53.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

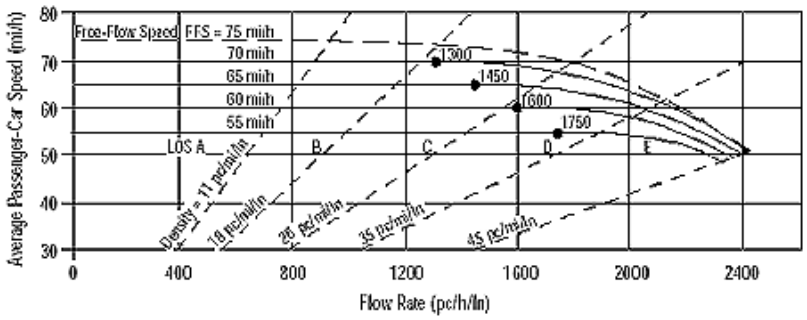
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Carson ONR to 5 lane section
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 71

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8650 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	67.9	mi/h	FFS	67.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

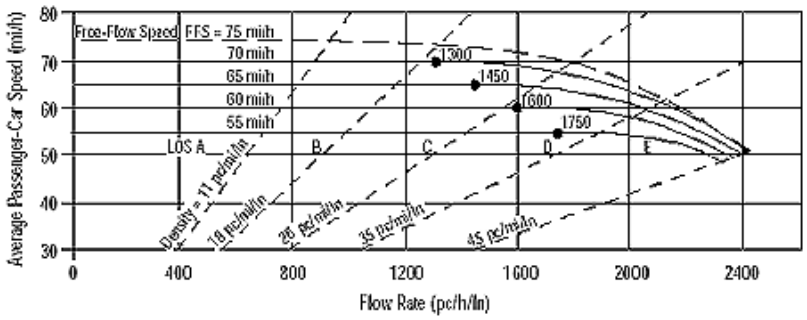
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2463	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	5 lane section to Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 72

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8650 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	67.9	mi/h	FFS	67.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1970	pc/h/ln	Design LOS		
S	64.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	30.8	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 73

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 67.9 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8650	0.90	Level	5	0	0.976	1.00	9851
Ramp	1130	0.90	Level	5	0	0.976	1.00	1287
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4162 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7881	9516	No
V_{12}	4162	4400:All	No
$V_{FO} = V_F - V_R$	6594	9516	No
V_R	1287	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.2 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.609 (Exhibit 25-19)

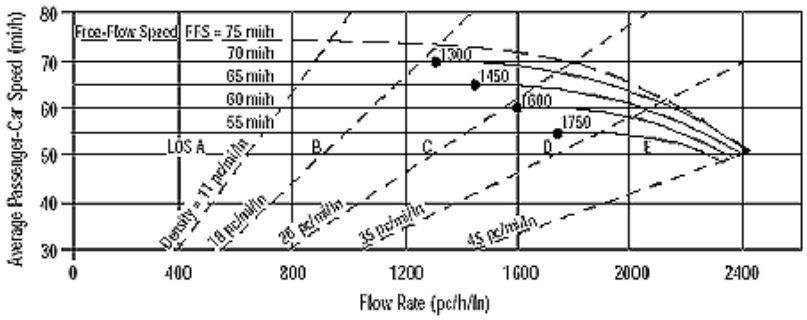
S_R= 52.1 mph (Exhibit 25-19)

S_0= 71.1 mph (Exhibit 25-19)

S = 59.7 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Spring OFR to Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 74

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7520 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2141	pc/h/ln	Design LOS		
S	61.7	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	34.7	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 75

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 66.2 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	7520	0.90	Level	5	0	0.976	1.00	8564
Ramp	600	0.90	Level	5	0	0.976	1.00	683
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4119 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	8564	9447	No
V_{12}	4119	4400:All	No
$V_{FO} = V_F - V_R$	7881	9447	No
V_R	683	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.7 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.554 (Exhibit 25-19)

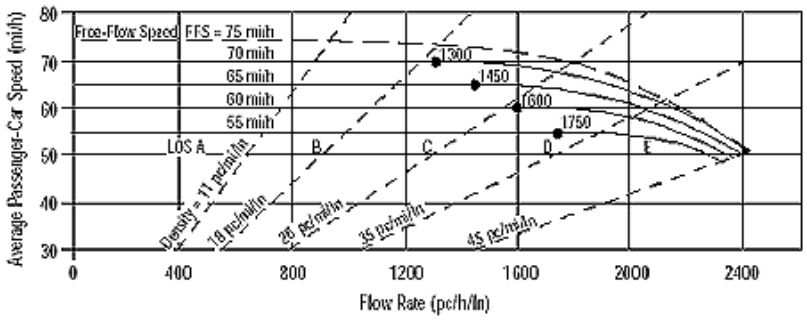
S_R= 52.8 mph (Exhibit 25-19)

S_0= 67.9 mph (Exhibit 25-19)

S = 59.7 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow OFR to Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 76

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	6930 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	66.2	mi/h	FFS	66.2	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1973	pc/h/ln	Design LOS		
S	62.7	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	31.5	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 77

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 63.9 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6930	0.90	Level	5	0	0.976	1.00	7893
Ramp	1210	0.90	Level	5	0	0.976	1.00	1378
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4219 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7893	9356	No
V_{12}	4219	4400:All	No
$V_{FO} = V_F - V_R$	6515	9356	No
V_R	1378	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.5 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.617 (Exhibit 25-19)

S_R= 50.4 mph (Exhibit 25-19)

S_0= 66.8 mph (Exhibit 25-19)

S = 56.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 79

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.9 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	5720	0.90	Level	5	0	0.976	1.00	6514
Ramp	670	0.90	Level	5	0	0.976	1.00	763
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.409 using Equation 4

V_{12}= 2665 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7277	See Exhibit 25-7	No
V_{R12}	3428	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.2 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.378 (Exibit 25-19)

S_R= 55.6 mph (Exhibit 25-19)

S_0= 58.8 mph (Exhibit 25-19)

S= 57.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

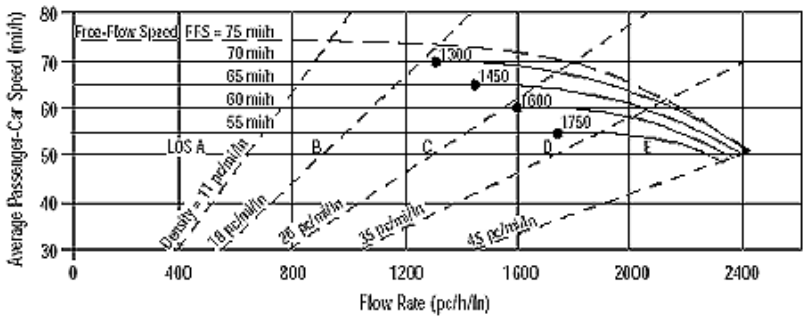
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow ONR CD to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 84

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	6390 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	66.5	mi/h	FFS	66.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1819	pc/h/ln	Design LOS		
S	64.9	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	28.0	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 85

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 66.5 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6390	0.90	Level	5	0	0.976	1.00	7278
Ramp	850	0.90	Level	5	0	0.976	1.00	968
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3719 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7278	9460	No
V_{12}	3719	4400:All	No
$V_{FO} = V_F - V_R$	6310	9460	No
V_R	968	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.8 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.320 (Exhibit 25-19)

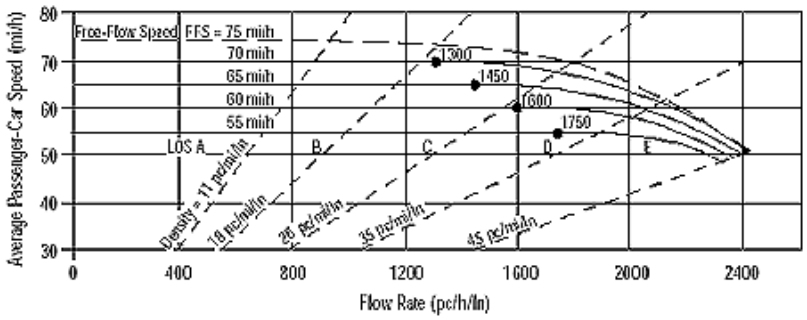
S_R= 58.7 mph (Exhibit 25-19)

S_0= 69.9 mph (Exhibit 25-19)

S = 63.7 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 86

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5540 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1577	pc/h/ln	Design LOS		
S	69.5	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	22.7	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 87

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 66.5 mph S_{FR} = 66.5 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5540	0.90	Level	5	0	0.976	1.00	6309
Ramp	3590	0.90	Level	5	0	0.976	1.00	4089
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 4666 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	6309	9460	No
V_{12}	4666	4400:All	Yes
V_{FO} = V_F - V_R	2220	9460	No
V_R	4089	4400	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -42.0 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.387 (Exhibit 25-19)

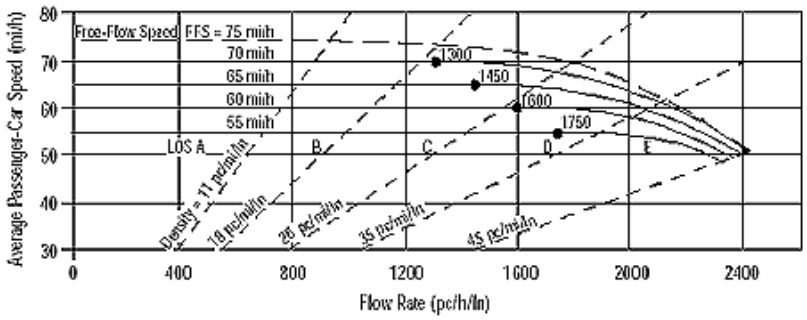
S_R= 57.0 mph (Exhibit 25-19)

S_0= 73.0 mph (Exhibit 25-19)

S = 60.5 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 88 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3900 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	66.5	mi/h	FFS	66.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2221	pc/h/ln	Design LOS		
S	57.4	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	38.7	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 89 coded as 2 lanes, double volume

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.5 mph S_{FR} = 50.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	3900	0.90	Level	5	0	0.976	1.00	4442
Ramp	100	0.90	Level	5	0	0.976	1.00	114
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 4442 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4556	See Exhibit 25-7	No
V_{R12}	4556	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 38.8 (pc/ m/ln)

LOS = E (Exhibit 25-4)

Speed Estimation

M_S = 0.657 (Exibit 25-19)

S_R= 50.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 50.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

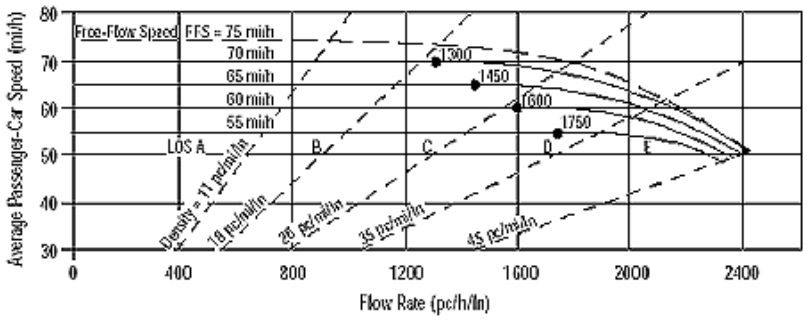
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB ONR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 90 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4100 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	66.5	mi/h	FFS	66.5	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2335	pc/h/ln	Design LOS		
S	53.7	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	43.5	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 91 coded for ramp being the mainline

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 55.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2150	0.90	Level	2	0	0.990	1.00	2413
Ramp	2050	0.90	Level	2	0	0.990	1.00	2301
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2413 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4714	See Exhibit 25-7	Yes
V_{R12}	4714	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 39.6 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.728 (Exibit 25-19)

S_R= 45.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 45.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

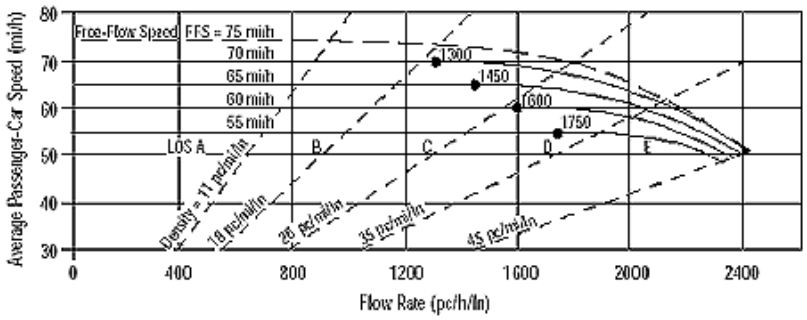
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	I-405 NB ONR to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 92

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4200 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2357	pc/h/ln	Design LOS		
S	55.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	42.9	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 95

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	3320	0.90	Level	2	0	0.990	1.00	3726
Ramp	690	0.90	Level	2	0	0.990	1.00	774
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 3726 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4500	See Exhibit 25-7	No
V_{R12}	4500	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 30.8 (pc/ m/ln)

LOS = D (Exhibit 25-4)

Speed Estimation

M_S = 0.567 (Exibit 25-19)

S_R= 47.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 47.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

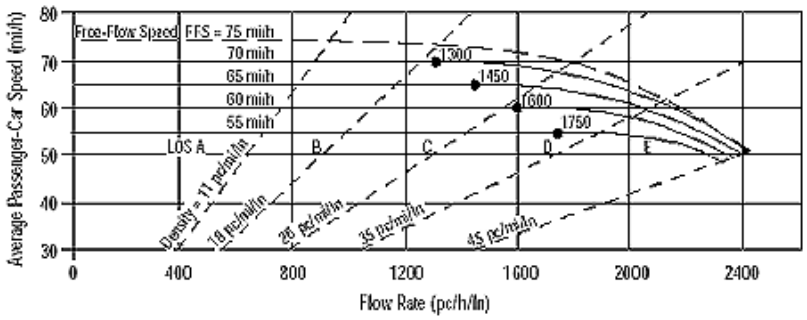
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	StudeB ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 96

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4010 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

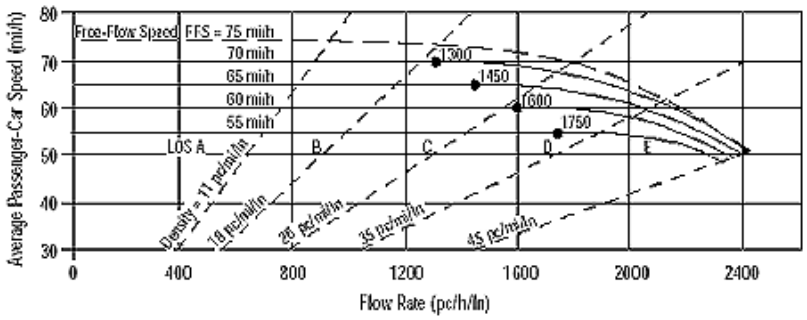
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1500	pc/h/ln	Design LOS		
S	69.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	21.5	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St EB
Agency or Company	Parsons	From/To	to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 97

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3180 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1190	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	17.0	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 98

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	3180	0.90	Level	5	0	0.976	1.00	3622
Ramp	210	0.90	Level	5	0	0.976	1.00	239
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 3622 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	3622	4500	No
V_{12}	3622	4400:All	No
$V_{FO} = V_F - V_R$	3383	4500	No
V_R	239	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.3 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.515 (Exhibit 25-19)

S_R= 48.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 48.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 100

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2970	0.90	Level	2	0	0.990	1.00	3333
Ramp	1380	0.90	Level	2	0	0.990	1.00	1549
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 3333 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4882	See Exhibit 25-7	Yes
V_{R12}	4882	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 40.3 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.807 (Exibit 25-19)

S_R= 44.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 44.5 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 101

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 20.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9920	0.90	Level	4	0	0.980	1.00	11243
Ramp	1040	0.90	Level	4	0	0.980	1.00	1179
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3211 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8995	9000	No
V_{12}	3211	4400:All	No
V_{FO} = V_F - V_R	7816	9000	No
V_R	1179	3500	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 15.7 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.729 (Exhibit 25-19)

S_R= 45.5 mph (Exhibit 25-19)

S_0= 53.0 mph (Exhibit 25-19)

S = 50.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 102

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 45.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9400	0.90	Level	4	0	0.980	1.00	10653
Ramp	710	0.90	Level	4	0	0.980	1.00	805
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4170 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8523	9000	No
V_{12}	4170	4400:All	No
V_{FO} = V_F - V_R	7718	9000	No
V_R	805	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 26.6 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.370 (Exhibit 25-19)

S_R= 50.2 mph (Exhibit 25-19)

S_0= 55.7 mph (Exhibit 25-19)

S = 52.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 103

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.0 mph S_{FR} = 25.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9540	0.90	Level	4	0	0.980	1.00	10812
Ramp	820	0.90	Level	4	0	0.980	1.00	929
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4295 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8650	9520	No
V_{12}	4295	4400:All	No
V_{FO} = V_F - V_R	7721	9520	No
V_R	929	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.2 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.642 (Exhibit 25-19)

S_R= 51.3 mph (Exhibit 25-19)

S_0= 70.0 mph (Exhibit 25-19)

S = 59.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 104

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 20.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9160	0.90	Level	4	0	0.980	1.00	10381
Ramp	570	0.90	Level	4	0	0.980	1.00	646
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3985 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8305	9000	No
V_{12}	3985	4400:All	No
V_{FO} = V_F - V_R	7659	9000	No
V_R	646	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.5 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.681 (Exhibit 25-19)

S_R= 46.1 mph (Exhibit 25-19)

S_0= 55.8 mph (Exhibit 25-19)

S = 50.7 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 105

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 65.3 mph S_{FR} = 35.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10070	0.90	Level	4	0	0.980	1.00	11413
Ramp	1530	0.90	Level	4	0	0.980	1.00	1734
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3657 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9131	9412	No
V_{12}	3657	4400:All	No
V_{FO} = V_F - V_R	7397	9412	No
V_R	1734	3800	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 19.5 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.584 (Exhibit 25-19)

S_R= 51.7 mph (Exhibit 25-19)

S_0= 64.9 mph (Exhibit 25-19)

S = 58.9 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 106

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 20.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9940	0.90	Level	4	0	0.980	1.00	11265
Ramp	710	0.90	Level	4	0	0.980	1.00	805
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4383 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9012	9000	Yes
V_{12}	4383	4400:All	No
V_{FO} = V_F - V_R	8207	9000	No
V_R	805	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.5 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.695 (Exhibit 25-19)

S_R= 46.0 mph (Exhibit 25-19)

S_0= 55.2 mph (Exhibit 25-19)

S = 50.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Studebaker Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 107

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 68.5 mph S_{FR} = 25.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9890	0.90	Level	4	0	0.980	1.00	11209
Ramp	450	0.90	Level	4	0	0.980	1.00	510
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4198 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	8968	9540	No
V_{12}	4198	4400:All	No
V_{FO} = V_F - V_R	8458	9540	No
V_R	510	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.1 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.604 (Exhibit 25-19)

S_R= 52.5 mph (Exhibit 25-19)

S_0= 69.7 mph (Exhibit 25-19)

S = 60.4 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	7th Street OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 108

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 68.9 mph S_{FR} = 45.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8090	0.90	Level	4	0	0.980	1.00	9169
Ramp	100	0.90	Level	4	0	0.980	1.00	113
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4061 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9169	9556	No
V_{12}	4061	4400:All	No
V_{FO} = V_F - V_R	9056	9556	No
V_R	113	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.4 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.308 (Exhibit 25-19)

S_R= 60.6 mph (Exhibit 25-19)

S_0= 69.5 mph (Exhibit 25-19)

S = 65.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 109

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 67.6 mph S_{FR} = 25.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9080	0.90	Level	5	0	0.976	1.00	10341
Ramp	1330	0.90	Level	5	0	0.976	1.00	1515
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.260 using Equation 0

V_{12} = 3272 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	8273	9503	No
V_{12}	3272	4400:All	No
$V_{FO} = V_F - V_R$	6758	9503	No
V_R	1515	3500	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 16.2 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.694 (Exhibit 25-19)

S_R= 49.8 mph (Exhibit 25-19)

S_0= 68.3 mph (Exhibit 25-19)

S = 59.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 110

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4200	0.90	Level	5	0	0.976	1.00	4783
Ramp	870	0.90	Level	5	0	0.976	1.00	991
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =1.000 using Equation 0
V_{12}= pc/h	V_{12} = 4783 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	4783	4500	Yes
V_{12}	4783	4400:All	Yes
V_{FO} = V_F - V_R	3792	4500	No
V_R	991	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.4 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.582 (Exhibit 25-19)

S_R= 47.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 47.4 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 111

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 61.6 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9560	0.90	Level	4	0	0.980	1.00	10835
Ramp	510	0.90	Level	4	0	0.980	1.00	578
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.241 using Equation 4

V_{12}= 2010 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8913	See Exhibit 25-7	No
V_{R12}	2588	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.5 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.352 (Exibit 25-19)

S_R= 54.7 mph (Exhibit 25-19)

S_0= 49.9 mph (Exhibit 25-19)

S= 51.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 112

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8870	0.90	Level	4	0	0.980	1.00	10053
Ramp	870	0.90	Level	4	0	0.980	1.00	986
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.572 using Equation 4

V_{12}= 5754 pc/h

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11039	See Exhibit 25-7	Yes
V_{R12}	6740	4600:All	Yes

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 48.2 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 3.514 (Exibit 25-19)

S_R= 9.3 mph (Exhibit 25-19)

S_0= 49.1 mph (Exhibit 25-19)

S= 13.6 mph (Exhibit 25-14)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Site Information

Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 113

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 114

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.7 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8530	0.90	Level	4	0	0.980	1.00	9667
Ramp	1010	0.90	Level	4	0	0.980	1.00	1145
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.393 using Equation 4

V_{12}= 3802 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10812	See Exhibit 25-7	Yes
V_{R12}	4947	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 37.3 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.800 (Exibit 25-19)

S_R= 46.9 mph (Exhibit 25-19)

S_0= 56.4 mph (Exhibit 25-19)

S= 51.6 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 115

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8690	0.90	Level	4	0	0.980	1.00	9849
Ramp	470	0.90	Level	4	0	0.980	1.00	533
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.438 using Equation 4

V_{12}= 4313 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10382	See Exhibit 25-7	Yes
V_{R12}	4846	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 37.4 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.754 (Exibit 25-19)

S_R= 45.2 mph (Exhibit 25-19)

S_0= 45.7 mph (Exhibit 25-19)

S= 45.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 116

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9240	0.90	Level	4	0	0.980	1.00	10472
Ramp	160	0.90	Level	4	0	0.980	1.00	181
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.769 using Equation 4

V_{12}= 8049 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10653	See Exhibit 25-7	Yes
V_{R12}	8230	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 58.3 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 14.827 (Exibit 25-19)

S_R= -137.8 mph (Exhibit 25-19)

S_0= 52.4 mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 117

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 68.2 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9440	0.90	Level	4	0	0.980	1.00	10699
Ramp	460	0.90	Level	4	0	0.980	1.00	521
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.248 using Equation 4

V_{12}= 2656 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11220	See Exhibit 25-7	Yes
V_{R12}	3177	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 28.1 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.394 (Exibit 25-19)

S_R= 57.9 mph (Exhibit 25-19)

S_0= 51.3 mph (Exhibit 25-19)

S= 53.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Studebaker ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 118

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9560	0.90	Level	4	0	0.980	1.00	10835
Ramp	380	0.90	Level	4	0	0.980	1.00	431
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.737 using Equation 4

V_{12}= 7989 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11266	See Exhibit 25-7	Yes
V_{R12}	8420	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 59.7 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 17.889 (Exibit 25-19)

S_R= -177.6 mph (Exhibit 25-19)

S_0= 51.7 mph (Exhibit 25-19)

S= 1472.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 119

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 59.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	5410	0.90	Level	5	0	0.976	1.00	6161
Ramp	830	0.90	Level	5	0	0.976	1.00	945
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.227 using Equation 4

V_{12}= 1399 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7106	See Exhibit 25-7	No
V_{R12}	2344	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.8 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.334 (Exibit 25-19)

S_R= 53.9 mph (Exhibit 25-19)

S_0= 52.8 mph (Exhibit 25-19)

S= 53.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

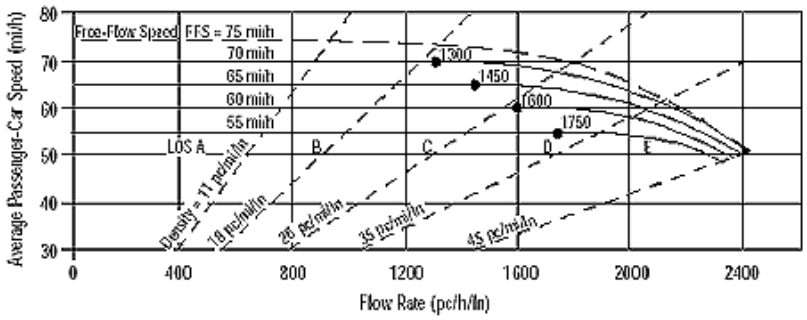
S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

PM Peak Hour

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	To Lakewood Blvd off ramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 1

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10840 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2457	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 2

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10840	0.90	Level	4	0	0.980	1.00	12285
Ramp	1490	0.90	Level	4	0	0.980	1.00	1689
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3805 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9828	9000	Yes
V_{12}	3805	4400:All	No
V_{FO} = V_F - V_R	8139	9000	No
V_R	1689	3800	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.6 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.645 (Exhibit 25-19)

S_R= 46.6 mph (Exhibit 25-19)

S_0= 52.5 mph (Exhibit 25-19)

S = 50.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Lakewood on - Willow St off
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	930	Weaving ratio, R	0.41
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	350	0.90	4	0	1.5	1.2	0.980	1.00	396
Vw2	510	0.90	4	0	1.5	1.2	0.980	1.00	578
Vw				974	Vnw				0
V									974

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.74	0.59
Weaving and non-weaving speeds, Si (mi/h)			21.68	30.70

Number of lanes required for unconstrained operation, Nw 1.74
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	21.68
Weaving segment density, D (pc/mi/ln)	22.47
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 8

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9350	0.90	Level	4	0	0.980	1.00	10597
Ramp	400	0.90	Level	4	0	0.980	1.00	453
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.543 using Equation 4

V_{12}= 5759 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11050	See Exhibit 25-7	Yes
V_{R12}	6212	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 46.2 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 2.182 (Exibit 25-19)

S_R= 26.6 mph (Exhibit 25-19)

S_0= 47.8 mph (Exhibit 25-19)

S= 33.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	Willow ONR - L Coyotes OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	41	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.25
Weaving seg length, L (ft)	1200	Weaving ratio, R	0.23
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	7774	0.90	4	0	1.5	1.2	0.980	1.00	8810
Vo2	104	0.90	4	0	1.5	1.2	0.980	1.00	117
Vw1	1976	0.90	4	0	1.5	1.2	0.980	1.00	2239
Vw2	586	0.90	4	0	1.5	1.2	0.980	1.00	664
Vw				2903	Vnw				8927
V									11830

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			3.66	0.57
Weaving and non-weaving speeds, Si (mi/h)			21.66	34.69

Number of lanes required for unconstrained operation, Nw 2.06
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	30.23
Weaving segment density, D (pc/mi/ln)	78.27
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	9008
Capacity as a 15-minute flow rate, c (veh/h)	8831
Capacity as a full-hour volume, c_h (veh/h)	7948

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - BellFl OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	35	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	650	Weaving ratio, R	0.21
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vo2	0	0.90	4	0	1.5	1.2	0.980	1.00	0
Vw1	150	0.90	4	0	1.5	1.2	0.980	1.00	170
Vw2	40	0.90	4	0	1.5	1.2	0.980	1.00	45
Vw				215	Vnw				0
V									215

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			0.84	0.11
Weaving and non-weaving speeds, Si (mi/h)			28.56	37.55

Number of lanes required for unconstrained operation, Nw 1.45
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	28.56
Weaving segment density, D (pc/mi/ln)	3.76
Level of service, LOS	A
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB CD
Weaving Seg Location	L Coyotes ONR - Woodruff OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	39	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.22
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.29
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	7724	0.90	4	0	1.5	1.2	0.980	1.00	8753
Vo2	34	0.90	4	0	1.5	1.2	0.980	1.00	38
Vw1	636	0.90	4	0	1.5	1.2	0.980	1.00	720
Vw2	1546	0.90	4	0	1.5	1.2	0.980	1.00	1752
Vw				2472	Vnw				8791
V									11263

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.15	0.00
b (Exhibit 24-6)			4.00	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			3.57	0.53
Weaving and non-weaving speeds, Si (mi/h)			21.35	33.97

Number of lanes required for unconstrained operation, Nw 1.91
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	30.07
Weaving segment density, D (pc/mi/ln)	74.92
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	8904
Capacity as a 15-minute flow rate, c (veh/h)	8729
Capacity as a full-hour volume, c_h (veh/h)	7856

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 22

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9270	0.90	Level	4	0	0.980	1.00	10506
Ramp	370	0.90	Level	4	0	0.980	1.00	419
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.229 using Equation 4

V_{12}= 2407 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10925	See Exhibit 25-7	Yes
V_{R12}	2826	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.1 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.373 (Exibit 25-19)

S_R= 50.2 mph (Exhibit 25-19)

S_0= 38.0 mph (Exhibit 25-19)

S= 40.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

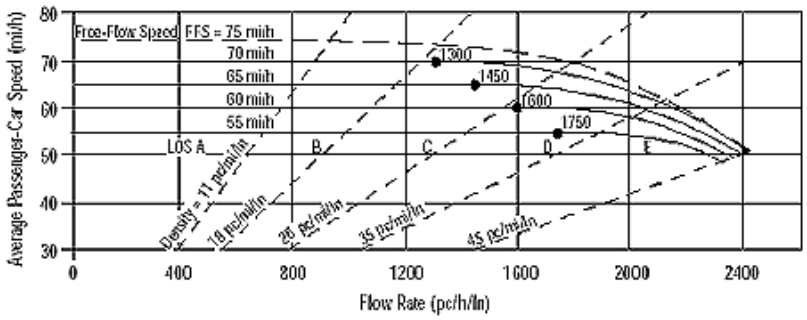
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Woodruff ONR to Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 23

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9640 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2731	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 SB
Weaving Seg Location	Stearns ONR to Studebaker OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	52	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.09
Weaving seg length, L (ft)	1100	Weaving ratio, R	0.36
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	9327	0.90	4	0	1.5	1.2	0.980	1.00	10570
Vo2	17	0.90	4	0	1.5	1.2	0.980	1.00	19
Vw1	313	0.90	4	0	1.5	1.2	0.980	1.00	354
Vw2	563	0.90	4	0	1.5	1.2	0.980	1.00	638
Vw				992	Vnw				10589
V									11581

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.66	0.23		
Weaving and non-weaving speeds, Si (mi/h)	40.38	49.18		

Number of lanes required for unconstrained operation, Nw 1.00
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

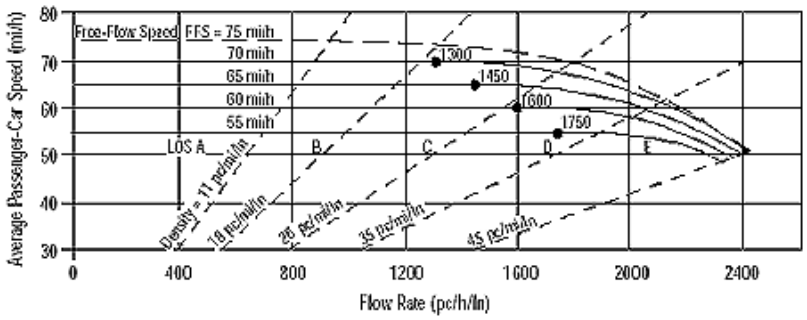
Weaving segment speed, S (mi/h)	48.28
Weaving segment density, D (pc/mi/ln)	47.97
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10836
Capacity as a 15-minute flow rate, c (veh/h)	10624
Capacity as a full-hour volume, c_h (veh/h)	9562

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	Studebaker OFR to 605NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 25

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9890 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2242	pc/h/ln	Design LOS		
S	50.2	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	44.7	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 26

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9890	0.90	Level	4	0	0.980	1.00	11209
Ramp	1060	0.90	Level	4	0	0.980	1.00	1201
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.260 using Equation 0

V_{12} = 3220 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	8968	9000	No
V_{12}	3220	4400:All	No
$V_{FO} = V_F - V_R$	7767	9000	No
V_R	1201	4100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 5.8 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.341 (Exhibit 25-19)

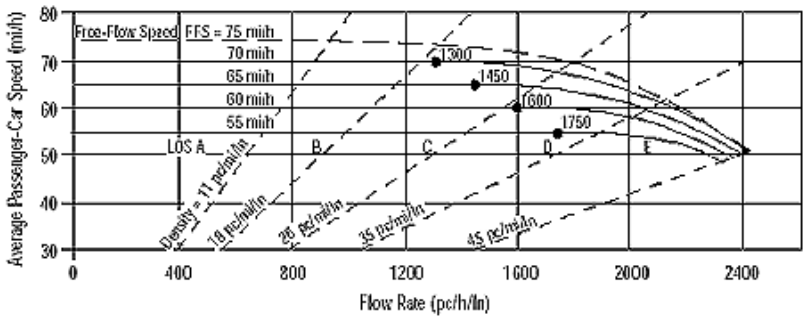
S_R= 50.6 mph (Exhibit 25-19)

S_0= 53.0 mph (Exhibit 25-19)

S = 52.1 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 27

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8830 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

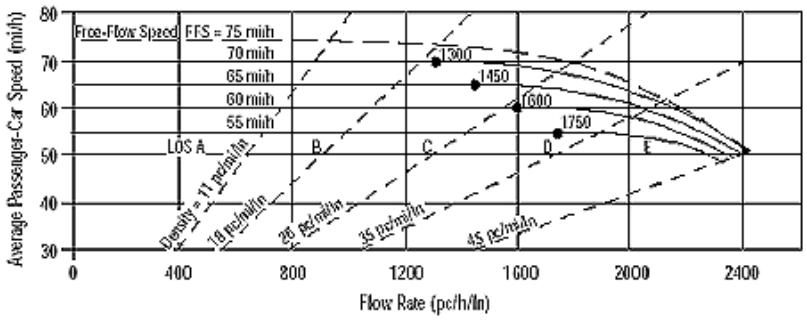
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2502	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB OFR to I-605 Sb ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 29

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8690 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	55.0	mi/h	FFS	55.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2462	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 30

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8690	0.90	Level	4	0	0.980	1.00	9849
Ramp	3640	0.90	Level	4	0	0.980	1.00	4125
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.209 using Equation 0

V_{12}= 2058 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	13974	See Exhibit 25-7	Yes
V_{R12}	6183	4600:All	Yes

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 33.6 (pc/ m/ln)

LOS = F (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 2.007 (Exibit 25-19)

S_R= 28.9 mph (Exhibit 25-19)

S_0= 38.9 mph (Exhibit 25-19)

S= 33.7 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

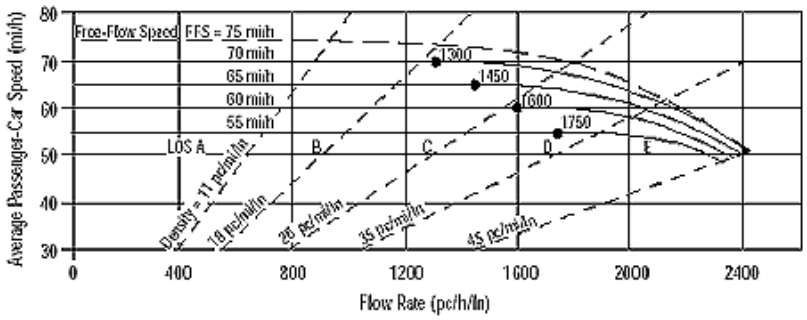
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 SB
Agency or Company	Parsons	From/To	I-605 SB ONR to 7th St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 31

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	12330 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	68.9	mi/h	FFS	68.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

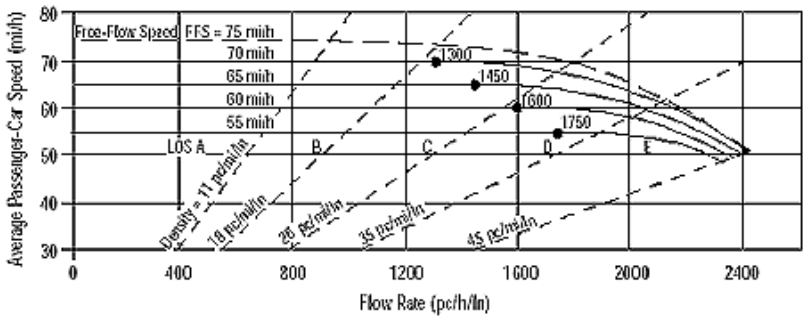
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2795	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	to I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 32

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	14050 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	3185	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	I-605 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 33

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 63.8 mph S_{FR} = 50.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	14050	0.90	Level	4	0	0.980	1.00	15923
Ramp	4650	0.90	Level	4	0	0.980	1.00	5270
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 7212 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	12739	9351	Yes
V_{12}	7212	4400:All	Yes
V_{FO} = V_F - V_R	7469	9351	No
V_R	5270	4100	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.1 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.707 (Exhibit 25-19)

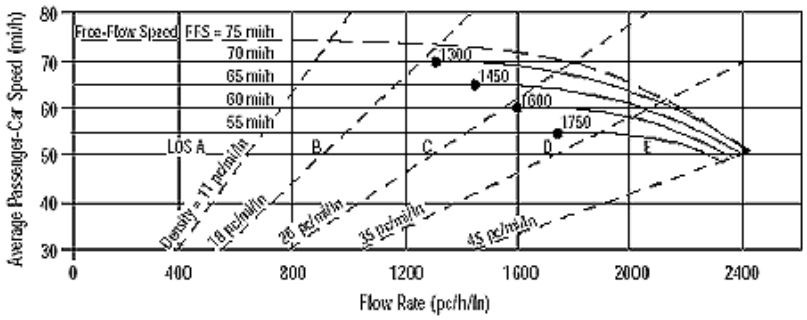
S_R= 48.4 mph (Exhibit 25-19)

S_0= 63.1 mph (Exhibit 25-19)

S = 53.8 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB OFR to I-605 Sb OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 34

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	9400 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2663	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	I-605 SB/NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 35

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 63.8 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9400	0.90	Level	4	0	0.980	1.00	10653
Ramp	1550	0.90	Level	4	0	0.980	1.00	1757
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.380 using Equation 4

V_{12}= 4053 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	12410	See Exhibit 25-7	Yes
V_{R12}	5810	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 42.5 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.538 (Exibit 25-19)

S_R= 30.3 mph (Exhibit 25-19)

S_0= 51.3 mph (Exhibit 25-19)

S= 38.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

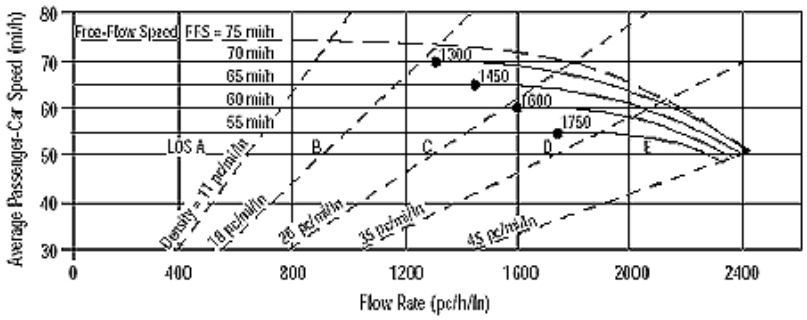
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	I-605 NB/SB ONR to Studeba ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 36

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10950 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	3103	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Studeb ONR - Palo Verde OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.09
Weaving seg length, L (ft)	1700	Weaving ratio, R	0.25
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	41	0.90	4	0	1.5	1.2	0.980	1.00	46
Vo2	10181	0.90	4	0	1.5	1.2	0.980	1.00	11538
Vw1	259	0.90	4	0	1.5	1.2	0.980	1.00	293
Vw2	769	0.90	4	0	1.5	1.2	0.980	1.00	871
Vw				1164	Vnw				11584
V									12748

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.95	0.50		
Weaving and non-weaving speeds, Si (mi/h)	43.15	51.60		

Number of lanes required for unconstrained operation, Nw 1.03
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	50.69
Weaving segment density, D (pc/mi/ln)	50.30
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	11220
Capacity as a 15-minute flow rate, c (veh/h)	11000
Capacity as a full-hour volume, c_h (veh/h)	9900

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Palo Verde ONR to Woodruff OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	66	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.06
Weaving seg length, L (ft)	1750	Weaving ratio, R	0.44
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	fHV	fp	v
Vo1	19	0.90	4	0	1.5	1.2	0.980	1.00	21
Vo2	10079	0.90	4	0	1.5	1.2	0.980	1.00	11422
Vw1	281	0.90	4	0	1.5	1.2	0.980	1.00	318
Vw2	361	0.90	4	0	1.5	1.2	0.980	1.00	409
Vw				727	Vnw				11443
V									12170

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.84	0.41		
Weaving and non-weaving speeds, Si (mi/h)	45.51	54.66		

Number of lanes required for unconstrained operation, Nw 0.80
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	54.01
Weaving segment density, D (pc/mi/ln)	45.06
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	11339
Capacity as a 15-minute flow rate, c (veh/h)	11117
Capacity as a full-hour volume, c_h (veh/h)	10005

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/16/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Woodruff ONR to Bellflower OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.06
Weaving seg length, L (ft)	890	Weaving ratio, R	0.50
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	31	0.90	4	0	1.5	1.2	0.980	1.00	35
Vo2	10049	0.90	4	0	1.5	1.2	0.980	1.00	11388
Vw1	309	0.90	4	0	1.5	1.2	0.980	1.00	350
Vw2	311	0.90	4	0	1.5	1.2	0.980	1.00	352
Vw				702	Vnw				11423
V									12125

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.42	0.68		
Weaving and non-weaving speeds, Si (mi/h)	37.69	47.82		

Number of lanes required for unconstrained operation, Nw 0.73
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	47.08
Weaving segment density, D (pc/mi/ln)	51.50
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	10148
Capacity as a 15-minute flow rate, c (veh/h)	9949
Capacity as a full-hour volume, c_h (veh/h)	8954

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons
Date Performed	10/17/2012
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-405 NB
Weaving Seg Location	Bellflower ONR to Lakewood OFR
Jurisdiction	
Analysis Year	2040 Alt 2

Inputs

Freeway free-flow speed, SFF (mi/h)	66	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.16
Weaving seg length, L (ft)	1300	Weaving ratio, R	0.45
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	52	0.90	4	0	1.5	1.2	0.980	1.00	58
Vo2	9092	0.90	4	0	1.5	1.2	0.980	1.00	10304
Vw1	818	0.90	4	0	1.5	1.2	0.980	1.00	927
Vw2	988	0.90	4	0	1.5	1.2	0.980	1.00	1119
Vw				2046	Vnw				10362
V									12408

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.74	0.34		
Weaving and non-weaving speeds, Si (mi/h)	47.21	56.67		

Number of lanes required for unconstrained operation, Nw 1.06
Maximum number of lanes, Nw (max) 3.50

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	54.86
Weaving segment density, D (pc/mi/ln)	45.24
Level of service, LOS	F
Capacity of base condition, c_b (pc/h)	11558
Capacity as a 15-minute flow rate, c (veh/h)	11331
Capacity as a full-hour volume, c_h (veh/h)	10198

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 46

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 65.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	10570	0.90	Level	4	0	0.980	1.00	11979
Ramp	300	0.90	Level	4	0	0.980	1.00	340
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.335 using Equation 4

V_{12}= 3172 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9819	See Exhibit 25-7	Yes
V_{R12}	3512	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 29.6 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.417 (Exibit 25-19)

S_R= 55.9 mph (Exhibit 25-19)

S_0= 54.2 mph (Exhibit 25-19)

S= 54.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

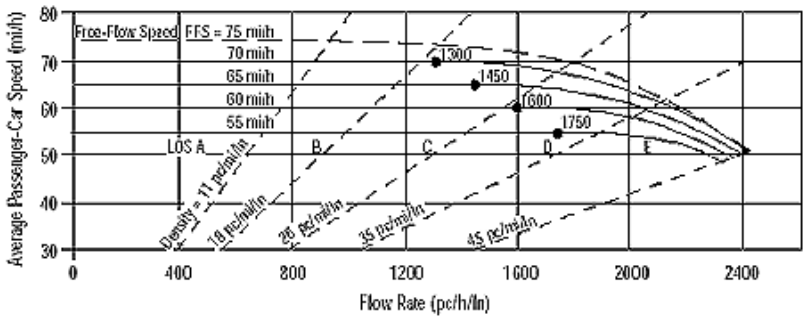
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-405 NB
Agency or Company	Parsons	From/To	Lakewood ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 47

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	10870 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	4
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.980

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	60.9	mi/h	FFS	60.9	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

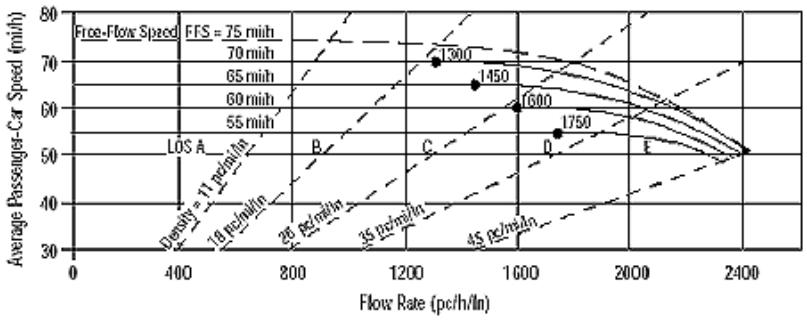
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2464	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	F		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	to I-40 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 48

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3530 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1981	pc/h/ln	Design LOS		
S	65.2	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	30.4	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 49

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	3530	0.90	Level	5	0	0.976	1.00	4020
Ramp	3150	0.90	Level	5	0	0.976	1.00	3588
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 4020 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	4020	4500	No
V_{12}	4020	4400:All	No
$V_{FO} = V_F - V_R$	432	4500	No
V_R	3588	3800	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 19.9 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.751 (Exhibit 25-19)

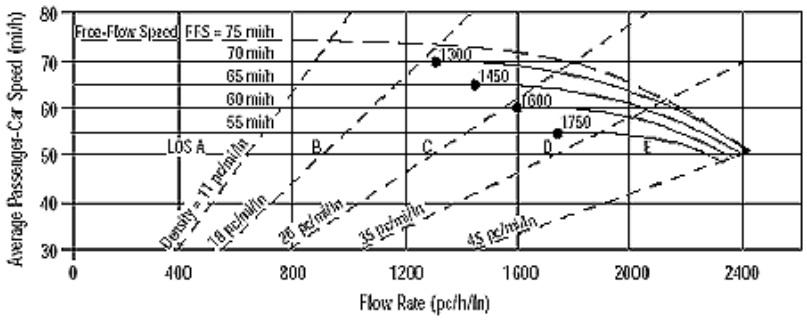
S_R= 45.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 45.2 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 50

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	380 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	60.0	mi/h	FFS	60.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	216	pc/h/ln	Design LOS		
S	60.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	3.6	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 51

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 62.8 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	1430	0.90	Level	5	0	0.976	1.00	1629
Ramp	480	0.90	Level	5	0	0.976	1.00	547
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =1.000 using Equation 0

V_{12} = 1629 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	1629	4655	No
V_{12}	1629	4400:All	No
$V_{FO} = V_F - V_R$	1082	4655	No
V_R	547	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 8.4 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.282 (Exhibit 25-19)

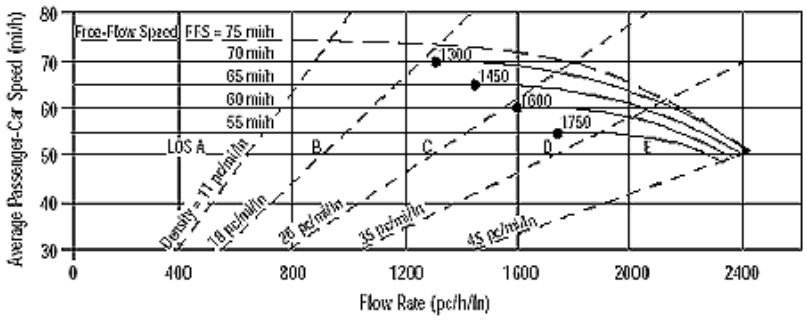
S_R= 56.9 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 52

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	960 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	62.8	mi/h	FFS	62.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

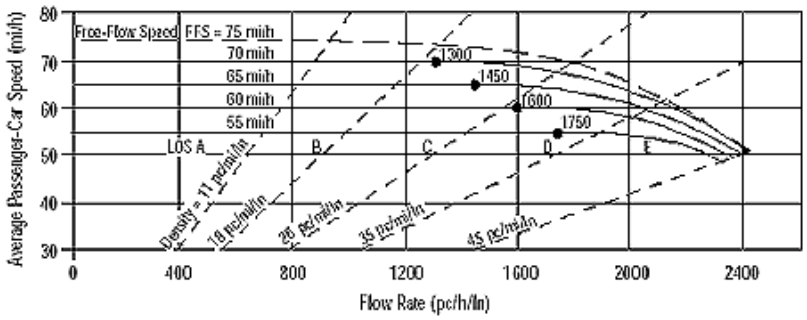
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	547	pc/h/ln	Design LOS		
S	62.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	8.7	pc/mi/ln	S		mi/h
LOS	A		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 NB ONR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 54

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4840 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	62.8	mi/h	FFS	62.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

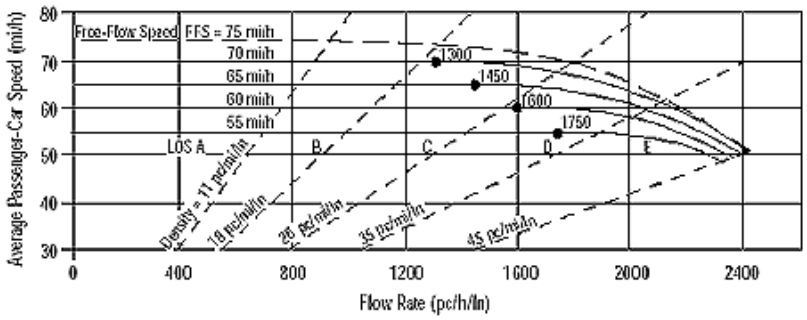
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1378	pc/h/ln	Design LOS		
S	62.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	21.9	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	I-405 SB ONR to Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 56

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	6140 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	62.8	mi/h	FFS	62.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1399	pc/h/ln	Design LOS		
S	62.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	22.3	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 57

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 62.8 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6140	0.90	Level	5	0	0.976	1.00	6993
Ramp	1760	0.90	Level	5	0	0.976	1.00	2004
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3722 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	5945	9311	No
V_{12}	3722	4400:All	No
$V_{FO} = V_F - V_R$	3941	9311	No
V_R	2004	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 7.5 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.543 (Exhibit 25-19)

S_R= 51.5 mph (Exhibit 25-19)

S_0= 68.5 mph (Exhibit 25-19)

S = 56.8 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Willow St ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 59

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 67.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4380	0.90	Level	5	0	0.976	1.00	4988
Ramp	1520	0.90	Level	5	0	0.976	1.00	1731
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.185 using Equation 4

V_{12}= 921 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6719	See Exhibit 25-7	No
V_{R12}	2652	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 21.8 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.336 (Exibit 25-19)

S_R= 59.1 mph (Exhibit 25-19)

S_0= 62.3 mph (Exhibit 25-19)

S= 61.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

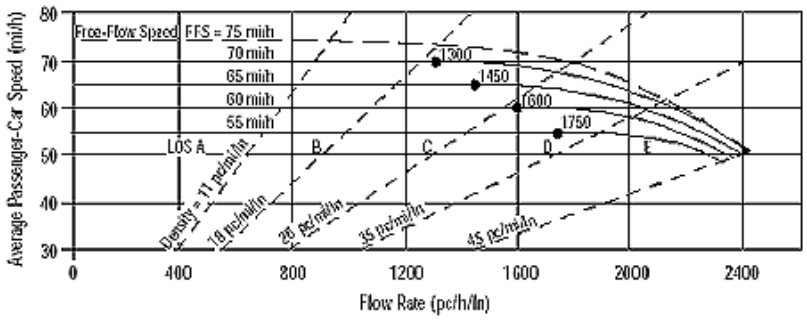
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Willow St ONR to Cerritos ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 60

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5900 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1680	pc/h/ln	Design LOS		
S	68.9	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	24.4	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Cerritos Ave ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 61

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 60.5 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5900	0.90	Level	5	0	0.976	1.00	6719
Ramp	1120	0.90	Level	5	0	0.976	1.00	1276
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.122 using Equation 4

V_{12}= 820 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7995	See Exhibit 25-7	No
V_{R12}	2096	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.0 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.339 (Exibit 25-19)

S_R= 54.2 mph (Exhibit 25-19)

S_0= 50.1 mph (Exhibit 25-19)

S= 51.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

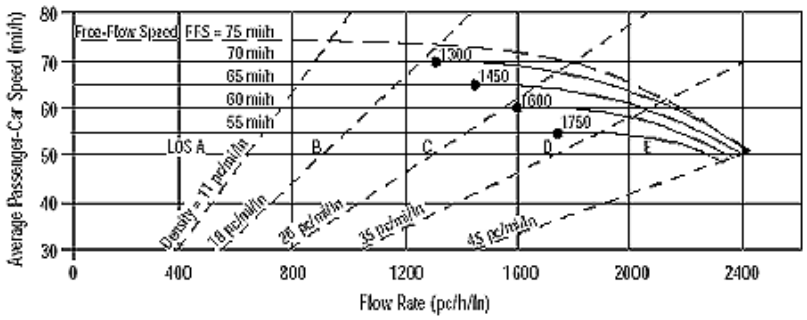
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 NB
Agency or Company	Parsons	From/To	Cerritos ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 62

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	7020 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	59.6	mi/h	FFS	59.6	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1999	pc/h/ln	Design LOS		
S	57.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	34.7	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 63

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 59.6 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	7020	0.90	Level	5	0	0.976	1.00	7995
Ramp	1060	0.90	Level	5	0	0.976	1.00	1207
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4167 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7995	9183	No
V_{12}	4167	4400:All	No
V_{FO} = V_F - V_R	6788	9183	No
V_R	1207	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.4 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.537 (Exhibit 25-19)

S_R= 50.2 mph (Exhibit 25-19)

S_0= 61.8 mph (Exhibit 25-19)

S = 55.1 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 65

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 58.0 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	5960	0.90	Level	5	0	0.976	1.00	6788
Ramp	590	0.90	Level	5	0	0.976	1.00	672
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.317 using Equation 4

V_{12}= 2152 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7460	See Exhibit 25-7	No
V_{R12}	2824	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.6 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.346 (Exibit 25-19)

S_R= 52.5 mph (Exhibit 25-19)

S_0= 51.4 mph (Exhibit 25-19)

S= 51.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 68

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 65.4 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7170	0.90	Level	5	0	0.976	1.00	8166
Ramp	490	0.90	Level	5	0	0.976	1.00	558
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.228 using Equation 4

V_{12}= 1859 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8724	See Exhibit 25-7	No
V_{R12}	2417	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.5 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.347 (Exibit 25-19)

S_R= 57.3 mph (Exhibit 25-19)

S_0= 53.8 mph (Exhibit 25-19)

S= 54.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 70

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.5 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	7650	0.90	Level	5	0	0.976	1.00	8713
Ramp	350	0.90	Level	5	0	0.976	1.00	399
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.232 using Equation 4

V_{12}= 2018 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9112	See Exhibit 25-7	No
V_{R12}	2417	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.9 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.351 (Exibit 25-19)

S_R= 56.0 mph (Exhibit 25-19)

S_0= 50.7 mph (Exhibit 25-19)

S= 52.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

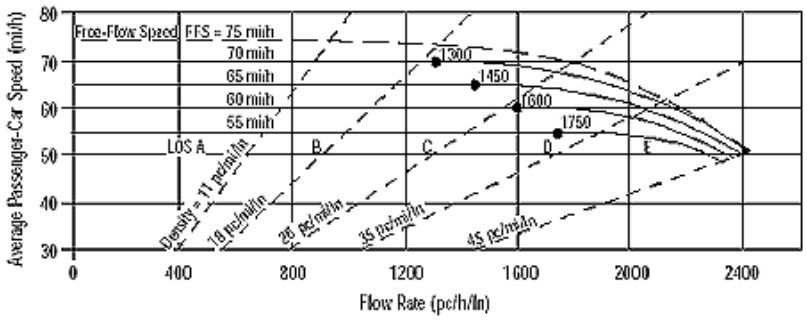
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Carson ONR to 5 lane section
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 71

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8000 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

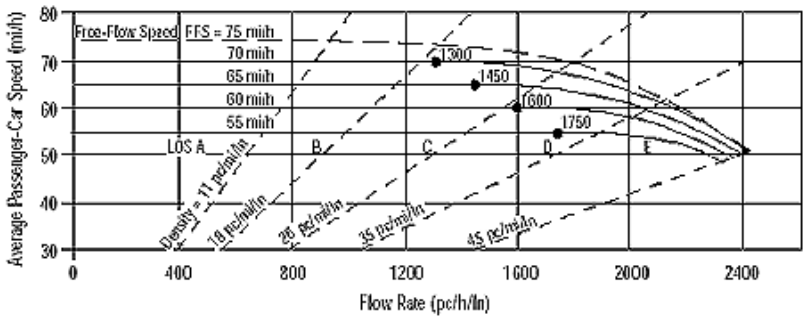
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2278	pc/h/ln	Design LOS		
S	54.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	42.2	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	5 lane section to Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 72

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	8000 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	5		f_N		mi/h
FFS (measured)	63.8	mi/h	FFS	63.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1822	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	62.7	mi/h	S	mi/h
D = v_p / S	29.0	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	D		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Spring OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 73

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 63.8 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8000	0.90	Level	5	0	0.976	1.00	9111
Ramp	1550	0.90	Level	5	0	0.976	1.00	1765
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4173 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7289	9351	No
V_{12}	4173	4400:All	No
V_{FO} = V_F - V_R	5524	9351	No
V_R	1765	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.3 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.652 (Exhibit 25-19)

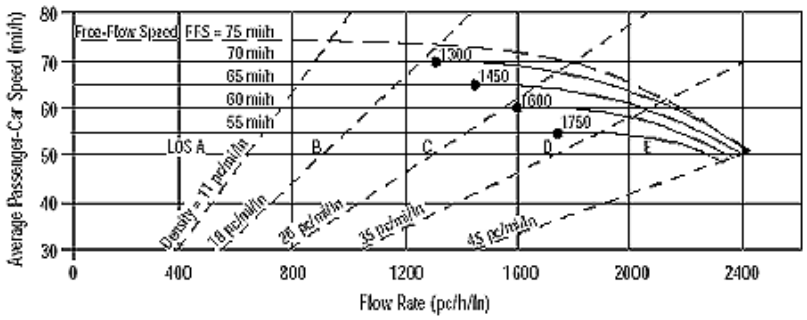
S_R= 49.6 mph (Exhibit 25-19)

S_0= 67.8 mph (Exhibit 25-19)

S = 56.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Spring OFR to Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 74

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	6450 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1836	pc/h/ln	Design LOS		
S	67.4	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	27.2	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 75

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 61.4 mph S_{FR} = 30.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6450	0.90	Level	5	0	0.976	1.00	7346
Ramp	630	0.90	Level	5	0	0.976	1.00	718
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3608 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	7346	9256	No
V_{12}	3608	4400:All	No
V_{FO} = V_F - V_R	6628	9256	No
V_R	718	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.3 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.558 (Exhibit 25-19)

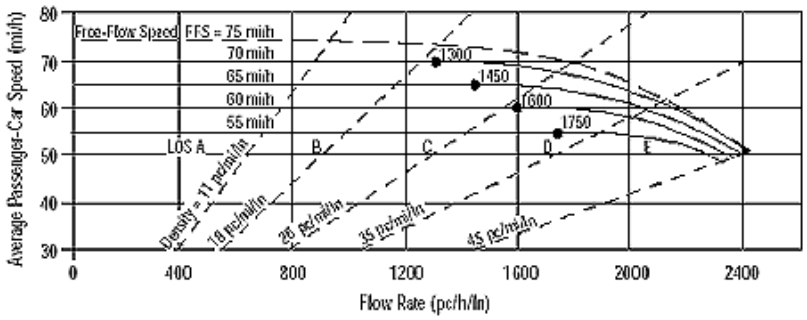
S_R= 50.6 mph (Exhibit 25-19)

S_0= 64.0 mph (Exhibit 25-19)

S = 56.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow OFR to Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 76

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5820 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	61.4	mi/h	FFS	61.4	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1657	pc/h/ln	Design LOS		
S	61.3	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	27.0	pc/mi/ln	S		mi/h
LOS	D		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow OFR CD
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 77

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☐ No ☐ Off
L_{up} = ft
Vu = veh/h

Terrain
S_{FF} = 55.0 mph S_{FR} = 30.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☐ No ☐ Off
L_{down} = ft
VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5820	0.90	Level	5	0	0.976	1.00	6628
Ramp	1110	0.90	Level	5	0	0.976	1.00	1264
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3603 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	6628	9000	No
V_{12}	3603	4400:All	No
$V_{FO} = V_F - V_R$	5364	9000	No
V_R	1264	2000	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.2 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.607 (Exhibit 25-19)

S_R= 47.1 mph (Exhibit 25-19)

S_0= 58.3 mph (Exhibit 25-19)

S = 51.6 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 79

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4720	0.90	Level	5	0	0.976	1.00	5376
Ramp	870	0.90	Level	5	0	0.976	1.00	991
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.381 using Equation 4

V_{12}= 2046 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6367	See Exhibit 25-7	No
V_{R12}	3037	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.1 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.339 (Exibit 25-19)

S_R= 50.6 mph (Exhibit 25-19)

S_0= 50.8 mph (Exhibit 25-19)

S= 50.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

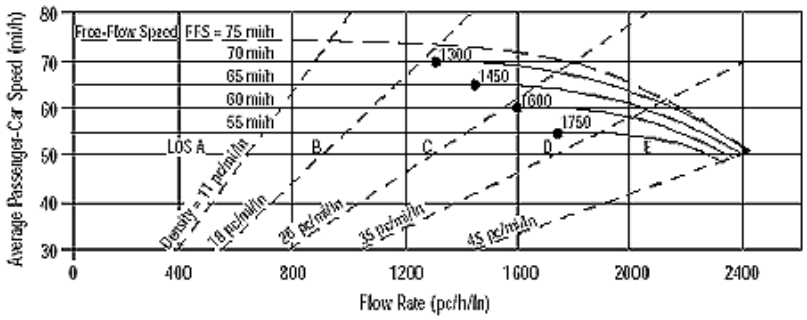
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	Willow ONR CD to I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 84

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	5580 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	59.8	mi/h	FFS	59.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1589	pc/h/ln	Design LOS	
S	59.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	26.6	pc/mi/ln	S	mi/h
LOS	D		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 NB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 85

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 59.8 mph S_{FR} = 50.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	5580	0.90	Level	5	0	0.976	1.00	6355
Ramp	1040	0.90	Level	5	0	0.976	1.00	1184
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 3439 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	6355	9191	No
V_{12}	3439	4400:All	No
V_{FO} = V_F - V_R	5171	9191	No
V_R	1184	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.4 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.340 (Exhibit 25-19)

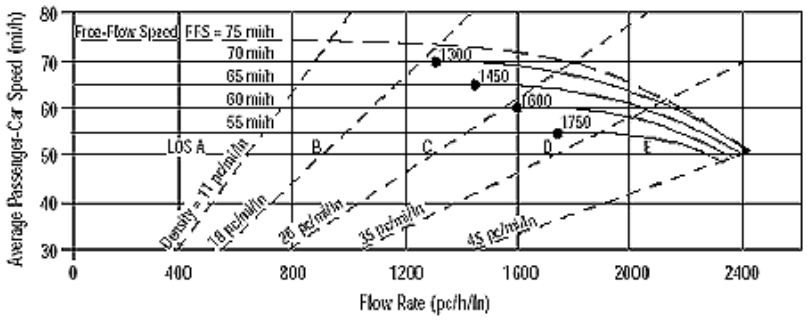
S_R= 53.8 mph (Exhibit 25-19)

S_0= 63.8 mph (Exhibit 25-19)

S = 57.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 NB OFR to I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 86

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4550 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	4		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1295	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	18.5	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 87

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

Vu = veh/h

Terrain

S_{FF} = 59.8 mph S_{FR} = 59.8 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4550	0.90	Level	5	0	0.976	1.00	5182
Ramp	3640	0.90	Level	5	0	0.976	1.00	4146
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.260 using Equation 0

V_{12} = 4415 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	5182	9191	No
V_{12}	4415	4400:All	Yes
$V_{FO} = V_F - V_R$	1036	9191	No
V_R	4146	4400	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -44.2 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.479 (Exhibit 25-19)

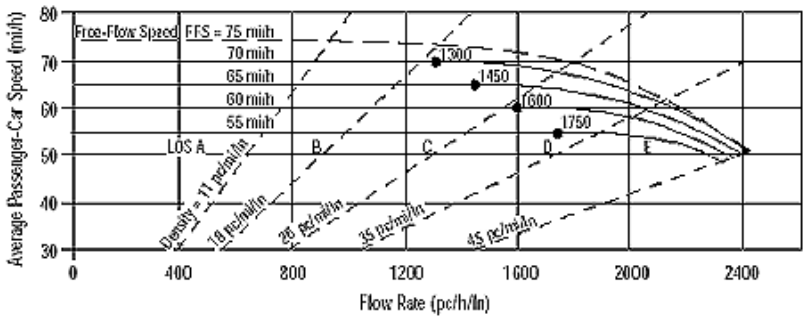
S_R= 51.3 mph (Exhibit 25-19)

S_0= 65.6 mph (Exhibit 25-19)

S = 53.0 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB OFR to I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 88 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	1820 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	59.8	mi/h	FFS	59.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1036	pc/h/ln	Design LOS		
S	59.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	17.3	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	I-405 SB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 89 coded as 2 lanes, double volume

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 59.8 mph S_{FR} = 50.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	1820	0.90	Level	5	0	0.976	1.00	2073
Ramp	130	0.90	Level	5	0	0.976	1.00	148
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2073 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2221	See Exhibit 25-7	No
V_{R12}	2221	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.5 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.322 (Exibit 25-19)

S_R= 54.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 54.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

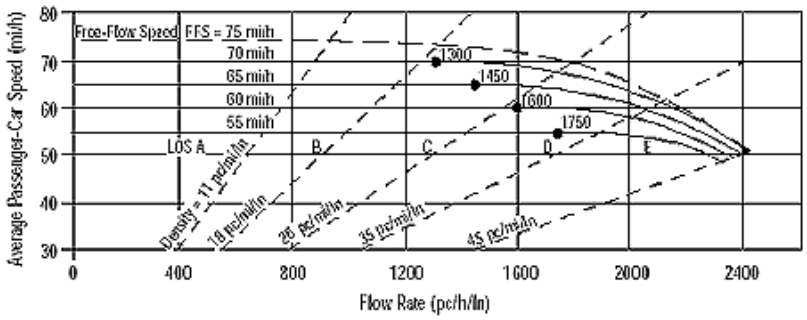
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	I-605 SB
Agency or Company	Parsons	From/To	I-405 SB ONR to I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 90 coded as 2 lanes, double volume

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	2080 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	5
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.976

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	59.8	mi/h	FFS	59.8	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1184	pc/h/ln	Design LOS		
S	59.8	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	19.8	pc/mi/ln	S		mi/h
LOS	C		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	I-405 NB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 91 coded for ramp being the mainline

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 55.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	3080	0.90	Level	2	0	0.990	1.00	3456
Ramp	1040	0.90	Level	2	0	0.990	1.00	1167
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 3456 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	4623	See Exhibit 25-7	Yes
V_{R12}	4623	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 39.4 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.691 (Exibit 25-19)

S_R= 46.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 46.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

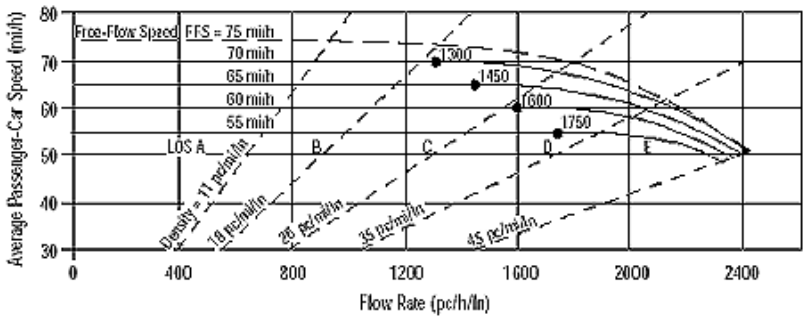
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	I-405 NB ONR to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 92

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	4120 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	2		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	2312	pc/h/ln	Design LOS		
S	56.6	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	40.9	pc/mi/ln	S		mi/h
LOS	E		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 95

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2530	0.90	Level	2	0	0.990	1.00	2839
Ramp	550	0.90	Level	2	0	0.990	1.00	617
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2839 pc/h

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3456	See Exhibit 25-7	No
V_{R12}	3456	4600:All	No

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.7 (pc/ m/ln)

LOS = C (Exhibit 25-4)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.340 (Exibit 25-19)

S_R= 50.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 50.6 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

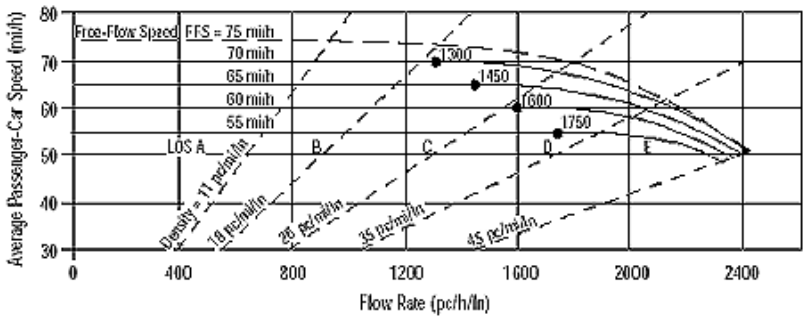
S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St WB
Agency or Company	Parsons	From/To	StudeB ONR to
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 96

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	3080 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

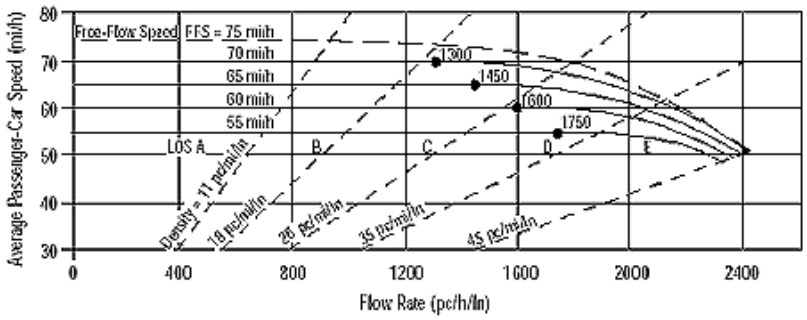
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1152	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	16.5	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst		Highway/Direction of Travel	7th St EB
Agency or Company	Parsons	From/To	to StudeB OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 97

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	2770 veh/h	Peak-Hour Factor, PHF	0.90
AADT	veh/day	%Trucks and Buses, P_T	2
Peak-Hr Prop. of AADT, K		%RVs, P_R	0
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade % Length	mi
Driver type adjustment	1.00	Up/Down %	

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.990

Speed Inputs / Calc Speed Adj and FFS

Lane Width	12.0	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	6.0	ft	f_{LC}		mi/h
Interchange Density	0.50	I/mi	f_{ID}		mi/h
Number of Lanes, N	3		f_N		mi/h
FFS (measured)	70.0	mi/h	FFS	70.0	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	1036	pc/h/ln	Design LOS		
S	70.0	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	14.8	pc/mi/ln	S		mi/h
LOS	B		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

HCS2000™ Copyright © 2003 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 98

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 30.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	2770	0.90	Level	5	0	0.976	1.00	3155
Ramp	790	0.90	Level	5	0	0.976	1.00	900
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =1.000 using Equation 0
V_{12}= pc/h	V_{12} = 3155 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	3155	4500	No
V_{12}	3155	4400:All	No
V_{FO} = V_F - V_R	2255	4500	No
V_R	900	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.574 (Exhibit 25-19)

S_R= 47.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 47.5 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	7th St EB
Agency or Company	Parsons	Junction	StudeB ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 100

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1990	0.90	Level	2	0	0.990	1.00	2233
Ramp	1540	0.90	Level	2	0	0.990	1.00	1728
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2233 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3961	See Exhibit 25-7	No
V_{R12}	3961	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 33.1 (pc/ m/ln)

LOS = D (Exhibit 25-4)

Speed Estimation

M_S = 0.498 (Exibit 25-19)

S_R= 48.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 48.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Lakewood Blvd Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 101

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 66.2 mph S_{FR} = 20.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10950	0.90	Level	4	0	0.980	1.00	12410
Ramp	1040	0.90	Level	4	0	0.980	1.00	1179
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 3454 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9928	9447	Yes
V_{12}	3454	4400:All	No
V_{FO} = V_F - V_R	8749	9447	No
V_R	1179	3500	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.8 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.729 (Exhibit 25-19)

S_R= 48.6 mph (Exhibit 25-19)

S_0= 63.9 mph (Exhibit 25-19)

S = 57.6 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 102

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 65.8 mph S_{FR} = 45.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10740	0.90	Level	4	0	0.980	1.00	12172
Ramp	380	0.90	Level	4	0	0.980	1.00	431
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4489 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9738	9432	Yes
V_{12}	4489	4400:All	Yes
V_{FO} = V_F - V_R	9307	9432	No
V_R	431	2100	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.4 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.337 (Exhibit 25-19)

S_R= 57.8 mph (Exhibit 25-19)

S_0= 65.8 mph (Exhibit 25-19)

S = 61.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Woodruff Ave Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 103

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 25.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	9930	0.90	Level	4	0	0.980	1.00	11254
Ramp	670	0.90	Level	4	0	0.980	1.00	759
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4354 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9004	9000	Yes
V_{12}	4354	4400:All	No
V_{FO} = V_F - V_R	8245	9000	No
V_R	759	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.7 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.626 (Exhibit 25-19)

S_R= 46.9 mph (Exhibit 25-19)

S_0= 55.2 mph (Exhibit 25-19)

S = 50.8 mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 104

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 64.7 mph S_{FR} = 20.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10700	0.90	Level	4	0	0.980	1.00	12127
Ramp	620	0.90	Level	4	0	0.980	1.00	703
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4627 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9702	9387	Yes
V_{12}	4627	4400:All	Yes
V_{FO} = V_F - V_R	8999	9387	No
V_R	703	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.0 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.686 (Exhibit 25-19)

S_R= 49.1 mph (Exhibit 25-19)

S_0= 65.0 mph (Exhibit 25-19)

S = 56.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 105

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10430	0.90	Level	4	0	0.980	1.00	11821
Ramp	2080	0.90	Level	4	0	0.980	1.00	2357
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.260 using Equation 0
V_{12}= pc/h	V_{12} = 4203 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9457	9000	Yes
V_{12}	4203	4400:All	No
V_{FO} = V_F - V_R	7100	9000	No
V_R	2357	3800	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.2 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.640 (Exhibit 25-19)

S_R= 46.7 mph (Exhibit 25-19)

S_0= 54.0 mph (Exhibit 25-19)

S = 50.5 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 106

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 65.0 mph S_{FR} = 20.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	11250	0.90	Level	4	0	0.980	1.00	12750
Ramp	810	0.90	Level	4	0	0.980	1.00	918
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4965 pc/h

Capacity Checks

	Actual	Maximum	LOS F?		Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7		V_{FI}=V_F	10200	9400	Yes
				V_{12}	4965	4400:All	Yes
V_{R12}		4600:All		V_{FO} = V_F - V_R	9282	9400	No
				V_R	918	1900	No

Level of Service Determination (if not F)

Merge Areas	Diverge Areas
$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$	$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$
D_R = (pc/ mi /ln)	D_R = 32.6 (pc/ mi /ln)
LOS = (Exhibit 25-4)	LOS= F (Exhibit 25-4)

Speed Estimation

Merge Areas	Diverge Areas
M_S = (Exibit 25-19)	D_s = 0.706 (Exhibit 25-19)
S_R= mph (Exhibit 25-19)	S_R= 48.8 mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)	S_0= 65.0 mph (Exhibit 25-19)
S= mph (Exhibit 25-14)	S = 55.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Studebaker Offramp
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 107

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 25.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	10220	0.90	Level	4	0	0.980	1.00	11583
Ramp	330	0.90	Level	4	0	0.980	1.00	374
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =0.436 using Equation 8
V_{12}= pc/h	V_{12} = 4251 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	9267	9000	Yes
V_{12}	4251	4400:All	No
V_{FO} = V_F - V_R	8893	9000	No
V_R	374	1900	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.6 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.592 (Exhibit 25-19)

S_R= 47.3 mph (Exhibit 25-19)

S_0= 54.5 mph (Exhibit 25-19)

S = 50.9 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	7th Street OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 108

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 45.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8830	0.90	Level	4	0	0.980	1.00	10007
Ramp	130	0.90	Level	4	0	0.980	1.00	147
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4446 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	10007	9000	Yes
V_{12}	4446	4400:All	Yes
$V_{FO} = V_F - V_R$	9860	9000	Yes
V_R	147	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 40.7 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.311 (Exhibit 25-19)

S_R= 51.0 mph (Exhibit 25-19)

S_0= 53.4 mph (Exhibit 25-19)

S = 52.3 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-605 SB
Agency or Company	Parsons	Junction	Carson OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 109

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 65.4 mph S_{FR} = 25.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	8760	0.90	Level	5	0	0.976	1.00	9977
Ramp	1600	0.90	Level	5	0	0.976	1.00	1822
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.260 using Equation 0

V_{12} = 3424 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7982	9416	No
V_{12}	3424	4400:All	No
$V_{FO} = V_F - V_R$	6160	9416	No
V_R	1822	3500	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.5 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.722 (Exhibit 25-19)

S_R= 48.5 mph (Exhibit 25-19)

S_0= 66.8 mph (Exhibit 25-19)

S = 57.5 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Willow ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 111

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9750	0.90	Level	4	0	0.980	1.00	11050
Ramp	690	0.90	Level	4	0	0.980	1.00	782
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.216 using Equation 4

V_{12}= 1844 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9332	See Exhibit 25-7	Yes
V_{R12}	2626	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.7 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.354 (Exibit 25-19)

S_R= 50.4 mph (Exhibit 25-19)

S_0= 42.2 mph (Exhibit 25-19)

S= 44.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	7th St WB
Agency or Company	Parsons	Junction	Studebaker OFR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 110

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 55.0 mph S_{FR} = 30.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	4120	0.90	Level	5	0	0.976	1.00	4692
Ramp	1580	0.90	Level	5	0	0.976	1.00	1799
UpStream								
DownStream								

Merge Areas	Diverge Areas
Estimation of v_{12}	**Estimation of v_{12}**
$V_{12} = V_F (P_{FM})$	$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-2 or 25-3)	L_{EQ} = (Equation 25-8 or 25-9)
P_{FM}= using Equation	P_{FD} =1.000 using Equation 0
V_{12}= pc/h	V_{12} = 4692 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

Capacity Checks

	Actual	Maximum	LOS F?
V_{FI}=V_F	4692	4500	Yes
V_{12}	4692	4400:All	Yes
V_{FO} = V_F - V_R	2893	4500	No
V_R	1799	2000	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/ mi /ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 42.6 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Speed Estimation

D_s = 0.655 (Exhibit 25-19)

S_R= 46.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 46.5 mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Lakewood ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 112

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.2 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9910	0.90	Level	4	0	0.980	1.00	11231
Ramp	660	0.90	Level	4	0	0.980	1.00	748
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.602 using Equation 4

V_{12}= 6763 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11979	See Exhibit 25-7	Yes
V_{R12}	7511	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 54.3 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 7.345 (Exibit 25-19)

S_R= -111.6 mph (Exhibit 25-19)

S_0= 60.0 mph (Exhibit 25-19)

S= 1665.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 113

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.4 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	10080	0.90	Level	4	0	0.980	1.00	11424
Ramp	870	0.90	Level	4	0	0.980	1.00	986
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.209 using Equation 0

V_{12}= 2388 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	12410	See Exhibit 25-7	Yes
V_{R12}	3374	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 15.0 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.253 (Exibit 25-19)

S_R= 58.0 mph (Exhibit 25-19)

S_0= 43.6 mph (Exhibit 25-19)

S= 46.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Bellflower ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 114

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	8360	0.90	Level	4	0	0.980	1.00	9475
Ramp	1580	0.90	Level	4	0	0.980	1.00	1791
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.312 using Equation 4

V_{12}= 2961 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11266	See Exhibit 25-7	Yes
V_{R12}	4752	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 35.4 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.703 (Exibit 25-19)

S_R= 45.9 mph (Exhibit 25-19)

S_0= 42.7 mph (Exhibit 25-19)

S= 44.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Woodruff ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 115

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 66.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	10360	0.90	Level	4	0	0.980	1.00	11741
Ramp	340	0.90	Level	4	0	0.980	1.00	385
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.456 using Equation 4

V_{12}= 5358 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	12126	See Exhibit 25-7	Yes
V_{R12}	5743	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 44.5 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 1.475 (Exibit 25-19)

S_R= 30.6 mph (Exhibit 25-19)

S_0= 54.1 mph (Exhibit 25-19)

S= 39.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Palo Verde ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 116

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 65.6 mph S_{FR} = 35.0 mph	V_D = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	10440	0.90	Level	4	0	0.980	1.00	11832
Ramp	300	0.90	Level	4	0	0.980	1.00	340
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.749 using Equation 4

V_{12}= 8859 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	12172	See Exhibit 25-7	Yes
V_{R12}	9199	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 65.8 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 38.755 (Exibit 25-19)

S_R= -849.0 mph (Exhibit 25-19)

S_0= 62.1 mph (Exhibit 25-19)

S= 328.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 SB
Agency or Company	Parsons	Junction	Stearns ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 117

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	9640	0.90	Level	4	0	0.980	1.00	10925
Ramp	580	0.90	Level	4	0	0.980	1.00	657
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.231 using Equation 4

V_{12}= 2526 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	11582	See Exhibit 25-7	Yes
V_{R12}	3183	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 28.1 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.394 (Exibit 25-19)

S_R= 49.9 mph (Exhibit 25-19)

S_0= 37.1 mph (Exhibit 25-19)

S= 39.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-405 NB
Agency or Company	Parsons	Junction	Studebaker ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 118

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 63.8 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	10950	0.90	Level	4	0	0.980	1.00	12410
Ramp	300	0.90	Level	4	0	0.980	1.00	340
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.749 using Equation 4

V_{12}= 9292 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	12750	See Exhibit 25-7	Yes
V_{R12}	9632	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 69.2 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 59.650 (Exibit 25-19)

S_R= -1236.6 mph (Exhibit 25-19)

S_0= 60.0 mph (Exhibit 25-19)

S= 288.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

Copyright © 2000 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

General Information		Site Information	
Analyst2		Freeway/Dir of Travel	I-605 NB
Agency or Company	Parsons	Junction	Carson ONR
Date Performed	10/16/2012	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2040 Alt 2

Project Description Segment ID 119

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Level

S_{FF} = 57.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	$v=V/PHF\ f_{HV}\ f_p$
Freeway	6550	0.90	Level	5	0	0.976	1.00	7460
Ramp	740	0.90	Level	5	0	0.976	1.00	843
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.240 using Equation 4

V_{12}= 1789 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8303	See Exhibit 25-7	No
V_{R12}	2632	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.1 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.347 (Exibit 25-19)

S_R= 51.8 mph (Exhibit 25-19)

S_0= 47.3 mph (Exhibit 25-19)

S= 48.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1f

This page intentionally left blank.