Calibration Notes

SimTraffic calibration was done for existing conditions, see Technical Memorandum #2.

Operations Analysis

Balanced forecast 2045 volumes were input into the AM peak and PM peak calibrated networks for intersection analysis using Synchro and SimTraffic. Intersection analysis summaries are provided in Figures D-3 through D-34, used for V/C calculation and LOS at ODOT intersections. Figures D-35 through D-44 provide the intersection summary reports with PHF set to 1 throughout the network to get LOS values for the five City of Medford intersections:

- Barnett Road at Stewart Avenue
- Barnett Road at Alba Drive
- Barnett Road at Highland Drive
- Barnett Road at Ellendale Drive
- Riverside/ OR 99 at Stewart Avenue

For AM peak, Synchro could not produce an HCM 6th Edition report, nor an HCM 2010 report at three intersections; the HCM 2000 report was used for manual V/C calculations. PM peak had the same issue for those intersections, and also Barnett Road at Highland Drive due to lower speed limits input for calibration.

- Barnett Road at Stewart Avenue
- Barnett Road at Alba Drive
- Garfield Street at the I-5 Exit 27 Interchange
- PM only: Barnett Road at Highland Drive

Signal timing and phasing are shown in Figures D-45 through D-68.
Freeway analysis HCS7 reports can be found in Figures D-69 through D-88.
Queuing and blocking reports are in Figures D-89 through D-104.

Note that at the Garfield Street intersection with Center Drive,
Garfield Street runs E-W in Synchro, Center Drive runs N-S.

Manual V/C calculation files are provided below.

VCcalc_2045_AM.xlsx

VCcalc_2045_PM.xlsx

Intersection Analysis Reports from Synchro

Figure D-3: AM Peak Barnett Road at Stewart Avenue HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 02/10/2021

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	345	65	265	565	135	565
Future Volume (vph)	345	65	265	565	135	565
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	5.0	5.5
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3197	1444	1630	3197	1630	2592
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3197	1444	1630	3197	1630	2592
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	371	70	285	608	145	608
RTOR Reduction (vph)	0	55	0	0	0	217
Lane Group Flow (vph)	371	15	285	608	145	391
Heavy Vehicles (%)	4%	3%	2%	4%	2%	1%
Turn Type	NA	Perm	Split	NA	Prot	pt+ov
Protected Phases	4		3	3	5	2 3
Permitted Phases		4				2 3
Actuated Green, G (s)	15.2	15.2	22.2	22.2	12.3	46.5
Effective Green, g (s)	15.2	15.2	22.2	22.2	11.3	45.5
Actuated g/C Ratio	0.21	0.21	0.31	0.31	0.16	0.64
Clearance Time (s)	4.5	4.5	4.5	4.5	4.0	
Vehicle Extension (s)	4.2	4.2	2.0	2.0	0.2	
Lane Grp Cap (vph)	687	310	511	1003	260	1668
v/s Ratio Prot	c0.12		0.17	c0.19	c0.09	c0.15
v/s Ratio Perm		0.01				
v/c Ratio	0.54	0.05	0.56	0.61	0.56	0.23
Uniform Delay, d1	24.6	22.0	20.2	20.5	27.4	5.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.1	0.8	0.7	1.5	0.1
Delay (s)	25.8	22.1	20.9	21.3	28.9	5.3
Level of Service	C	C	C	C	C	A
Approach Delay (s)	25.2			21.2	9.9	
Approach LOS	C			C	A	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	70.7	Sum of lost time (s)	19.5
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-4: AM Peak Barnett Road at Stewart Avenue HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
83: Stewart Avenue & Barnett Road 02/10/2021

HCM 6th Edition methodology does not support exclusive ped or hold phases.

Figure D-5: AM Peak Barnett Road at Alba Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
91: Alba Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	905	0	0	810	15	0	0	0	15	0	20
Future Volume (vph)	5	905	0	0	810	15	0	0	0	15	0	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0					5.5		4.5
Lane Util. Factor	1.00	0.95			0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00			1.00					1.00		1.00
Frt	1.00	1.00			1.00					1.00		0.85
Flt Protected	0.95	1.00			1.00					0.95		1.00
Satd. Flow (prot)	1646	3197			3156					1625		1454
Flt Permitted	0.22	1.00			1.00					0.95		1.00
Satd. Flow (perm)	382	3197			3156					1625		1454
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	6	1052	0	0	942	17	0	0	0	17	0	23
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	19
Lane Group Flow (vph)	6	1052	0	0	958	0	0	0	0	17	0	4
Confl. Peds. (#/hr)	5		3	3		5	1		5	5		1
Heavy Vehicles (%)	1%	4%	2%	2%	5%	7%	2%	2%	2%	2%	2%	1%
Turn Type	pm+pt	NA		Prot	NA					Perm		Perm
Protected Phases	7	4		3	8							
Permitted Phases	4									2		6
Actuated Green, G (s)	35.3	35.3			30.4					9.4		10.4
Effective Green, g (s)	34.8	35.3			30.4					8.9		9.9
Actuated g/C Ratio	0.64	0.65			0.56					0.16		0.18
Clearance Time (s)	4.0	5.0			5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0			5.0					0.2		5.0
Lane Grp Cap (vph)	252	2063			1753					264		263
v/s Ratio Prot	0.00	c0.33			0.30							
v/s Ratio Perm	0.01									c0.01		0.00
v/c Ratio	0.02	0.51			0.55					0.06		0.02
Uniform Delay, d1	4.4	5.1			7.8					19.4		18.4
Progression Factor	1.00	1.00			1.00					1.00		1.00
Incremental Delay, d2	0.1	0.4			0.6					0.0		0.1
Delay (s)	4.5	5.5			8.4					19.4		18.4
Level of Service	A	A			A					B		B
Approach Delay (s)		5.5			8.4			0.0			18.9	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	54.7	Sum of lost time (s)	14.5
Intersection Capacity Utilization	39.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Figure D-6: AM Peak Barnett Road at Alba Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
91: Alba Drive & Barnett Road 02/10/2021

HCM 6th Edition methodology does not support Non-NEMA phasing.

Figure D-7: AM Peak Barnett Road at Highland Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
90: Highland Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	680	125	900	580	125	115	470	1305	150	535	130
Future Volume (vph)	115	680	125	900	580	125	115	470	1305	150	535	130
Ideal Flow (vphpl)	1790	1790	1790	1850	1850	1850	1750	1750	1700	1740	1740	1740
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.97	
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)	3266	3334	1477	3310	3358		1554	3292	1417	1637	3149	
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)	3266	3334	1477	3310	3358		1554	3292	1417	1637	3149	
Peak-hour factor, PHF	0.94	0.74	0.94	0.95	0.91	0.88	0.80	0.74	0.80	0.71	0.85	0.82
Adj. Flow (vph)	122	919	133	947	637	142	144	635	1631	211	629	159
RTOR Reduction (vph)	0	0	50	0	13	0	0	0	22	0	16	0
Lane Group Flow (vph)	122	919	83	947	766	0	144	635	1609	211	772	0
Heavy Vehicles (%)	1%	2%	3%	3%	2%	1%	7%	1%	2%	1%	1%	5%
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	7	4	5	3	8		5	2	3	1	6	
Permitted Phases			4						2			
Actuated Green, G (s)	9.0	42.8	52.3	30.5	64.3		9.5	42.0	72.5	9.5	42.0	
Effective Green, g (s)	9.0	42.8	52.3	30.5	64.3		9.5	42.0	72.5	9.5	42.0	
Actuated g/C Ratio	0.06	0.30	0.37	0.21	0.45		0.07	0.29	0.51	0.07	0.29	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	1.5	4.2	1.5	1.5	4.2		1.5	2.5	1.5	1.5	2.5	
Lane Grp Cap (vph)	205	999	540	706	1512		103	968	719	108	926	
v/s Ratio Prot	0.04	c0.28	0.01	0.29	0.23		0.09	0.19	c0.48	c0.13	0.25	
v/s Ratio Perm			0.05						0.66			
v/c Ratio	0.60	0.92	0.15	1.34	0.51		1.40	0.66	2.24	1.95	0.83	
Uniform Delay, d1	65.1	48.3	30.4	56.2	28.0		66.7	44.1	35.2	66.7	47.1	
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	3.1	13.3	0.0	163.1	0.4		227.5	3.5	561.4	461.0	8.8	
Delay (s)	68.2	61.7	30.4	219.2	28.4		294.1	47.5	596.6	527.6	55.9	
Level of Service	E	E	C	F	C		F	D	F	F	E	
Approach Delay (s)		58.8			133.1			433.8			155.5	
Approach LOS		E			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	237.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.76		
Actuated Cycle Length (s)	142.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	130.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-8: AM Peak Barnett Road at Highland Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
90: Highland Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	680	125	900	580	125	115	470	1305	150	535	130
Future Volume (veh/h)	115	680	125	900	580	125	115	470	1305	150	535	130
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1776	1762	1748	1807	1821	1821	1654	1736	1673	1726	1726	1726
Adj Flow Rate, veh/h	122	919	133	947	637	142	144	635	1631	211	629	159
Peak Hour Factor	0.94	0.74	0.94	0.95	0.91	0.88	0.80	0.74	0.80	0.71	0.85	0.82
Percent Heavy Veh, %	1	2	3	3	2	2	7	1	2	1	1	1
Cap, veh/h	166	1007	544	712	1304	290	105	969	719	109	762	192
Arrive On Green	0.05	0.30	0.30	0.21	0.46	0.46	0.07	0.29	0.29	0.07	0.29	0.29
Sat Flow, veh/h	3281	3348	1481	3338	2813	626	1576	3299	1418	1644	2594	655
Grp Volume(v), veh/h	122	919	133	947	391	388	144	635	1631	211	397	391
Grp Sat Flow(s),veh/h/ln	1641	1674	1481	1669	1730	1708	1576	1650	1418	1644	1640	1609
Q Serve(g_s), s	5.2	37.8	3.5	30.5	22.4	22.5	9.5	24.1	42.0	9.5	32.3	32.4
Cycle Q Clear(g_c), s	5.2	37.8	3.5	30.5	22.4	22.5	9.5	24.1	42.0	9.5	32.3	32.4
Prop In Lane	1.00		1.00	1.00		0.37	1.00		1.00	1.00		0.41
Lane Grp Cap(c), veh/h	166	1007	544	712	802	792	105	969	719	109	482	472
V/C Ratio(X)	0.74	0.91	0.24	1.33	0.49	0.49	1.38	0.66	2.27	1.93	0.83	0.83
Avail Cap(c_a), veh/h	259	1042	559	712	802	792	105	969	719	109	482	472
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	67.0	48.2	13.0	56.3	26.6	26.6	66.8	44.2	18.7	66.8	47.1	47.1
Incr Delay (d2), s/veh	2.4	12.0	0.4	158.2	0.7	0.7	218.0	3.5	575.4	451.2	14.8	15.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	17.3	1.5	28.4	9.4	9.3	10.2	10.4	129.6	17.7	15.1	14.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.3	60.2	13.4	214.5	27.3	27.3	284.8	47.6	594.2	518.0	61.9	62.4
LnGrp LOS	E	E	B	F	C	C	F	D	F	F	E	E
Approach Vol, veh/h		1174			1726			2410			999	
Approach Delay, s/veh		55.8			130.0			431.7			158.4	
Approach LOS		E			F			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	46.5	35.0	47.5	14.0	46.5	11.7	70.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	42.0	30.5	44.5	9.5	42.0	11.3	63.2
Max Q Clear Time (g_c+I1), s	11.5	44.0	32.5	39.8	11.5	34.4	7.2	24.5
Green Ext Time (p_c), s	0.0	0.0	0.0	3.2	0.0	2.5	0.0	8.8

Intersection Summary	
HCM 6th Ctrl Delay	235.9
HCM 6th LOS	F

Figure D-9: AM Peak Barnett Road at Ellendale Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
94: Ellendale Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	1980	140	25	1415	35	120	15	20	55	25	70
Future Volume (vph)	15	1980	140	25	1415	35	120	15	20	55	25	70
Ideal Flow (vphpl)	1775	1775	1775	1775	1765	1775	1825	1825	1825	1825	1825	1825
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1670	3252		1547	3273		1609	1502		1697	1560	
Flt Permitted	0.95	1.00		0.95	1.00		0.60	1.00		0.73	1.00	
Satd. Flow (perm)	1670	3252		1547	3273		1023	1502		1307	1560	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	2200	156	28	1572	39	133	17	22	61	28	78
RTOR Reduction (vph)	0	3	0	0	1	0	0	17	0	0	61	0
Lane Group Flow (vph)	17	2353	0	28	1610	0	133	22	0	61	45	0
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Heavy Vehicles (%)	1%	2%	7%	9%	2%	1%	7%	1%	16%	1%	5%	1%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	3.0	82.6		4.5	84.1		40.4	32.9		37.4	31.4	
Effective Green, g (s)	3.0	82.6		4.5	84.1		40.4	32.9		37.4	31.4	
Actuated g/C Ratio	0.02	0.57		0.03	0.58		0.28	0.23		0.26	0.22	
Clearance Time (s)	4.5	4.5		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	
Lane Grp Cap (vph)	34	1865		48	1911		317	343		355	340	
v/s Ratio Prot	0.01	c0.72		0.02	c0.49		c0.02	0.01		0.01	0.03	
v/s Ratio Perm							c0.10			0.04		
v/c Ratio	0.50	1.26		0.58	0.84		0.42	0.06		0.17	0.13	
Uniform Delay, d1	69.8	30.7		68.8	24.5		41.4	43.5		40.9	45.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	11.1	122.1		16.8	4.7		0.9	0.4		0.2	0.8	
Delay (s)	80.9	152.8		85.6	29.2		42.3	43.9		41.2	46.1	
Level of Service	F	F		F	C		D	D		D	D	
Approach Delay (s)		152.3			30.2			42.6			44.3	
Approach LOS		F			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	97.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Figure D-10: AM Peak Barnett Road at Ellendale Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

94: Ellendale Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	1980	140	25	1415	35	120	15	20	55	25	70
Future Volume (veh/h)	15	1980	140	25	1415	35	120	15	20	55	25	70
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1761	1747	1747	1650	1737	1747	1725	1811	1811	1811	1754	1754
Adj Flow Rate, veh/h	17	2200	156	28	1572	39	133	17	22	61	28	78
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	2	2	9	2	2	7	1	1	1	5	5
Cap, veh/h	87	1848	129	37	1840	46	331	161	208	409	86	239
Arrive On Green	0.05	0.59	0.59	0.02	0.56	0.56	0.05	0.23	0.23	0.04	0.21	0.21
Sat Flow, veh/h	1677	3145	220	1572	3291	81	1643	711	920	1725	405	1127
Grp Volume(v), veh/h	17	1148	1208	28	787	824	133	0	39	61	0	106
Grp Sat Flow(s),veh/h/ln	1677	1660	1705	1572	1651	1722	1643	0	1631	1725	0	1532
Q Serve(g_s), s	1.4	84.6	84.6	2.6	57.9	58.3	7.5	0.0	2.7	4.0	0.0	8.4
Cycle Q Clear(g_c), s	1.4	84.6	84.6	2.6	57.9	58.3	7.5	0.0	2.7	4.0	0.0	8.4
Prop In Lane	1.00		0.13	1.00		0.05	1.00		0.56	1.00		0.74
Lane Grp Cap(c), veh/h	87	976	1002	37	923	963	331	0	369	409	0	324
V/C Ratio(X)	0.19	1.18	1.21	0.76	0.85	0.86	0.40	0.00	0.11	0.15	0.00	0.33
Avail Cap(c_a), veh/h	87	976	1002	82	923	963	331	0	369	434	0	324
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.09	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	65.4	29.7	29.7	69.9	26.8	26.9	44.1	0.0	44.2	42.0	0.0	48.1
Incr Delay (d2), s/veh	0.1	80.5	93.4	27.0	9.8	9.7	0.8	0.0	0.6	0.2	0.0	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	53.5	58.5	1.3	24.4	25.5	0.9	0.0	1.2	1.7	0.0	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	65.5	110.2	123.1	96.9	36.6	36.5	44.9	0.0	44.8	42.2	0.0	50.7
LnGrp LOS	E	F	F	F	D	D	D	A	D	D	A	D
Approach Vol, veh/h		2373			1639			172			167	
Approach Delay, s/veh		116.4			37.6			44.9			47.6	
Approach LOS		F			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	37.0	7.9	89.1	12.0	35.0	12.0	85.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	30.5	7.5	80.5	7.5	30.5	7.5	80.5
Max Q Clear Time (g_c+I1), s	6.0	4.7	4.6	86.6	9.5	10.4	3.4	60.3
Green Ext Time (p_c), s	0.0	0.2	0.0	0.0	0.0	0.5	0.0	11.7

Intersection Summary	
HCM 6th Ctrl Delay	81.3
HCM 6th LOS	F

Figure D-11: AM Peak Garfield Street at I-5 Exit 27 Interchange HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

Movement	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	815	730	395	375	500	700	490	405	645	510
Future Volume (vph)	815	730	395	375	500	700	490	405	645	510
Ideal Flow (vphpl)	1650	1650	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	8.3	4.0	8.3	4.0	8.7	7.3	4.0	8.7	7.3	8.3
Lane Util. Factor	*0.67	1.00	0.97	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	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)	2020	1323	3131	1444	3043	3260	1365	3101	3228	1458
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)	2020	1323	3131	1444	3043	3260	1365	3101	3228	1458
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	896	802	434	412	549	769	538	445	709	560
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	306
Lane Group Flow (vph)	896	802	434	412	549	769	538	445	709	254
Confl. Peds. (#/hr)										
Heavy Vehicles (%)	4%	6%	3%	3%	6%	2%	9%	4%	3%	2%
Turn Type	Prot	Free	Prot	Free	Prot	NA	Free	Prot	NA	custom
Protected Phases	2		6		3	8		7	4	
Permitted Phases		Free		Free			Free			6
Actuated Green, G (s)	68.5	152.0	68.5	152.0	29.2	33.3	152.0	25.9	30.0	68.5
Effective Green, g (s)	68.5	152.0	68.5	152.0	29.2	33.3	152.0	25.9	30.0	68.5
Actuated g/C Ratio	0.45	1.00	0.45	1.00	0.19	0.22	1.00	0.17	0.20	0.45
Clearance Time (s)	8.3		8.3		8.7	7.3		8.7	7.3	8.3
Vehicle Extension (s)	2.5		2.5		2.5	4.2		2.5	4.2	2.5
Lane Grp Cap (vph)	910	1323	1411	1444	584	714	1365	528	637	657
v/s Ratio Prot	c0.44		0.14		c0.18	c0.24		0.14	0.22	
v/s Ratio Perm		c0.61		0.29			0.39			0.17
v/c Ratio	0.98	0.61	0.31	0.29	0.94	1.08	0.39	0.84	1.11	0.39
Uniform Delay, d1	41.2	0.0	26.6	0.0	60.5	59.4	0.0	61.1	61.0	27.8
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	25.9	2.1	0.1	0.5	23.4	56.3	0.9	11.5	70.8	0.3
Delay (s)	67.1	2.1	26.7	0.5	83.9	115.7	0.9	72.6	131.8	28.1
Level of Service	E	A	C	A	F	F	A	E	F	C
Approach Delay (s)						73.0			82.5	
Approach LOS						E			F	

Intersection Summary			
HCM 2000 Control Delay	57.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	152.0	Sum of lost time (s)	24.3
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Figure D-12: AM Peak Garfield Street at I-5 Exit 27 Interchange HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

HCM 6th Edition methodology does not support more than 4 approaches.

Figure D-13: AM Peak Garfield Street at Center Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

827: Center Drive & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	1420	55	0	1285	485	20	0	40	230	65	60
Future Volume (vph)	75	1420	55	0	1285	485	20	0	40	230	65	60
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5			4.5	4.5	4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	0.99			1.00	0.85	1.00	0.85		1.00	0.93	
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1599	3211			3228	1444	1630	1417		3072	1547	
Flt Permitted	0.08	1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	141	3211			3228	1444	1630	1417		3072	1547	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	93	1753	68	0	1586	599	25	0	49	284	80	74
RTOR Reduction (vph)	0	1	0	0	0	114	0	43	0	0	24	0
Lane Group Flow (vph)	93	1820	0	0	1586	485	25	6	0	284	130	0
Heavy Vehicles (%)	4%	3%	2%	7%	3%	3%	2%	3%	5%	5%	4%	6%
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)	54.0	54.0			43.3	55.2	2.6	11.1		11.9	20.4	
Effective Green, g (s)	54.0	54.0			43.3	55.2	2.6	11.1		11.9	20.4	
Actuated g/C Ratio	0.60	0.60			0.48	0.61	0.03	0.12		0.13	0.23	
Clearance Time (s)	4.5	4.5			4.5	4.5	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	1.5	4.2			4.2	2.5	2.5	2.5		2.5	1.5	
Lane Grp Cap (vph)	184	1915			1544	952	46	173		403	348	
v/s Ratio Prot	0.03	c0.57			c0.49	c0.07	0.02	0.00		c0.09	c0.08	
v/s Ratio Perm	0.27					0.27						
v/c Ratio	0.51	0.95			1.03	0.51	0.54	0.03		0.70	0.37	
Uniform Delay, d1	18.0	17.0			23.6	10.0	43.4	35.0		37.6	29.6	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	11.2			30.1	0.3	10.0	0.1		5.1	0.2	
Delay (s)	18.8	28.2			53.7	10.3	53.3	35.0		42.7	29.9	
Level of Service	B	C			D	B	D	D		D	C	
Approach Delay (s)		27.7			41.8			41.2			38.2	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	35.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-14: AM Peak Garfield Street at Center Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
827: Center Drive & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	75	1420	55	0	1285	485	20	0	40	230	65	60
Future Volume (veh/h)	75	1420	55	0	1285	485	20	0	40	230	65	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1695	1709	1709	1654	1709	1709	1723	1709	1709	1682	1695	1695
Adj Flow Rate, veh/h	93	1753	68	0	1586	599	25	0	49	284	80	74
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	4	3	3	7	3	3	2	3	3	5	4	4
Cap, veh/h	194	2018	78	140	1684	936	44	0	93	396	134	124
Arrive On Green	0.06	0.63	0.63	0.00	0.52	0.52	0.03	0.00	0.06	0.13	0.16	0.16
Sat Flow, veh/h	1615	3187	123	1576	3247	1448	1641	0	1448	3107	811	750
Grp Volume(v), veh/h	93	889	932	0	1586	599	25	0	49	284	0	154
Grp Sat Flow(s),veh/h/ln	1615	1624	1687	1576	1624	1448	1641	0	1448	1554	0	1560
Q Serve(g_s), s	1.9	34.2	35.0	0.0	35.4	19.2	1.2	0.0	2.5	6.8	0.0	7.0
Cycle Q Clear(g_c), s	1.9	34.2	35.0	0.0	35.4	19.2	1.2	0.0	2.5	6.8	0.0	7.0
Prop In Lane	1.00		0.07	1.00		1.00	1.00		1.00	1.00		0.48
Lane Grp Cap(c), veh/h	194	1028	1068	140	1684	936	44	0	93	396	0	257
V/C Ratio(X)	0.48	0.86	0.87	0.00	0.94	0.64	0.57	0.00	0.53	0.72	0.00	0.60
Avail Cap(c_a), veh/h	418	1028	1068	649	1685	936	532	0	789	1008	0	830
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.7	11.5	11.6	0.0	17.5	8.2	37.1	0.0	34.9	32.3	0.0	29.8
Incr Delay (d2), s/veh	0.7	8.1	8.4	0.0	11.2	1.8	8.2	0.0	3.4	1.8	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	11.6	12.4	0.0	13.8	5.0	0.6	0.0	1.0	2.6	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.4	19.5	20.0	0.0	28.6	10.0	45.3	0.0	38.3	34.1	0.0	30.7
LnGrp LOS	B	B	B	A	C	A	D	A	D	C	A	C
Approach Vol, veh/h		1914			2185			74			438	
Approach Delay, s/veh		19.7			23.5			40.6			32.9	
Approach LOS		B			C			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.3	9.5	0.0	53.3	6.6	17.2	8.8	44.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	25.0	42.0	25.0	40.0	25.0	41.0	15.0	40.0
Max Q Clear Time (g_c+I1), s	8.8	4.5	0.0	37.0	3.2	9.0	3.9	37.4
Green Ext Time (p_c), s	1.1	0.2	0.0	3.0	0.0	0.4	0.1	2.6

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

Figure D-15: AM Peak Garfield Street at Riverside/OR 99 HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

87: Riverside/OR99 & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	115	675	75	395	460	510	405	415	60	70	695	470
Future Volume (vph)	115	675	75	395	460	510	405	415	60	70	695	470
Ideal Flow (vphpl)	1785	1785	1785	1785	1785	1785	1780	1780	1780	1785	1785	1785
Total Lost time (s)	4.0	4.5		4.0	4.5	4.0	4.0	5.4	4.0	4.0	5.4	4.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1662	3237		3133	1716	1431	3154	3283	1388	1585	3293	1473
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1662	3237		3133	1716	1431	3154	3283	1388	1585	3293	1473
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	137	804	89	470	548	607	482	494	71	83	827	560
RTOR Reduction (vph)	0	6	0	0	0	51	0	0	41	0	0	26
Lane Group Flow (vph)	137	887	0	470	548	556	482	494	30	83	827	534
Heavy Vehicles (%)	2%	3%	5%	5%	4%	6%	4%	3%	9%	7%	3%	3%
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4		3	8	1	1	6	7	5	2	3
Permitted Phases						8			6			2
Actuated Green, G (s)	14.3	38.8		25.0	49.5	73.8	24.3	42.9	57.2	11.8	30.4	55.4
Effective Green, g (s)	14.3	38.8		25.0	49.5	73.8	24.3	42.9	57.2	11.8	30.4	55.4
Actuated g/C Ratio	0.10	0.28		0.18	0.36	0.54	0.18	0.31	0.42	0.09	0.22	0.41
Clearance Time (s)	4.0	4.5		4.0	4.5	4.0	4.0	5.4	4.0	4.0	5.4	4.0
Vehicle Extension (s)	2.5	2.5		2.1	2.5	2.1	2.1	4.7	2.5	2.1	4.7	2.1
Lane Grp Cap (vph)	174	920		574	622	774	561	1032	582	137	733	598
v/s Ratio Prot	0.08	c0.27		0.15	0.32	0.13	c0.15	0.15	0.01	0.05	c0.25	c0.16
v/s Ratio Perm						0.26			0.02			0.20
v/c Ratio	0.79	0.96		0.82	0.88	0.72	0.86	0.48	0.05	0.61	1.13	0.89
Uniform Delay, d1	59.6	48.1		53.5	40.7	23.5	54.4	37.7	23.5	60.1	53.0	37.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.9	21.3		8.5	13.7	2.7	12.1	0.7	0.0	5.3	74.5	15.4
Delay (s)	79.5	69.4		62.0	54.4	26.2	66.5	38.4	23.5	65.4	127.5	53.2
Level of Service	E	E		E	D	C	E	D	C	E	F	D
Approach Delay (s)		70.8			46.1			50.3			95.7	
Approach LOS		E			D			D			F	

Intersection Summary			
HCM 2000 Control Delay	65.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	136.4	Sum of lost time (s)	17.9
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-16: AM Peak Garfield Street at Riverside/OR 99 HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

87: Riverside/OR99 & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	115	675	75	395	460	510	405	415	60	70	695	470
Future Volume (veh/h)	115	675	75	395	460	510	405	415	60	70	695	470
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1757	1743	1743	1715	1729	1701	1724	1738	1655	1688	1743	1743
Adj Flow Rate, veh/h	137	804	89	470	548	607	482	494	0	83	827	560
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	2	3	3	5	4	6	4	3	9	7	3	3
Cap, veh/h	161	928	103	536	659	789	529	1075		102	739	579
Arrive On Green	0.10	0.31	0.31	0.17	0.38	0.38	0.17	0.33	0.00	0.06	0.22	0.22
Sat Flow, veh/h	1673	3007	333	3169	1729	1442	3186	3303	1403	1607	3312	1477
Grp Volume(v), veh/h	137	443	450	470	548	607	482	494	0	83	827	560
Grp Sat Flow(s),veh/h/ln	1673	1656	1683	1585	1729	1442	1593	1651	1403	1607	1656	1477
Q Serve(g_s), s	10.8	33.9	33.9	19.5	38.6	44.3	20.0	15.9	0.0	6.9	30.0	30.0
Cycle Q Clear(g_c), s	10.8	33.9	33.9	19.5	38.6	44.3	20.0	15.9	0.0	6.9	30.0	30.0
Prop In Lane	1.00		0.20	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	161	511	519	536	659	789	529	1075		102	739	579
V/C Ratio(X)	0.85	0.87	0.87	0.88	0.83	0.77	0.91	0.46		0.81	1.12	0.97
Avail Cap(c_a), veh/h	266	511	519	825	965	1044	569	1075		299	739	579
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	59.8	43.9	43.9	54.5	37.7	23.8	55.1	36.0	0.0	62.1	52.2	40.0
Incr Delay (d2), s/veh	10.0	14.3	14.2	4.9	3.5	2.2	17.5	0.6	0.0	6.9	70.9	29.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	15.8	16.0	8.1	16.7	14.9	9.1	6.4	0.0	2.9	19.4	22.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.8	58.2	58.0	59.4	41.2	26.0	72.6	36.5	0.0	69.0	123.1	69.3
LnGrp LOS	E	E	E	E	D	C	E	D		E	F	E
Approach Vol, veh/h		1030			1625			976	A		1470	
Approach Delay, s/veh		59.7			40.8			54.3			99.5	
Approach LOS		E			D			D			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.3	35.4	26.7	46.0	12.6	49.2	17.0	55.7
Change Period (Y+Rc), s	4.0	* 5.4	4.0	4.5	4.0	* 5.4	4.0	4.5
Max Green Setting (Gmax), s	24.0	* 30	35.0	30.0	25.0	* 30	21.4	75.0
Max Q Clear Time (g_c+I1), s	22.0	32.0	21.5	35.9	8.9	17.9	12.8	46.3
Green Ext Time (p_c), s	0.4	0.0	1.3	0.0	0.1	6.4	0.2	5.0

Intersection Summary	
HCM 6th Ctrl Delay	64.1
HCM 6th LOS	E

Notes

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

Unsignalized Delay for [SER] is excluded from calculations of the approach delay and intersection delay.

Figure D-17: AM Peak Riverside/OR 99 at Stewart Avenue HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

84: Riverside/OR99 & Stewart 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	220	615	330	15	215	55	85	535	200	410	895	15
Future Volume (vph)	220	615	330	15	215	55	85	535	200	410	895	15
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1725	1725	1725	1700	1700	1700
Total Lost time (s)	5.0	4.5		5.0	4.5		5.0	5.4		5.0	5.4	5.4
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	0.95	1.00
Frt	1.00	0.95		1.00	0.97		1.00	0.96		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)	1568	3049		1630	3086		1366	2872		2984	3047	1417
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1568	3049		1630	3086		1366	2872		2984	3047	1417
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	259	724	388	18	253	65	100	629	235	482	1053	18
RTOR Reduction (vph)	0	49	0	0	20	0	0	27	0	0	0	10
Lane Group Flow (vph)	259	1063	0	18	298	0	100	837	0	482	1053	8
Heavy Vehicles (%)	6%	3%	4%	2%	3%	10%	20%	10%	8%	5%	6%	2%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pt+ov
Protected Phases	7	4		3	8		1	6		5	2	2 3
Permitted Phases												
Actuated Green, G (s)	21.1	39.3		3.1	21.3		12.2	37.1		20.1	45.0	53.5
Effective Green, g (s)	20.1	39.3		2.1	21.3		11.2	37.1		19.1	45.0	53.5
Actuated g/C Ratio	0.17	0.33		0.02	0.18		0.10	0.32		0.16	0.38	0.46
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	5.4		4.0	5.4	
Vehicle Extension (s)	2.5	2.5		1.5	2.5		1.5	4.7		1.5	4.7	
Lane Grp Cap (vph)	268	1019		29	559		130	906		485	1166	645
v/s Ratio Prot	c0.17	c0.35		0.01	0.10		0.07	0.29		c0.16	c0.35	0.01
v/s Ratio Perm												
v/c Ratio	0.97	1.04		0.62	0.53		0.77	0.92		0.99	0.90	0.01
Uniform Delay, d1	48.4	39.1		57.3	43.6		51.9	38.8		49.1	34.2	17.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	45.3	40.2		26.1	0.8		21.4	16.3		39.0	11.4	0.0
Delay (s)	93.6	79.3		83.4	44.4		73.3	55.1		88.1	45.6	17.5
Level of Service	F	E		F	D		E	E		F	D	B
Approach Delay (s)		82.0			46.5			57.0			58.5	
Approach LOS		F			D			E			E	

Intersection Summary					
HCM 2000 Control Delay	64.8	HCM 2000 Level of Service		E	
HCM 2000 Volume to Capacity ratio	1.03				
Actuated Cycle Length (s)	117.5	Sum of lost time (s)		19.9	
Intersection Capacity Utilization	87.1%	ICU Level of Service		E	
Analysis Period (min)	15				
c Critical Lane Group					

Figure D-18: AM Peak Riverside/OR 99 at Stewart Avenue HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

84: Riverside/OR99 & Stewart 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	220	615	330	15	215	55	85	535	200	410	895	15
Future Volume (veh/h)	220	615	330	15	215	55	85	535	200	410	895	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1668	1709	1709	1723	1709	1709	1456	1590	1590	1634	1620	1673
Adj Flow Rate, veh/h	259	724	388	18	253	65	100	629	235	482	1053	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	6	3	3	2	3	3	20	10	10	5	6	2
Cap, veh/h	271	663	354	17	421	106	108	698	261	503	1272	
Arrive On Green	0.17	0.32	0.32	0.01	0.16	0.16	0.08	0.32	0.32	0.17	0.41	0.00
Sat Flow, veh/h	1589	2043	1093	1641	2569	647	1387	2153	804	3018	3079	1418
Grp Volume(v), veh/h	259	575	537	18	158	160	100	441	423	482	1053	0
Grp Sat Flow(s),veh/h/ln	1589	1624	1512	1641	1624	1593	1387	1511	1446	1509	1539	1418
Q Serve(g_s), s	18.4	37.0	37.0	1.2	10.3	10.7	8.2	31.8	31.8	18.1	34.8	0.0
Cycle Q Clear(g_c), s	18.4	37.0	37.0	1.2	10.3	10.7	8.2	31.8	31.8	18.1	34.8	0.0
Prop In Lane	1.00		0.72	1.00		0.41	1.00		0.56	1.00		1.00
Lane Grp Cap(c), veh/h	271	527	491	17	266	261	108	490	469	503	1272	
V/C Ratio(X)	0.95	1.09	1.09	1.07	0.59	0.61	0.93	0.90	0.90	0.96	0.83	
Avail Cap(c_a), veh/h	279	527	491	302	455	447	231	490	469	503	1272	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	46.9	38.5	38.5	56.5	44.2	44.3	52.3	36.8	36.8	47.1	29.8	0.0
Incr Delay (d2), s/veh	41.0	66.6	68.8	80.7	1.6	1.7	12.5	22.2	23.1	29.6	6.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.3	24.0	22.7	0.9	4.2	4.3	3.2	14.4	13.9	8.6	13.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	87.8	105.2	107.4	137.1	45.8	46.1	64.8	59.0	59.9	76.8	36.1	0.0
LnGrp LOS	F	F	F	F	D	D	E	E	E	E	D	
Approach Vol, veh/h		1371			336			964			1535	A
Approach Delay, s/veh		102.7			50.8			60.0			48.9	
Approach LOS		F			D			E			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.9	52.5	6.2	41.5	24.0	42.4	24.5	23.2
Change Period (Y+Rc), s	4.0	* 5.4	4.0	4.5	4.0	* 5.4	4.0	4.5
Max Green Setting (Gmax), s	20.0	* 36	22.0	37.0	20.0	* 37	21.0	32.0
Max Q Clear Time (g_c+I1), s	10.2	36.8	3.2	39.0	20.1	33.8	20.4	12.7
Green Ext Time (p_c), s	0.1	0.0	0.0	0.0	0.0	2.5	0.1	2.9

Intersection Summary	
HCM 6th Ctrl Delay	69.1
HCM 6th LOS	E

Notes

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

Unsignalized Delay for [NWR] is excluded from calculations of the approach delay and intersection delay.

Figure D-19: PM Peak Barnett Road at Stewart Avenue HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 02/10/2021

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	725	240	430	810	215	390
Future Volume (vph)	725	240	430	810	215	390
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	5.0	5.5
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3292	1473	1646	3228	1646	2592
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3292	1473	1646	3228	1646	2592
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	763	253	453	853	226	411
RTOR Reduction (vph)	0	148	0	0	0	175
Lane Group Flow (vph)	763	105	453	853	226	236
Heavy Vehicles (%)	1%	1%	1%	3%	1%	1%
Turn Type	NA	Perm	Split	NA	Prot	pt+ov
Protected Phases	4		3	3	5	2 3
Permitted Phases		4				2 3
Actuated Green, G (s)	26.4	26.4	22.1	22.1	15.9	50.1
Effective Green, g (s)	26.4	26.4	22.1	22.1	14.9	49.1
Actuated g/C Ratio	0.31	0.31	0.26	0.26	0.17	0.57
Clearance Time (s)	4.5	4.5	4.5	4.5	4.0	
Vehicle Extension (s)	4.2	4.2	2.0	2.0	0.2	
Lane Grp Cap (vph)	1016	454	425	834	286	1488
v/s Ratio Prot	c0.23		c0.28	0.26	c0.14	c0.09
v/s Ratio Perm		0.07				
v/c Ratio	0.75	0.23	1.07	1.02	0.79	0.16
Uniform Delay, d1	26.6	22.0	31.7	31.7	33.8	8.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	0.4	62.3	37.1	12.9	0.0
Delay (s)	30.0	22.4	94.0	68.8	46.7	8.6
Level of Service	C	C	F	E	D	A
Approach Delay (s)	28.1			77.5	22.1	
Approach LOS	C			E	C	

Intersection Summary			
HCM 2000 Control Delay	48.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	19.5
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-20: PM Peak Barnett Road at Stewart Avenue HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
83: Stewart Avenue & Barnett Road 02/10/2021

HCM 6th Edition methodology does not support exclusive ped or hold phases.

Figure D-21: PM Peak Barnett Road at Alba Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
91: Alba Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	1100	0	0	1215	40	0	0	0	35	0	25
Future Volume (vph)	15	1100	0	0	1215	40	0	0	0	35	0	25
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0					5.5		4.5
Lane Util. Factor	1.00	0.95			0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00			1.00					1.00		1.00
Frt	1.00	1.00			1.00					1.00		0.85
Flt Protected	0.95	1.00			1.00					0.95		1.00
Satd. Flow (prot)	1554	3292			3271					1623		1454
Flt Permitted	0.14	1.00			1.00					0.95		1.00
Satd. Flow (perm)	228	3292			3271					1623		1454
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	16	1183	0	0	1306	43	0	0	0	38	0	27
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	23
Lane Group Flow (vph)	16	1183	0	0	1348	0	0	0	0	38	0	4
Confl. Peds. (#/hr)	5		3	3		5	1		5	5		1
Heavy Vehicles (%)	7%	1%	2%	2%	1%	3%	2%	2%	2%	2%	2%	1%
Turn Type	pm+pt	NA		Prot	NA					Perm		Perm
Protected Phases	7	4		3	8							
Permitted Phases	4									2		6
Actuated Green, G (s)	50.8	50.8			45.8					9.4		10.4
Effective Green, g (s)	50.3	50.8			45.8					8.9		9.9
Actuated g/C Ratio	0.72	0.72			0.65					0.13		0.14
Clearance Time (s)	4.0	5.0			5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0			5.0					0.2		5.0
Lane Grp Cap (vph)	172	2382			2134					205		205
v/s Ratio Prot	0.00	c0.36			c0.41							
v/s Ratio Perm	0.07									c0.02		0.00
v/c Ratio	0.09	0.50			0.63					0.19		0.02
Uniform Delay, d1	4.6	4.2			7.2					27.4		26.0
Progression Factor	1.00	1.00			1.00					1.00		1.00
Incremental Delay, d2	0.5	0.3			0.9					0.2		0.1
Delay (s)	5.1	4.5			8.1					27.6		26.0
Level of Service	A	A			A					C		C
Approach Delay (s)		4.5			8.1			0.0			26.9	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	6.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.2	Sum of lost time (s)	14.5
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Figure D-22: PM Peak Barnett Road at Alba Drive HCM 6th Edition Report

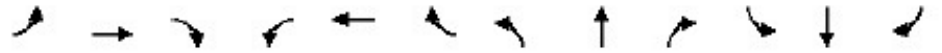
HCM 6th Signalized Intersection Summary
91: Alba Drive & Barnett Road 02/10/2021

HCM 6th Edition methodology does not support Non-NEMA phasing.

Figure D-23: PM Peak Barnett Road at Highland Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

90: Highland Drive & Barnett Road 02/10/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	630	295	955	845	115	200	605	870	100	720	210
Future Volume (vph)	210	630	295	955	845	115	200	605	870	100	720	210
Ideal Flow (vphpl)	1700	1725	1725	1700	1700	1725	1725	1725	1725	1700	1700	1700
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	0.97	0.95	1.00	*0.67	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.96	
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)	3102	3245	1452	2143	3118		1561	3245	1452	1553	3086	
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)	3102	3245	1452	2143	3118		1561	3245	1452	1553	3086	
Peak-hour factor, PHF	0.94	0.77	0.92	0.80	0.96	0.80	0.89	0.89	0.95	0.89	0.95	0.91
Adj. Flow (vph)	223	818	321	1194	880	144	225	680	916	112	758	231
RTOR Reduction (vph)	0	0	39	0	5	0	0	0	74	0	16	0
Lane Group Flow (vph)	223	818	282	1194	1019	0	225	680	842	112	973	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	4%	5%	1%	1%	4%	1%	1%
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	7	4	5	3	8		5	2	3	1	6	
Permitted Phases			4						2			
Actuated Green, G (s)	17.0	45.5	71.0	55.5	84.0		25.5	35.5	91.0	25.5	35.5	
Effective Green, g (s)	17.0	45.5	71.0	55.5	84.0		25.5	35.5	91.0	25.5	35.5	
Actuated g/C Ratio	0.09	0.25	0.39	0.31	0.47		0.14	0.20	0.51	0.14	0.20	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	1.5	4.2	1.5	1.5	4.2		1.5	2.5	1.5	1.5	2.5	
Lane Grp Cap (vph)	292	820	609	660	1455		221	639	770	220	608	
v/s Ratio Prot	0.07	c0.25	0.07	c0.56	0.33		c0.14	0.21	0.34	0.07	c0.32	
v/s Ratio Perm			0.13						0.24			
v/c Ratio	0.76	1.00	0.46	1.81	0.70		1.02	1.06	1.09	0.51	1.60	
Uniform Delay, d1	79.5	67.2	40.4	62.2	38.0		77.2	72.2	44.5	71.5	72.2	
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	10.2	30.6	0.2	370.1	1.7		65.3	53.9	61.1	0.7	277.8	
Delay (s)	89.7	97.8	40.6	432.3	39.7		142.5	126.1	105.6	72.1	350.0	
Level of Service	F	F	D	F	D		F	F	F	E	F	
Approach Delay (s)		83.0			251.1			117.8			321.8	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	190.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	106.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-24: PM Peak Barnett Road at Highland Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

90: Highland Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	630	295	955	845	115	200	605	870	100	720	210
Future Volume (veh/h)	210	630	295	955	845	115	200	605	870	100	720	210
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1687	1712	1712	1687	1687	1712	1658	1712	1712	1647	1687	1687
Adj Flow Rate, veh/h	223	818	321	1194	880	144	225	680	916	112	758	231
Peak Hour Factor	0.94	0.77	0.92	0.80	0.96	0.80	0.89	0.89	0.95	0.89	0.95	0.91
Percent Heavy Veh, %	1	1	1	1	1	1	5	1	1	4	1	1
Cap, veh/h	259	822	572	664	1318	216	224	641	733	222	477	145
Arrive On Green	0.08	0.25	0.25	0.31	0.48	0.48	0.14	0.20	0.20	0.14	0.20	0.20
Sat Flow, veh/h	3116	3252	1450	2153	2757	451	1579	3252	1450	1569	2419	737
Grp Volume(v), veh/h	223	818	321	1194	511	513	225	680	916	112	502	487
Grp Sat Flow(s),veh/h/ln	1558	1626	1450	1076	1602	1606	1579	1626	1450	1569	1602	1554
Q Serve(g_s), s	12.7	45.2	5.5	55.5	44.1	44.1	25.5	35.5	35.5	11.9	35.5	35.5
Cycle Q Clear(g_c), s	12.7	45.2	5.5	55.5	44.1	44.1	25.5	35.5	35.5	11.9	35.5	35.5
Prop In Lane	1.00		1.00	1.00		0.28	1.00		1.00	1.00		0.47
Lane Grp Cap(c), veh/h	259	822	572	664	766	767	224	641	733	222	316	306
V/C Ratio(X)	0.86	1.00	0.56	1.80	0.67	0.67	1.01	1.06	1.25	0.50	1.59	1.59
Avail Cap(c_a), veh/h	961	822	572	664	766	767	224	641	733	222	316	306
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	81.5	67.1	42.4	62.2	36.0	36.0	77.3	72.2	44.5	71.4	72.3	72.3
Incr Delay (d2), s/veh	3.2	30.1	1.6	365.5	2.6	2.6	61.7	52.6	123.3	0.7	279.5	279.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	22.2	11.5	48.9	18.0	18.0	14.2	19.5	35.1	4.8	39.1	38.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	84.7	97.3	44.0	427.8	38.6	38.6	139.0	124.8	167.8	72.1	351.7	352.2
LnGrp LOS	F	F	D	F	D	D	F	F	F	E	F	F
Approach Vol, veh/h		1362			2218			1821			1101	
Approach Delay, s/veh		82.7			248.1			148.2			323.5	
Approach LOS		F			F			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	30.0	40.0	60.0	50.0	30.0	40.0	19.5	90.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	25.5	35.5	55.5	45.5	25.5	35.5	55.5	45.5
Max Q Clear Time (g_c+I1), s	13.9	37.5	57.5	47.2	27.5	37.5	14.7	46.1
Green Ext Time (p_c), s	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0

Intersection Summary	
HCM 6th Ctrl Delay	198.2
HCM 6th LOS	F

Figure D-25: PM Peak Barnett Road at Ellendale Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

94: Ellendale Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	1345	225	55	1695	15	185	30	45	35	15	35
Future Volume (vph)	30	1345	225	55	1695	15	185	30	45	35	15	35
Ideal Flow (vphpl)	1000	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	0.98		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.91		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	922	3197		1646	3285		1633	1551		1629	1521	
Flt Permitted	0.95	1.00		0.95	1.00		0.64	1.00		0.71	1.00	
Satd. Flow (perm)	922	3197		1646	3285		1099	1551		1212	1521	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	31	1387	232	57	1747	15	191	31	46	36	15	36
RTOR Reduction (vph)	0	10	0	0	0	0	0	33	0	0	27	0
Lane Group Flow (vph)	31	1609	0	57	1762	0	191	44	0	36	24	0
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Heavy Vehicles (%)	3%	1%	1%	1%	1%	7%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	6.0	73.7		6.0	73.7		50.8	40.5		39.9	34.1	
Effective Green, g (s)	6.0	73.7		6.0	73.7		50.8	40.5		39.9	34.1	
Actuated g/C Ratio	0.04	0.51		0.04	0.51		0.35	0.28		0.28	0.24	
Clearance Time (s)	4.5	4.5		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	
Lane Grp Cap (vph)	38	1636		68	1681		432	436		352	360	
v/s Ratio Prot	0.03	0.50		c0.03	c0.54		c0.04	0.03		0.00	0.02	
v/s Ratio Perm							c0.12			0.02		
v/c Ratio	0.82	0.98		0.84	1.05		0.44	0.10		0.10	0.07	
Uniform Delay, d1	68.5	34.6		68.5	35.1		34.3	38.3		38.5	42.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	76.1	18.7		56.3	35.7		0.7	0.5		0.1	0.3	
Delay (s)	144.6	53.2		124.8	70.8		35.0	38.7		38.6	42.9	
Level of Service	F	D		F	E		D	D		D	D	
Approach Delay (s)		55.0			72.5			36.1			41.2	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	61.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Figure D-26: PM Peak Barnett Road at Ellendale Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

94: Ellendale Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	1345	225	55	1695	15	185	30	45	35	15	35
Future Volume (veh/h)	30	1345	225	55	1695	15	185	30	45	35	15	35
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	977	1736	1736	1736	1736	1736	1736	1736	1736	1736	1736	1736
Adj Flow Rate, veh/h	31	1387	232	57	1747	15	191	31	46	36	15	36
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	48	1484	245	86	1757	15	443	171	253	372	95	228
Arrive On Green	0.05	0.52	0.52	0.05	0.52	0.52	0.09	0.27	0.27	0.03	0.21	0.21
Sat Flow, veh/h	930	2829	467	1654	3352	29	1654	627	930	1654	448	1076
Grp Volume(v), veh/h	31	801	818	57	859	903	191	0	77	36	0	51
Grp Sat Flow(s),veh/h/ln	930	1650	1647	1654	1650	1731	1654	0	1557	1654	0	1524
Q Serve(g_s), s	4.7	64.6	67.6	4.9	74.4	74.7	12.5	0.0	5.5	2.4	0.0	3.9
Cycle Q Clear(g_c), s	4.7	64.6	67.6	4.9	74.4	74.7	12.5	0.0	5.5	2.4	0.0	3.9
Prop In Lane	1.00		0.28	1.00		0.02	1.00		0.60	1.00		0.71
Lane Grp Cap(c), veh/h	48	865	864	86	865	907	443	0	424	372	0	323
V/C Ratio(X)	0.64	0.93	0.95	0.66	0.99	1.00	0.43	0.00	0.18	0.10	0.00	0.16
Avail Cap(c_a), veh/h	48	865	864	86	865	907	443	0	424	415	0	323
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.09	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	66.9	31.7	32.4	67.0	34.0	34.1	38.8	0.0	40.1	42.7	0.0	46.3
Incr Delay (d2), s/veh	2.5	2.2	3.0	17.3	29.0	28.7	0.7	0.0	0.9	0.1	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	25.3	26.6	2.5	35.5	37.3	5.4	0.0	2.3	1.0	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.5	33.9	35.4	84.3	63.0	62.8	39.4	0.0	41.1	42.8	0.0	47.3
LnGrp LOS	E	C	D	F	E	E	D	A	D	D	A	D
Approach Vol, veh/h		1650			1819			268			87	
Approach Delay, s/veh		35.3			63.6			39.9			45.5	
Approach LOS		D			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	43.7	12.0	80.0	17.0	35.0	12.0	80.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	35.5	7.5	75.5	12.5	30.5	7.5	75.5
Max Q Clear Time (g_c+I1), s	4.4	7.5	6.9	69.6	14.5	5.9	6.7	76.7
Green Ext Time (p_c), s	0.0	0.4	0.0	4.6	0.0	0.2	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	49.3
HCM 6th LOS	D

Figure D-27: PM Peak Garfield Street at I-5 Exit 27 Interchange HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

Movement	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	420	685	455	525	630	730	540	405	765	800
Future Volume (vph)	420	685	455	525	630	730	540	405	765	800
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	8.3	4.0	8.3	4.0	8.7	7.3	7.3	8.7	7.3	7.3
Lane Util. Factor	*0.67	1.00	0.97	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	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)	2184	1430	3131	1458	3101	3292	1390	3193	3260	1444
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)	2184	1430	3131	1458	3101	3292	1390	3193	3260	1444
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	433	706	469	541	649	753	557	418	789	825
RTOR Reduction (vph)	0	0	0	0	0	0	332	0	0	411
Lane Group Flow (vph)	433	706	469	541	649	753	225	418	789	414
Confl. Peds. (#/hr)										
Heavy Vehicles (%)	2%	4%	3%	2%	4%	1%	7%	1%	2%	3%
Turn Type	Perm	Free	Perm	Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases					3	8		7	4	
Permitted Phases	2	Free	6	Free			8			4
Actuated Green, G (s)	30.9	129.9	30.9	129.9	31.2	52.5	52.5	22.2	43.5	43.5
Effective Green, g (s)	30.9	129.9	30.9	129.9	31.2	52.5	52.5	22.2	43.5	43.5
Actuated g/C Ratio	0.24	1.00	0.24	1.00	0.24	0.40	0.40	0.17	0.33	0.33
Clearance Time (s)	8.3		8.3		8.7	7.3	7.3	8.7	7.3	7.3
Vehicle Extension (s)	2.5		2.5		2.5	4.2	4.2	2.5	4.2	4.2
Lane Grp Cap (vph)	519	1430	744	1458	744	1330	561	545	1091	483
v/s Ratio Prot					c0.21	0.23		0.13	0.24	
v/s Ratio Perm	c0.20	c0.49	0.15	0.37			0.16			c0.29
v/c Ratio	0.83	0.49	0.63	0.37	0.87	0.57	0.40	0.77	0.72	0.86
Uniform Delay, d1	47.1	0.0	44.4	0.0	47.4	29.9	27.5	51.4	37.9	40.3
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	10.9	1.2	1.5	0.7	10.9	0.7	0.7	6.1	2.6	14.6
Delay (s)	57.9	1.2	45.9	0.7	58.4	30.6	28.2	57.5	40.5	54.9
Level of Service	E	A	D	A	E	C	C	E	D	D
Approach Delay (s)						39.1			49.9	
Approach LOS						D			D	

Intersection Summary			
HCM 2000 Control Delay	36.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	129.9	Sum of lost time (s)	24.3
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Figure D-28: PM Peak Garfield Street at I-5 Exit 27 Interchange HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

HCM 6th Edition methodology does not support more than 4 approaches.

Figure D-29: PM Peak Garfield Street at Center Drive HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

827: Center Drive & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	1195	50	115	1130	660	30	15	100	605	35	335
Future Volume (vph)	160	1195	50	115	1130	660	30	15	100	605	35	335
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.87		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1630	3272		1646	3292	1444	1614	1442		3162	1468	
Flt Permitted	0.09	1.00		0.07	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	154	3272		125	3292	1444	1614	1442		3162	1468	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	165	1232	52	119	1165	680	31	15	103	624	36	345
RTOR Reduction (vph)	0	2	0	0	0	151	0	88	0	0	195	0
Lane Group Flow (vph)	165	1282	0	119	1165	529	31	30	0	624	186	0
Heavy Vehicles (%)	2%	1%	1%	1%	1%	3%	3%	2%	6%	2%	3%	3%
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases	4			8		8						
Actuated Green, G (s)	72.1	59.1		67.5	56.8	82.6	4.9	19.7		25.8	40.6	
Effective Green, g (s)	72.1	59.1		67.5	56.8	82.6	4.9	19.7		25.8	40.6	
Actuated g/C Ratio	0.54	0.44		0.51	0.43	0.62	0.04	0.15		0.19	0.30	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	1.5	4.2		2.5	4.2	2.5	2.5	2.5		2.5	1.5	
Lane Grp Cap (vph)	227	1450		185	1402	943	59	213		612	447	
v/s Ratio Prot	c0.07	c0.39		0.05	0.35	0.11	0.02	0.02		c0.20	c0.13	
v/s Ratio Perm	0.32			0.27		0.26						
v/c Ratio	0.73	0.88		0.64	0.83	0.56	0.53	0.14		1.02	0.42	
Uniform Delay, d1	26.3	34.0		25.4	34.0	14.8	63.1	49.4		53.8	36.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.4	7.0		6.6	4.6	0.6	6.3	0.2		41.4	0.2	
Delay (s)	35.7	41.0		32.0	38.6	15.4	69.4	49.7		95.2	37.1	
Level of Service	D	D		C	D	B	E	D		F	D	
Approach Delay (s)		40.4			30.2			53.8			73.2	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	43.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	133.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-30: PM Peak Garfield Street at Center Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

827: Center Drive & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	1195	50	115	1130	660	30	15	100	605	35	335
Future Volume (veh/h)	160	1195	50	115	1130	660	30	15	100	605	35	335
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1723	1736	1736	1736	1736	1709	1709	1723	1723	1723	1709	1709
Adj Flow Rate, veh/h	165	1232	52	119	1165	680	31	15	103	624	36	345
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	1	1	1	1	3	3	2	2	2	3	3
Cap, veh/h	221	1542	65	222	1527	977	44	19	129	673	39	378
Arrive On Green	0.07	0.48	0.48	0.06	0.46	0.46	0.03	0.10	0.10	0.21	0.28	0.28
Sat Flow, veh/h	1641	3225	136	1654	3299	1448	1628	189	1300	3183	139	1331
Grp Volume(v), veh/h	165	630	654	119	1165	680	31	0	118	624	0	381
Grp Sat Flow(s),veh/h/ln	1641	1650	1712	1654	1650	1448	1628	0	1489	1591	0	1470
Q Serve(g_s), s	6.1	37.4	37.5	4.3	34.1	33.5	2.2	0.0	9.0	22.3	0.0	29.1
Cycle Q Clear(g_c), s	6.1	37.4	37.5	4.3	34.1	33.5	2.2	0.0	9.0	22.3	0.0	29.1
Prop In Lane	1.00		0.08	1.00		1.00	1.00		0.87	1.00		0.91
Lane Grp Cap(c), veh/h	221	789	818	222	1527	977	44	0	148	673	0	417
V/C Ratio(X)	0.75	0.80	0.80	0.54	0.76	0.70	0.70	0.00	0.80	0.93	0.00	0.91
Avail Cap(c_a), veh/h	457	789	818	485	1562	992	350	0	538	685	0	519
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.9	25.6	25.6	22.1	25.9	11.6	56.0	0.0	51.2	44.9	0.0	40.2
Incr Delay (d2), s/veh	1.9	6.2	6.0	1.5	2.4	2.4	13.8	0.0	7.1	18.5	0.0	16.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	15.3	15.9	1.7	13.4	10.1	1.1	0.0	3.7	10.5	0.0	12.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.8	31.8	31.6	23.6	28.4	14.0	69.8	0.0	58.2	63.4	0.0	56.6
LnGrp LOS	C	C	C	C	C	B	E	A	E	E	A	E
Approach Vol, veh/h		1449			1964			149			1005	
Approach Delay, s/veh		31.0			23.1			60.6			60.9	
Approach LOS		C			C			E			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.1	16.1	11.0	60.0	7.7	37.5	12.8	58.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	25.0	42.0	25.0	55.0	25.0	41.0	25.0	55.0
Max Q Clear Time (g_c+I1), s	24.3	11.0	6.3	39.5	4.2	31.1	8.1	36.1
Green Ext Time (p_c), s	0.2	0.6	0.3	13.3	0.1	0.9	0.3	17.7

Intersection Summary	
HCM 6th Ctrl Delay	35.2
HCM 6th LOS	D

Figure D-31: PM Peak Garfield Street at Riverside/OR 99 HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

87: Riverside/OR99 & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	170	460	120	635	540	320	385	890	110	115	1040	560
Future Volume (vph)	170	460	120	635	540	320	385	890	110	115	1040	560
Ideal Flow (vphpl)	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
Total Lost time (s)	4.0	4.5		4.0	4.5	4.0	4.0	5.4	4.0	4.0	5.4	4.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1646	3196		3225	1733	1473	3225	3358	1517	1679	3358	1473
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1646	3196		3225	1733	1473	3225	3358	1517	1679	3358	1473
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	183	495	129	683	581	344	414	957	118	124	1118	602
RTOR Reduction (vph)	0	16	0	0	0	32	0	0	72	0	0	75
Lane Group Flow (vph)	183	608	0	683	581	312	414	957	46	124	1118	527
Heavy Vehicles (%)	3%	2%	6%	2%	3%	3%	2%	1%	0%	1%	1%	3%
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4		3	8	1	1	6	7	5	2	3
Permitted Phases						8			6			2
Actuated Green, G (s)	19.0	38.6		35.4	55.0	77.1	22.1	37.2	56.2	15.3	30.4	65.8
Effective Green, g (s)	19.0	38.6		35.4	55.0	77.1	22.1	37.2	56.2	15.3	30.4	65.8
Actuated g/C Ratio	0.13	0.27		0.25	0.38	0.53	0.15	0.26	0.39	0.11	0.21	0.46
Clearance Time (s)	4.0	4.5		4.0	4.5	4.0	4.0	5.4	4.0	4.0	5.4	4.0
Vehicle Extension (s)	2.5	2.5		2.1	2.5	2.1	2.1	4.7	2.5	2.1	4.7	2.1
Lane Grp Cap (vph)	216	854		790	660	786	493	865	590	177	706	671
v/s Ratio Prot	0.11	0.19		c0.21	c0.34	0.06	c0.13	c0.28	0.01	0.07	c0.33	0.19
v/s Ratio Perm						0.15			0.02			0.17
v/c Ratio	0.85	0.71		0.86	0.88	0.40	0.84	1.11	0.08	0.70	1.58	0.79
Uniform Delay, d1	61.3	47.9		52.2	41.6	19.9	59.4	53.6	27.8	62.3	57.0	33.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.8	2.6		9.5	13.0	0.1	11.5	64.0	0.0	10.0	269.4	5.6
Delay (s)	86.1	50.5		61.7	54.6	20.1	70.9	117.6	27.8	72.3	326.4	39.0
Level of Service	F	D		E	D	C	E	F	C	E	F	D
Approach Delay (s)		58.6			50.2			97.5			215.5	
Approach LOS		E			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	116.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	144.4	Sum of lost time (s)	17.9
Intersection Capacity Utilization	97.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-32: PM Peak Garfield Street at Riverside/OR 99 HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

87: Riverside/OR99 & Garfield Street 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	170	460	120	635	540	320	385	890	110	115	1040	560
Future Volume (veh/h)	170	460	120	635	540	320	385	890	110	115	1040	560
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1743	1757	1757	1757	1743	1743	1757	1771	1785	1771	1771	1743
Adj Flow Rate, veh/h	183	495	129	683	581	344	414	957	0	124	1118	602
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	3	2	2	2	3	3	2	1	0	1	1	3
Cap, veh/h	208	673	174	749	631	749	472	967		149	775	681
Arrive On Green	0.13	0.26	0.26	0.23	0.36	0.36	0.15	0.29	0.00	0.09	0.23	0.23
Sat Flow, veh/h	1660	2624	680	3247	1743	1477	3247	3365	1513	1687	3365	1477
Grp Volume(v), veh/h	183	314	310	683	581	344	414	957	0	124	1118	602
Grp Sat Flow(s),veh/h/ln	1660	1669	1635	1623	1743	1477	1623	1683	1513	1687	1683	1477
Q Serve(g_s), s	14.1	22.4	22.7	26.7	41.6	19.5	16.3	36.9	0.0	9.4	30.0	30.0
Cycle Q Clear(g_c), s	14.1	22.4	22.7	26.7	41.6	19.5	16.3	36.9	0.0	9.4	30.0	30.0
Prop In Lane	1.00		0.42	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	208	428	419	749	631	749	472	967		149	775	681
V/C Ratio(X)	0.88	0.73	0.74	0.91	0.92	0.46	0.88	0.99		0.83	1.44	0.88
Avail Cap(c_a), veh/h	273	428	419	872	1003	1065	598	967		324	775	681
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.0	44.4	44.5	48.8	39.8	20.6	54.6	46.3	0.0	58.5	50.2	32.0
Incr Delay (d2), s/veh	20.5	6.1	6.5	11.7	8.0	0.3	10.3	26.4	0.0	5.6	206.9	13.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.1	9.9	9.9	11.9	18.8	6.7	7.2	18.4	0.0	4.2	34.5	19.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	76.6	50.4	51.0	60.5	47.8	21.0	64.9	72.7	0.0	64.1	257.0	45.7
LnGrp LOS	E	D	D	E	D	C	E	E		E	F	D
Approach Vol, veh/h		807			1608			1371	A		1844	
Approach Delay, s/veh		56.6			47.5			70.3			175.1	
Approach LOS		E			D			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.9	35.4	34.1	37.9	15.5	42.8	20.3	51.7
Change Period (Y+Rc), s	4.0	* 5.4	4.0	4.5	4.0	* 5.4	4.0	4.5
Max Green Setting (Gmax), s	24.0	* 30	35.0	30.0	25.0	* 30	21.4	75.0
Max Q Clear Time (g_c+I1), s	18.3	32.0	28.7	24.7	11.4	38.9	16.1	43.6
Green Ext Time (p_c), s	0.7	0.0	1.4	1.1	0.2	0.0	0.2	3.6

Intersection Summary	
HCM 6th Ctrl Delay	96.1
HCM 6th LOS	F

Notes

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

Unsignalized Delay for [SER] is excluded from calculations of the approach delay and intersection delay.

Figure D-33: PM Peak Riverside/OR 99 at Stewart Avenue HCM 2000 Report

HCM Signalized Intersection Capacity Analysis

84: Riverside/OR99 & Stewart 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	530	305	225	75	445	245	130	1085	205	695	615	220
Future Volume (vph)	530	305	225	75	445	245	130	1085	205	695	615	220
Ideal Flow (vphpl)	1750	1740	1740	1750	1750	1750	1740	1740	1740	1750	1750	1750
Total Lost time (s)	5.0	4.5		5.0	4.5		5.0	5.4		5.0	5.4	5.4
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	0.95	1.00
Frt	1.00	0.94		1.00	0.95		1.00	0.98		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)	1614	3039		1614	3003		1503	3164		3101	3228	1417
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1614	3039		1614	3003		1503	3164		3101	3228	1417
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	602	347	256	85	506	278	148	1233	233	790	699	250
RTOR Reduction (vph)	0	89	0	0	57	0	0	11	0	0	0	135
Lane Group Flow (vph)	602	514	0	85	727	0	148	1455	0	790	699	115
Heavy Vehicles (%)	3%	1%	3%	3%	2%	10%	10%	2%	2%	4%	3%	5%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pt+ov
Protected Phases	7	4		3	8		1	6		5	2	2 3
Permitted Phases												
Actuated Green, G (s)	21.0	46.0		9.4	34.4		16.1	37.0		20.0	40.9	55.7
Effective Green, g (s)	20.0	46.0		8.4	34.4		15.1	37.0		19.0	40.9	55.7
Actuated g/C Ratio	0.15	0.35		0.06	0.26		0.12	0.28		0.15	0.31	0.43
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	5.4		4.0	5.4	
Vehicle Extension (s)	2.5	2.5		1.5	2.5		1.5	4.7		1.5	4.7	
Lane Grp Cap (vph)	247	1072		104	792		174	898		452	1013	605
v/s Ratio Prot	c0.37	0.17		0.05	c0.24		0.10	c0.46		c0.25	c0.22	0.08
v/s Ratio Perm												
v/c Ratio	2.44	0.48		0.82	0.92		0.85	1.62		1.75	0.69	0.19
Uniform Delay, d1	55.2	32.8		60.2	46.6		56.5	46.7		55.7	39.1	23.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	658.9	0.2		35.6	15.4		29.8	284.0		345.6	3.8	0.1
Delay (s)	714.0	33.1		95.8	62.0		86.3	330.7		401.2	43.0	23.3
Level of Service	F	C		F	E		F	F		F	D	C
Approach Delay (s)		373.3			65.3			308.3			202.9	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	250.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.56		
Actuated Cycle Length (s)	130.3	Sum of lost time (s)	19.9
Intersection Capacity Utilization	131.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-34: PM Peak Riverside/OR 99 at Stewart Avenue HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

84: Riverside/OR99 & Stewart 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	530	305	225	75	445	245	130	1085	205	695	615	220
Future Volume (veh/h)	530	305	225	75	445	245	130	1085	205	695	615	220
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1709	1726	1726	1709	1723	1723	1604	1713	1713	1695	1709	1682
Adj Flow Rate, veh/h	602	347	256	85	506	278	148	1233	233	790	699	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	3	1	1	3	2	2	10	2	2	4	3	5
Cap, veh/h	248	662	480	93	551	302	159	770	144	453	1046	
Arrive On Green	0.15	0.37	0.37	0.06	0.27	0.27	0.10	0.28	0.28	0.14	0.32	0.00
Sat Flow, veh/h	1628	1815	1315	1628	2041	1117	1528	2735	513	3132	3247	1425
Grp Volume(v), veh/h	602	313	290	85	405	379	148	729	737	790	699	0
Grp Sat Flow(s),veh/h/ln	1628	1640	1490	1628	1637	1522	1528	1627	1621	1566	1624	1425
Q Serve(g_s), s	20.0	19.7	20.2	6.8	31.6	31.8	12.6	37.0	37.0	19.0	24.4	0.0
Cycle Q Clear(g_c), s	20.0	19.7	20.2	6.8	31.6	31.8	12.6	37.0	37.0	19.0	24.4	0.0
Prop In Lane	1.00		0.88	1.00		0.73	1.00		0.32	1.00		1.00
Lane Grp Cap(c), veh/h	248	599	544	93	442	411	159	458	456	453	1046	
V/C Ratio(X)	2.43	0.52	0.53	0.91	0.92	0.92	0.93	1.59	1.61	1.74	0.67	
Avail Cap(c_a), veh/h	248	599	544	260	455	423	221	458	456	453	1046	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	55.7	32.7	32.9	61.6	46.5	46.6	58.4	47.2	47.2	56.2	38.5	0.0
Incr Delay (d2), s/veh	655.5	0.7	0.8	12.2	22.9	24.8	30.1	276.4	286.3	343.9	3.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	53.2	7.9	7.3	3.1	15.5	14.7	6.2	49.9	51.0	29.0	9.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	711.2	33.4	33.7	73.8	69.4	71.4	88.5	323.6	333.5	400.0	41.9	0.0
LnGrp LOS	F	C	C	E	E	E	F	F	F	F	D	
Approach Vol, veh/h		1205			869			1614			1489	A
Approach Delay, s/veh		372.1			70.7			306.6			231.9	
Approach LOS		F			E			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.7	47.7	12.5	52.5	24.0	42.4	25.0	40.0
Change Period (Y+Rc), s	4.0	* 5.4	4.0	4.5	4.0	* 5.4	4.0	4.5
Max Green Setting (Gmax), s	20.0	* 36	22.0	37.0	20.0	* 37	21.0	36.5
Max Q Clear Time (g_c+I1), s	14.6	26.4	8.8	22.2	21.0	39.0	22.0	33.8
Green Ext Time (p_c), s	0.1	6.7	0.1	5.2	0.0	0.0	0.0	1.7

Intersection Summary	
HCM 6th Ctrl Delay	260.8
HCM 6th LOS	F

Notes

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

Unsignalized Delay for [NWR] is excluded from calculations of the approach delay and intersection delay.

LOS for Medford Intersections, PHF = 1

Figure D-35: AM Peak LOS for Barnett Road at Stewart Avenue, PHF = 1

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 02/10/2021

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	345	65	265	565	135	565
Future Volume (vph)	345	65	265	565	135	565
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	5.0	5.5
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3197	1444	1630	3197	1630	2592
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3197	1444	1630	3197	1630	2592
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	345	65	265	565	135	565
RTOR Reduction (vph)	0	51	0	0	0	200
Lane Group Flow (vph)	345	14	265	565	135	365
Heavy Vehicles (%)	4%	3%	2%	4%	2%	1%
Turn Type	NA	Perm	Split	NA	Prot	pt+ov
Protected Phases	4		3	3	5	2 3
Permitted Phases		4				2 3
Actuated Green, G (s)	14.9	14.9	22.2	22.2	12.1	46.3
Effective Green, g (s)	14.9	14.9	22.2	22.2	11.1	45.3
Actuated g/C Ratio	0.21	0.21	0.32	0.32	0.16	0.65
Clearance Time (s)	4.5	4.5	4.5	4.5	4.0	
Vehicle Extension (s)	4.2	4.2	2.0	2.0	0.2	
Lane Grp Cap (vph)	678	306	515	1011	257	1672
v/s Ratio Prot	c0.11		0.16	c0.18	c0.08	c0.14
v/s Ratio Perm		0.01				
v/c Ratio	0.51	0.05	0.51	0.56	0.53	0.22
Uniform Delay, d1	24.4	22.0	19.6	19.9	27.1	5.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	0.4	0.4	0.9	0.0
Delay (s)	25.3	22.1	20.0	20.3	28.0	5.2
Level of Service	C	C	B	C	C	A
Approach Delay (s)	24.8			20.2	9.6	
Approach LOS	C			C	A	

Intersection Summary			
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	70.2	Sum of lost time (s)	19.5
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-36: AM Peak LOS for Barnett Road at Alba Drive, PHF = 1

HCM Signalized Intersection Capacity Analysis
91: Alba Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	905	0	0	810	15	0	0	0	15	0	20
Future Volume (vph)	5	905	0	0	810	15	0	0	0	15	0	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0					5.5		4.5
Lane Util. Factor	1.00	0.95			0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00			1.00					1.00		1.00
Frt	1.00	1.00			1.00					1.00		0.85
Flt Protected	0.95	1.00			1.00					0.95		1.00
Satd. Flow (prot)	1645	3197			3155					1625		1454
Flt Permitted	0.26	1.00			1.00					0.95		1.00
Satd. Flow (perm)	446	3197			3155					1625		1454
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	5	905	0	0	810	15	0	0	0	15	0	20
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	16
Lane Group Flow (vph)	5	905	0	0	824	0	0	0	0	15	0	4
Confl. Peds. (#/hr)	5		3	3		5	1		5	5		1
Heavy Vehicles (%)	1%	4%	2%	2%	5%	7%	2%	2%	2%	2%	2%	1%
Turn Type	pm+pt	NA		Prot	NA					Perm		Perm
Protected Phases	7	4		3	8							
Permitted Phases	4									2		6
Actuated Green, G (s)	30.5	30.5			25.6					9.4		10.4
Effective Green, g (s)	30.0	30.5			25.6					8.9		9.9
Actuated g/C Ratio	0.60	0.61			0.51					0.18		0.20
Clearance Time (s)	4.0	5.0			5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0			5.0					0.2		5.0
Lane Grp Cap (vph)	277	1954			1618					289		288
v/s Ratio Prot	0.00	c0.28			c0.26							
v/s Ratio Perm	0.01									c0.01		0.00
v/c Ratio	0.02	0.46			0.51					0.05		0.01
Uniform Delay, d1	4.5	5.3			8.0					17.0		16.1
Progression Factor	1.00	1.00			1.00					1.00		1.00
Incremental Delay, d2	0.1	0.4			0.5					0.0		0.0
Delay (s)	4.6	5.6			8.5					17.0		16.1
Level of Service	A	A			A					B		B
Approach Delay (s)		5.6			8.5			0.0			16.5	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	49.9	Sum of lost time (s)	14.5
Intersection Capacity Utilization	39.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Figure D-37: AM Peak LOS for Barnett Road at Highland Drive, PHF = 1

HCM 6th Signalized Intersection Summary
90: Highland Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	680	125	900	580	125	115	470	1305	150	535	130
Future Volume (veh/h)	115	680	125	900	580	125	115	470	1305	150	535	130
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1776	1762	1748	1807	1821	1821	1654	1736	1673	1726	1726	1726
Adj Flow Rate, veh/h	115	680	125	900	580	125	115	470	1305	150	535	130
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	2	3	3	2	2	7	1	2	1	1	1
Cap, veh/h	161	851	481	759	1225	263	112	1034	767	117	820	199
Arrive On Green	0.05	0.25	0.25	0.23	0.43	0.43	0.07	0.31	0.31	0.07	0.31	0.31
Sat Flow, veh/h	3281	3348	1481	3338	2833	609	1576	3299	1418	1644	2619	634
Grp Volume(v), veh/h	115	680	125	900	354	351	115	470	1305	150	334	331
Grp Sat Flow(s),veh/h/ln	1641	1674	1481	1669	1730	1712	1576	1650	1418	1644	1640	1612
Q Serve(g_s), s	4.6	25.5	3.2	30.5	19.5	19.7	9.5	15.3	42.0	9.5	23.6	23.8
Cycle Q Clear(g_c), s	4.6	25.5	3.2	30.5	19.5	19.7	9.5	15.3	42.0	9.5	23.6	23.8
Prop In Lane	1.00		1.00	1.00		0.36	1.00		1.00	1.00		0.39
Lane Grp Cap(c), veh/h	161	851	481	759	748	740	112	1034	767	117	514	505
V/C Ratio(X)	0.71	0.80	0.26	1.19	0.47	0.47	1.03	0.45	1.70	1.29	0.65	0.65
Avail Cap(c_a), veh/h	277	1111	597	759	816	807	112	1034	767	117	514	505
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.8	46.8	13.8	51.8	27.1	27.2	62.3	36.9	14.3	62.3	39.7	39.8
Incr Delay (d2), s/veh	2.2	3.9	0.4	96.4	0.7	0.7	93.4	1.4	321.3	179.2	6.3	6.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	11.0	1.4	22.8	8.2	8.1	6.7	6.4	81.1	9.8	10.3	10.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	65.0	50.7	14.2	148.2	27.8	27.9	155.7	38.3	335.6	241.5	46.0	46.3
LnGrp LOS	E	D	B	F	C	C	F	D	F	F	D	D
Approach Vol, veh/h		920			1605			1890			815	
Approach Delay, s/veh		47.5			95.3			250.7			82.1	
Approach LOS		D			F			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	46.5	35.0	38.6	14.0	46.5	11.1	62.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	42.0	30.5	44.5	9.5	42.0	11.3	63.2
Max Q Clear Time (g_c+I1), s	11.5	44.0	32.5	27.5	11.5	25.8	6.6	21.7
Green Ext Time (p_c), s	0.0	0.0	0.0	6.6	0.0	3.0	0.0	7.9

Intersection Summary	
HCM 6th Ctrl Delay	141.0
HCM 6th LOS	F

Figure D-38: AM Peak LOS for Barnett Road at Ellendale Drive, PHF = 1

HCM 6th Signalized Intersection Summary

94: Ellendale Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	1980	140	25	1415	35	120	15	20	55	25	70
Future Volume (veh/h)	15	1980	140	25	1415	35	120	15	20	55	25	70
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1761	1747	1747	1650	1737	1747	1725	1811	1811	1811	1754	1754
Adj Flow Rate, veh/h	15	1980	140	25	1415	35	120	15	20	55	25	70
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	2	2	9	2	2	7	1	1	1	5	5
Cap, veh/h	87	1853	129	34	1840	45	341	160	213	411	85	239
Arrive On Green	0.05	0.59	0.59	0.02	0.56	0.56	0.05	0.23	0.23	0.03	0.21	0.21
Sat Flow, veh/h	1677	3146	220	1572	3291	81	1643	698	931	1725	403	1129
Grp Volume(v), veh/h	15	1033	1087	25	709	741	120	0	35	55	0	95
Grp Sat Flow(s),veh/h/ln	1677	1660	1706	1572	1651	1722	1643	0	1629	1725	0	1532
Q Serve(g_s), s	1.2	84.8	84.8	2.3	47.8	48.0	7.5	0.0	2.4	3.6	0.0	7.5
Cycle Q Clear(g_c), s	1.2	84.8	84.8	2.3	47.8	48.0	7.5	0.0	2.4	3.6	0.0	7.5
Prop In Lane	1.00		0.13	1.00		0.05	1.00		0.57	1.00		0.74
Lane Grp Cap(c), veh/h	87	978	1005	34	923	963	341	0	374	411	0	324
V/C Ratio(X)	0.17	1.06	1.08	0.72	0.77	0.77	0.35	0.00	0.09	0.13	0.00	0.29
Avail Cap(c_a), veh/h	87	978	1005	82	923	963	341	0	374	441	0	324
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.09	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	65.3	29.6	29.6	70.0	24.5	24.6	42.9	0.0	43.7	42.2	0.0	47.7
Incr Delay (d2), s/veh	0.1	28.0	38.9	24.7	6.1	5.9	0.6	0.0	0.5	0.1	0.0	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	39.3	43.5	1.2	19.6	20.5	0.4	0.0	1.1	1.6	0.0	3.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	65.4	57.6	68.5	94.7	30.6	30.5	43.5	0.0	44.2	42.4	0.0	50.0
LnGrp LOS	E	F	F	F	C	C	D	A	D	D	A	D
Approach Vol, veh/h		2135			1475			155			150	
Approach Delay, s/veh		63.2			31.7			43.7			47.2	
Approach LOS		E			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.5	37.5	7.7	89.3	12.0	35.0	12.0	85.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	30.5	7.5	80.5	7.5	30.5	7.5	80.5
Max Q Clear Time (g_c+I1), s	5.6	4.4	4.3	86.8	9.5	9.5	3.2	50.0
Green Ext Time (p_c), s	0.0	0.1	0.0	0.0	0.0	0.5	0.0	12.6

Intersection Summary	
HCM 6th Ctrl Delay	49.9
HCM 6th LOS	D

Figure D-39: AM Peak LOS for Riverside/ OR 99 at Stewart Avenue, PHF = 1

HCM 6th Signalized Intersection Summary

84: Riverside/OR99 & Stewart 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	220	615	330	15	215	55	85	535	200	410	895	15
Future Volume (veh/h)	220	615	330	15	215	55	85	535	200	410	895	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1668	1709	1709	1723	1709	1709	1456	1590	1590	1634	1620	1673
Adj Flow Rate, veh/h	220	615	330	15	215	55	85	535	200	410	895	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	6	3	3	2	3	3	20	10	10	5	6	2
Cap, veh/h	236	670	359	13	482	121	90	725	270	443	1287	
Arrive On Green	0.15	0.33	0.33	0.01	0.19	0.19	0.07	0.34	0.34	0.15	0.42	0.00
Sat Flow, veh/h	1589	2041	1095	1641	2573	644	1387	2155	802	3018	3079	1418
Grp Volume(v), veh/h	220	489	456	15	134	136	85	375	360	410	895	0
Grp Sat Flow(s),veh/h/ln	1589	1624	1512	1641	1624	1593	1387	1511	1446	1509	1539	1418
Q Serve(g_s), s	15.1	31.9	31.9	0.8	8.0	8.4	6.7	24.1	24.2	14.8	26.2	0.0
Cycle Q Clear(g_c), s	15.1	31.9	31.9	0.8	8.0	8.4	6.7	24.1	24.2	14.8	26.2	0.0
Prop In Lane	1.00		0.72	1.00		0.40	1.00		0.55	1.00		1.00
Lane Grp Cap(c), veh/h	236	533	496	13	304	299	90	508	486	443	1287	
V/C Ratio(X)	0.93	0.92	0.92	1.20	0.44	0.46	0.94	0.74	0.74	0.93	0.70	
Avail Cap(c_a), veh/h	289	546	509	313	472	464	240	508	486	521	1287	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	46.3	35.5	35.5	54.6	39.6	39.7	51.2	32.2	32.3	46.3	26.3	0.0
Incr Delay (d2), s/veh	31.3	20.2	21.3	135.7	0.7	0.8	16.0	9.2	9.8	19.4	3.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.9	15.2	14.3	0.8	3.2	3.3	2.7	9.8	9.6	6.5	9.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	77.6	55.7	56.8	190.3	40.3	40.5	67.2	41.4	42.0	65.8	29.4	0.0
LnGrp LOS	E	E	E	F	D	D	E	D	D	E	C	
Approach Vol, veh/h		1165			285			820			1305	A
Approach Delay, s/veh		60.2			48.3			44.3			40.8	
Approach LOS		E			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.2	51.4	5.8	40.6	21.1	42.4	21.3	25.1
Change Period (Y+Rc), s	4.0	* 5.4	4.0	4.5	4.0	* 5.4	4.0	4.5
Max Green Setting (Gmax), s	20.0	* 36	22.0	37.0	20.0	* 37	21.0	32.0
Max Q Clear Time (g_c+I1), s	8.7	28.2	2.8	33.9	16.8	26.2	17.1	10.4
Green Ext Time (p_c), s	0.1	6.4	0.0	2.2	0.4	7.0	0.3	2.5

Intersection Summary	
HCM 6th Ctrl Delay	48.6
HCM 6th LOS	D

Notes

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

Unsignalized Delay for [NWR] is excluded from calculations of the approach delay and intersection delay.

Figure D-40: PM Peak LOS for Barnett Road at Stewart Avenue, PHF = 1

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 02/10/2021

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	725	240	430	810	215	390
Future Volume (vph)	725	240	430	810	215	390
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5	4.5	4.5	5.0	5.5
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3292	1473	1646	3228	1646	2592
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3292	1473	1646	3228	1646	2592
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	725	240	430	810	215	390
RTOR Reduction (vph)	0	149	0	0	0	163
Lane Group Flow (vph)	725	91	430	810	215	227
Heavy Vehicles (%)	1%	1%	1%	3%	1%	1%
Turn Type	NA	Perm	Split	NA	Prot	pt+ov
Protected Phases	4		3	3	5	2 3
Permitted Phases		4				2 3
Actuated Green, G (s)	24.9	24.9	22.2	22.2	15.3	49.5
Effective Green, g (s)	24.9	24.9	22.2	22.2	14.3	48.5
Actuated g/C Ratio	0.30	0.30	0.27	0.27	0.17	0.58
Clearance Time (s)	4.5	4.5	4.5	4.5	4.0	
Vehicle Extension (s)	4.2	4.2	2.0	2.0	0.2	
Lane Grp Cap (vph)	982	439	438	859	282	1507
v/s Ratio Prot	c0.22		c0.26	0.25	c0.13	c0.09
v/s Ratio Perm		0.06				
v/c Ratio	0.74	0.21	0.98	0.94	0.76	0.15
Uniform Delay, d1	26.3	21.9	30.4	30.0	32.9	8.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2	0.4	37.9	18.1	10.4	0.0
Delay (s)	29.5	22.2	68.3	48.1	43.4	8.0
Level of Service	C	C	E	D	D	A
Approach Delay (s)	27.7			55.1	20.6	
Approach LOS	C			E	C	

Intersection Summary			
HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	83.4	Sum of lost time (s)	19.5
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Figure D-41: PM Peak LOS for Barnett Road at Alba Drive, PHF = 1

HCM Signalized Intersection Capacity Analysis

91: Alba Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	1100	0	0	1215	40	0	0	0	35	0	25
Future Volume (vph)	15	1100	0	0	1215	40	0	0	0	35	0	25
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	5.0			5.0					5.5		4.5
Lane Util. Factor	1.00	0.95			0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00			1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00			1.00					1.00		1.00
Frt	1.00	1.00			1.00					1.00		0.85
Flt Protected	0.95	1.00			1.00					0.95		1.00
Satd. Flow (prot)	1554	3292			3271					1623		1454
Flt Permitted	0.16	1.00			1.00					0.95		1.00
Satd. Flow (perm)	257	3292			3271					1623		1454
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	1100	0	0	1215	40	0	0	0	35	0	25
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	21
Lane Group Flow (vph)	15	1100	0	0	1254	0	0	0	0	35	0	4
Confl. Peds. (#/hr)	5		3	3		5	1		5	5		1
Heavy Vehicles (%)	7%	1%	2%	2%	1%	3%	2%	2%	2%	2%	2%	1%
Turn Type	pm+pt	NA		Prot	NA					Perm		Perm
Protected Phases	7	4		3	8							
Permitted Phases	4									2		6
Actuated Green, G (s)	47.4	47.4			42.5					9.4		10.4
Effective Green, g (s)	46.9	47.4			42.5					8.9		9.9
Actuated g/C Ratio	0.70	0.71			0.64					0.13		0.15
Clearance Time (s)	4.0	5.0			5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0			5.0					0.2		5.0
Lane Grp Cap (vph)	188	2335			2081					216		215
v/s Ratio Prot	0.00	c0.33			c0.38							
v/s Ratio Perm	0.06									c0.02		0.00
v/c Ratio	0.08	0.47			0.60					0.16		0.02
Uniform Delay, d1	4.4	4.2			7.2					25.6		24.3
Progression Factor	1.00	1.00			1.00					1.00		1.00
Incremental Delay, d2	0.4	0.3			0.7					0.1		0.1
Delay (s)	4.8	4.5			7.9					25.8		24.4
Level of Service	A	A			A					C		C
Approach Delay (s)		4.6			7.9			0.0			25.2	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	66.8	Sum of lost time (s)	14.5
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Figure D-42: PM Peak LOS for Barnett Road at Highland Drive, PHF = 1

HCM 6th Signalized Intersection Summary

90: Highland Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	630	295	955	845	115	200	605	870	100	720	210
Future Volume (veh/h)	210	630	295	955	845	115	200	605	870	100	720	210
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1687	1712	1712	1687	1687	1712	1658	1712	1712	1647	1687	1687
Adj Flow Rate, veh/h	210	630	295	955	845	115	200	605	870	100	720	210
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	1	1	1	1	1	5	1	1	4	1	1
Cap, veh/h	248	746	532	694	1339	182	216	671	767	215	505	147
Arrive On Green	0.08	0.23	0.23	0.32	0.47	0.47	0.14	0.21	0.21	0.14	0.21	0.21
Sat Flow, veh/h	3116	3252	1450	2153	2834	386	1579	3252	1450	1569	2447	714
Grp Volume(v), veh/h	210	630	295	955	478	482	200	605	870	100	471	459
Grp Sat Flow(s),veh/h/ln	1558	1626	1450	1076	1602	1617	1579	1626	1450	1569	1602	1558
Q Serve(g_s), s	11.4	31.9	4.3	55.5	38.6	38.6	21.5	31.2	35.5	10.1	35.5	35.5
Cycle Q Clear(g_c), s	11.4	31.9	4.3	55.5	38.6	38.6	21.5	31.2	35.5	10.1	35.5	35.5
Prop In Lane	1.00		1.00	1.00		0.24	1.00		1.00	1.00		0.46
Lane Grp Cap(c), veh/h	248	746	532	694	757	764	216	671	767	215	331	322
V/C Ratio(X)	0.85	0.84	0.55	1.38	0.63	0.63	0.92	0.90	1.13	0.47	1.43	1.43
Avail Cap(c_a), veh/h	1005	860	582	694	757	764	234	671	767	232	331	322
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	78.1	63.4	43.3	58.3	34.1	34.1	73.4	66.6	40.5	68.4	68.3	68.3
Incr Delay (d2), s/veh	3.1	7.6	1.4	177.9	2.0	2.0	36.2	17.6	76.1	0.6	208.4	209.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	14.0	10.4	32.3	15.6	15.8	10.9	14.6	25.8	4.1	33.7	32.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	81.2	70.9	44.8	236.2	36.1	36.1	109.5	84.2	116.6	69.0	276.7	277.2
LnGrp LOS	F	E	D	F	D	D	F	F	F	E	F	F
Approach Vol, veh/h		1135			1915			1675			1030	
Approach Delay, s/veh		66.0			135.9			104.0			256.8	
Approach LOS		E			F			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	28.1	40.0	60.0	44.0	28.1	40.0	18.2	85.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	25.5	35.5	55.5	45.5	25.5	35.5	55.5	45.5
Max Q Clear Time (g_c+I1), s	12.1	37.5	57.5	33.9	23.5	37.5	13.4	40.6
Green Ext Time (p_c), s	0.1	0.0	0.0	5.6	0.0	0.0	0.2	3.2

Intersection Summary	
HCM 6th Ctrl Delay	134.5
HCM 6th LOS	F

Figure D-43: PM Peak LOS for Barnett Road at Ellendale Drive, PHF = 1

HCM 6th Signalized Intersection Summary

94: Ellendale Drive & Barnett Road 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	1345	225	55	1695	15	185	30	45	35	15	35
Future Volume (veh/h)	30	1345	225	55	1695	15	185	30	45	35	15	35
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	977	1736	1736	1736	1736	1736	1736	1736	1736	1736	1736	1736
Adj Flow Rate, veh/h	30	1345	225	55	1695	15	185	30	45	35	15	35
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	3	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	48	1483	245	86	1757	16	444	170	254	372	97	226
Arrive On Green	0.05	0.52	0.52	0.05	0.52	0.52	0.09	0.27	0.27	0.03	0.21	0.21
Sat Flow, veh/h	930	2829	468	1654	3351	30	1654	622	934	1654	458	1068
Grp Volume(v), veh/h	30	778	792	55	834	876	185	0	75	35	0	50
Grp Sat Flow(s),veh/h/ln	930	1650	1647	1654	1650	1731	1654	0	1556	1654	0	1526
Q Serve(g_s), s	4.5	61.1	63.5	4.7	70.0	70.3	12.5	0.0	5.3	2.4	0.0	3.8
Cycle Q Clear(g_c), s	4.5	61.1	63.5	4.7	70.0	70.3	12.5	0.0	5.3	2.4	0.0	3.8
Prop In Lane	1.00		0.28	1.00		0.02	1.00		0.60	1.00		0.70
Lane Grp Cap(c), veh/h	48	865	863	86	865	907	444	0	424	372	0	323
V/C Ratio(X)	0.62	0.90	0.92	0.64	0.96	0.97	0.42	0.00	0.18	0.09	0.00	0.15
Avail Cap(c_a), veh/h	48	865	863	86	865	907	444	0	424	415	0	323
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.31	0.31	0.31	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	66.9	30.8	31.4	66.9	32.9	33.0	38.5	0.0	40.0	42.7	0.0	46.2
Incr Delay (d2), s/veh	7.2	5.2	6.2	14.7	23.0	22.6	0.6	0.0	0.9	0.1	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	24.7	25.7	2.3	32.3	33.9	5.2	0.0	2.2	1.0	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.1	36.0	37.5	81.6	56.0	55.7	39.1	0.0	41.0	42.8	0.0	47.3
LnGrp LOS	E	D	D	F	E	E	D	A	D	D	A	D
Approach Vol, veh/h		1600			1765			260			85	
Approach Delay, s/veh		37.5			56.6			39.6			45.4	
Approach LOS		D			E			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	43.7	12.0	80.0	17.0	35.0	12.0	80.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	35.5	7.5	75.5	12.5	30.5	7.5	75.5
Max Q Clear Time (g_c+I1), s	4.4	7.3	6.7	65.5	14.5	5.8	6.5	72.3
Green Ext Time (p_c), s	0.0	0.4	0.0	7.0	0.0	0.2	0.0	2.7

Intersection Summary	
HCM 6th Ctrl Delay	46.9
HCM 6th LOS	D

Figure D-44: PM Peak LOS for Riverside/OR 99 at Stewart Avenue, PHF = 1

HCM 6th Signalized Intersection Summary

84: Riverside/OR99 & Stewart 02/10/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	530	305	225	75	445	245	130	1085	205	695	615	220
Future Volume (veh/h)	530	305	225	75	445	245	130	1085	205	695	615	220
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1709	1726	1726	1709	1723	1723	1604	1713	1713	1695	1709	1682
Adj Flow Rate, veh/h	530	305	225	75	445	245	130	1085	205	695	615	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	3	1	1	3	2	2	10	2	2	4	3	5
Cap, veh/h	253	655	471	82	519	284	141	786	148	463	1115	
Arrive On Green	0.16	0.36	0.36	0.05	0.25	0.25	0.09	0.29	0.29	0.15	0.34	0.00
Sat Flow, veh/h	1628	1821	1309	1628	2043	1116	1528	2733	515	3132	3247	1425
Grp Volume(v), veh/h	530	274	256	75	356	334	130	645	645	695	615	0
Grp Sat Flow(s),veh/h/ln	1628	1640	1491	1628	1637	1522	1528	1627	1620	1566	1624	1425
Q Serve(g_s), s	20.0	16.5	17.1	5.9	26.6	27.0	10.9	37.0	37.0	19.0	19.7	0.0
Cycle Q Clear(g_c), s	20.0	16.5	17.1	5.9	26.6	27.0	10.9	37.0	37.0	19.0	19.7	0.0
Prop In Lane	1.00		0.88	1.00		0.73	1.00		0.32	1.00		1.00
Lane Grp Cap(c), veh/h	253	590	536	82	416	387	141	468	466	463	1115	
V/C Ratio(X)	2.09	0.46	0.48	0.92	0.86	0.86	0.92	1.38	1.38	1.50	0.55	
Avail Cap(c_a), veh/h	253	590	536	266	465	432	226	468	466	463	1115	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	54.3	31.6	31.8	60.8	45.7	45.8	57.9	45.8	45.8	54.8	34.2	0.0
Incr Delay (d2), s/veh	505.4	0.4	0.5	14.4	12.9	14.7	20.9	182.5	186.0	236.8	2.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	43.6	6.6	6.2	2.7	12.2	11.7	5.0	38.4	38.7	22.5	7.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	559.7	32.1	32.3	75.2	58.6	60.6	78.8	228.3	231.8	291.6	36.2	0.0
LnGrp LOS	F	C	C	E	E	E	E	F	F	F	D	
Approach Vol, veh/h		1060			765			1420			1310	A
Approach Delay, s/veh		295.9			61.1			216.2			171.7	
Approach LOS		F			E			F			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.9	49.5	11.4	50.7	24.0	42.4	25.0	37.2
Change Period (Y+Rc), s	4.0	* 5.4	4.0	4.5	4.0	* 5.4	4.0	4.5
Max Green Setting (Gmax), s	20.0	* 36	22.0	37.0	20.0	* 37	21.0	36.5
Max Q Clear Time (g_c+I1), s	12.9	21.7	7.9	19.1	21.0	39.0	22.0	29.0
Green Ext Time (p_c), s	0.1	8.4	0.1	5.0	0.0	0.0	0.0	3.7

Intersection Summary	
HCM 6th Ctrl Delay	195.9
HCM 6th LOS	F

Notes

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

Unsignalized Delay for [NWR] is excluded from calculations of the approach delay and intersection delay.

Signal Timing and Phasing

Figure D-45: AM and PM Peak Barnett Road at Stewart Avenue Signal Timing

Timings

83: Stewart Avenue & Barnett Road 02/10/2021

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø1	Ø2	Ø6
Lane Configurations									
Traffic Volume (vph)	725	240	430	810	215	390			
Future Volume (vph)	725	240	430	810	215	390			
Turn Type	NA	Perm	Split	NA	Prot	pt+ov			
Protected Phases	4		3	3	5	2 3	1	2	6
Permitted Phases		4				2 3			
Detector Phase	4	4	3	3	5	2 3			
Switch Phase									
Minimum Initial (s)	10.0	10.0	4.0	4.0	1.0		1.0	10.0	10.0
Minimum Split (s)	33.0	33.0	24.0	24.0	32.0		33.0	14.5	34.0
Total Split (s)	42.0	42.0	25.0	25.0	32.0		33.0	21.0	34.0
Total Split (%)	31.6%	31.6%	18.8%	18.8%	24.1%		25%	16%	26%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.5		3.5	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	1.0				
Total Lost Time (s)	4.5	4.5	4.5	4.5	5.0				
Lead/Lag	Lag	Lag	Lead	Lead	Lead		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None		None	None	None
Act Effct Green (s)	26.4	26.4	22.1	22.1	14.8	45.3			
Actuated g/C Ratio	0.32	0.32	0.27	0.27	0.18	0.55			
v/c Ratio	0.72	0.41	1.03	0.99	0.77	0.26			
Control Delay	31.4	8.5	84.8	61.4	52.9	1.4			
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0			
Total Delay	31.4	8.5	84.8	61.4	52.9	1.4			
LOS	C	A	F	E	D	A			
Approach Delay	25.7			69.5	19.6				
Approach LOS	C			E	B				

Intersection Summary	
Cycle Length: 133	
Actuated Cycle Length: 82.5	
Natural Cycle: 125	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 43.7	Intersection LOS: D
Intersection Capacity Utilization 72.2%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 83: Stewart Avenue & Barnett Road

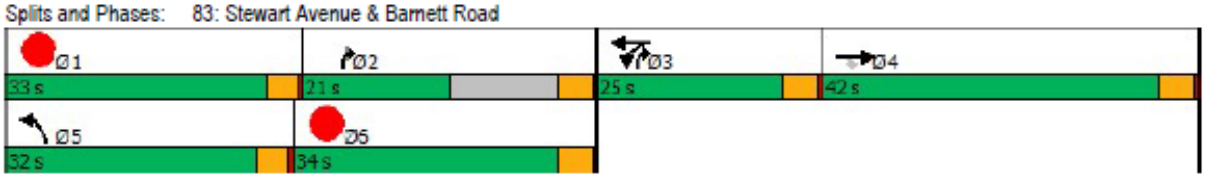
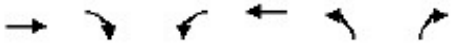


Figure D-46: AM and PM Peak Barnett Road at Stewart Avenue Signal Phasing

Phasings

83: Stewart Avenue & Barnett Road 02/10/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø1	Ø2	Ø6
Protected Phases	4		3	3	5	2 3	1	2	6
Permitted Phases		4				2 3			
Minimum Initial (s)	10.0	10.0	4.0	4.0	1.0		1.0	10.0	10.0
Minimum Split (s)	33.0	33.0	24.0	24.0	32.0		33.0	14.5	34.0
Total Split (s)	42.0	42.0	25.0	25.0	32.0		33.0	21.0	34.0
Total Split (%)	31.6%	31.6%	18.8%	18.8%	24.1%		25%	16%	26%
Maximum Green (s)	37.5	37.5	20.5	20.5	28.0		29.0	16.5	29.5
Yellow Time (s)	4.0	4.0	4.0	4.0	3.5		3.5	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5
Lead/Lag	Lag	Lag	Lead	Lead	Lead		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	4.2	4.2	2.0	2.0	0.2		1.0	2.5	0.2
Minimum Gap (s)	2.0	2.0	2.0	2.0	0.2		0.2	1.0	0.2
Time Before Reduce (s)	10.0	10.0	0.0	0.0	0.0		0.0	5.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Recall Mode	None	None	None	None	None		None	None	None
Walk Time (s)	6.0	6.0			6.0		6.0		6.0
Flash Dont Walk (s)	22.0	22.0			22.0		23.0		23.0
Pedestrian Calls (#/hr)	10	10			0		0		10
90th %ile Green (s)	37.5	37.5	20.5	20.5	28.0		0.0	61.0	29.0
90th %ile Term Code	Max	Max	Max	Max	Max		Skip	Hold	Ped
70th %ile Green (s)	29.1	29.1	20.5	20.5	16.8		0.0	16.3	0.0
70th %ile Term Code	Gap	Gap	Max	Max	Gap		Skip	Hold	Skip
50th %ile Green (s)	25.6	25.6	20.5	20.5	14.2		0.0	13.7	0.0
50th %ile Term Code	Gap	Gap	Max	Max	Gap		Skip	Hold	Skip
30th %ile Green (s)	21.6	21.6	20.5	20.5	11.4		0.0	10.9	0.0
30th %ile Term Code	Gap	Gap	Max	Max	Gap		Skip	Hold	Skip
10th %ile Green (s)	16.9	16.9	20.5	20.5	10.5		0.0	10.0	0.0
10th %ile Term Code	Gap	Gap	Max	Max	Hold		Skip	Min	Skip

Intersection Summary
Cycle Length: 133
Actuated Cycle Length: 82.5
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 132.5
70th %ile Actuated Cycle: 79.4
50th %ile Actuated Cycle: 73.3
30th %ile Actuated Cycle: 66.5
10th %ile Actuated Cycle: 60.9

Figure D-47: AM and PM Peak Barnett Road at Alba Drive Signal Timing

Timings

91: Alba Drive & Barnett Road 02/10/2021

Lane Group	EBL	EBT	WBT	SBL	SBR	Ø3
Lane Configurations						
Traffic Volume (vph)	15	1100	1215	35	25	
Future Volume (vph)	15	1100	1215	35	25	
Turn Type	pm+pt	NA	NA	Perm	Perm	
Protected Phases	7	4	8			3
Permitted Phases	4			2	6	
Detector Phase	7	4	8	2	6	
Switch Phase						
Minimum Initial (s)	5.0	10.0	10.0	1.0	5.0	5.0
Minimum Split (s)	9.0	24.0	24.0	30.0	29.0	9.0
Total Split (s)	12.0	80.0	68.0	40.0	29.0	9.0
Total Split (%)	9.3%	62.0%	52.7%	31.0%	22.5%	7%
Yellow Time (s)	3.5	4.0	4.0	4.0	3.5	3.5
All-Red Time (s)	0.5	1.0	1.0	1.0	0.5	0.5
Lost Time Adjust (s)	0.5	0.0	0.0	0.5	0.5	
Total Lost Time (s)	4.5	5.0	5.0	5.5	4.5	
Lead/Lag	Lead	Lag	Lag			Lead
Lead-Lag Optimize?	Yes	Yes	Yes			Yes
Recall Mode	None	None	None	Min	None	None
Act Effct Green (s)	47.8	47.2	45.8	8.7	9.8	
Actuated g/C Ratio	0.71	0.70	0.68	0.13	0.15	
v/c Ratio	0.05	0.51	0.61	0.18	0.11	
Control Delay	4.1	6.0	9.0	31.3	4.0	
Queue Delay	0.0	0.0	0.3	0.0	0.0	
Total Delay	4.1	6.0	9.3	31.3	4.0	
LOS	A	A	A	C	A	
Approach Delay		5.9	9.3			
Approach LOS		A	A			

Intersection Summary	
Cycle Length: 129	
Actuated Cycle Length: 67.3	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.61	
Intersection Signal Delay: 8.0	Intersection LOS: A
Intersection Capacity Utilization 50.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 91: Alba Drive & Barnett Road

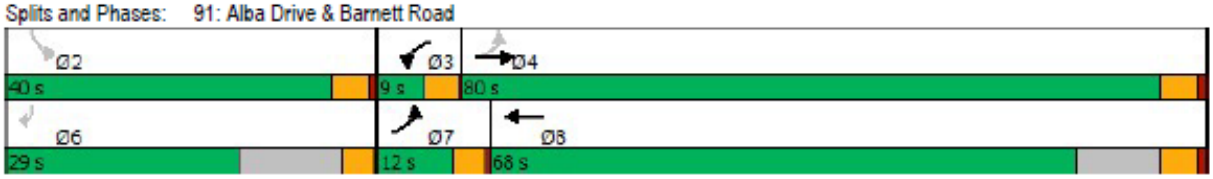
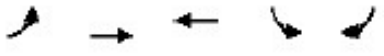


Figure D-48: AM and PM Peak Barnett Road at Alba Drive Signal Phasing

Phasings

91: Alba Drive & Barnett Road 02/10/2021



Lane Group	EBL	EBT	WBT	SBL	SBR	Ø3
Protected Phases	7	4	8			3
Permitted Phases	4			2	6	
Minimum Initial (s)	5.0	10.0	10.0	1.0	5.0	5.0
Minimum Split (s)	9.0	24.0	24.0	30.0	29.0	9.0
Total Split (s)	12.0	80.0	68.0	40.0	29.0	9.0
Total Split (%)	9.3%	62.0%	52.7%	31.0%	22.5%	7%
Maximum Green (s)	8.0	75.0	63.0	35.0	25.0	5.0
Yellow Time (s)	3.5	4.0	4.0	4.0	3.5	3.5
All-Red Time (s)	0.5	1.0	1.0	1.0	0.5	0.5
Lead/Lag	Lead	Lag	Lag			Lead
Lead-Lag Optimize?	Yes	Yes	Yes			Yes
Vehicle Extension (s)	5.0	5.0	5.0	0.2	5.0	5.0
Minimum Gap (s)	1.5	1.0	2.0	0.2	1.0	1.5
Time Before Reduce (s)	5.0	0.0	5.0	0.0	5.0	5.0
Time To Reduce (s)	0.0	40.0	40.0	0.0	0.0	0.0
Recall Mode	None	None	None	Min	None	None
Walk Time (s)		6.0	6.0	6.0	6.0	
Flash Dont Walk (s)		13.0	13.0	19.0	19.0	
Pedestrian Calls (#/hr)		10	10	10	10	
90th %ile Green (s)	8.0	75.0	63.0	25.0	26.0	0.0
90th %ile Term Code	Max	Hold	Max	Ped	Hold	Skip
70th %ile Green (s)	0.0	45.7	45.7	6.5	7.5	0.0
70th %ile Term Code	Skip	Hold	Gap	Hold	Gap	Skip
50th %ile Green (s)	0.0	42.8	42.8	6.5	7.5	0.0
50th %ile Term Code	Skip	Hold	Gap	Hold	Gap	Skip
30th %ile Green (s)	0.0	39.1	39.1	6.5	7.5	0.0
30th %ile Term Code	Skip	Hold	Gap	Hold	Hold	Skip
10th %ile Green (s)	0.0	33.0	33.0	6.5	7.5	0.0
10th %ile Term Code	Skip	Hold	Gap	Hold	Hold	Skip

Intersection Summary
Cycle Length: 129
Actuated Cycle Length: 67.3
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 110
70th %ile Actuated Cycle: 62.2
50th %ile Actuated Cycle: 59.3
30th %ile Actuated Cycle: 55.6
10th %ile Actuated Cycle: 49.5

Figure D-49: AM Peak Barnett Road at Highland Drive Signal Timing

Timings

90: Highland Drive & Barnett Road 02/10/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	115	680	125	900	580	115	470	1305	150	535
Future Volume (vph)	115	680	125	900	580	115	470	1305	150	535
Turn Type	Prot	NA	pm+ov	Prot	NA	Prot	NA	pm+ov	Prot	NA
Protected Phases	7	4	5	3	8	5	2	3	1	6
Permitted Phases			4					2		
Detector Phase	7	4	5	3	8	5	2	3	1	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	49.0	10.0	10.0	38.0	10.0	43.0	10.0	10.0	45.0
Total Split (s)	15.8	49.0	14.0	35.0	67.7	14.0	46.5	35.0	14.0	46.5
Total Split (%)	10.9%	33.9%	9.7%	24.2%	46.9%	9.7%	32.2%	24.2%	9.7%	32.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	None	Max	None	None	Max
Act Effct Green (s)	9.0	42.8	52.3	30.5	64.3	9.5	42.0	72.5	9.5	42.0
Actuated g/C Ratio	0.06	0.30	0.37	0.21	0.45	0.07	0.29	0.51	0.07	0.29
v/c Ratio	0.59	0.92	0.23	1.34	0.51	1.40	0.66	2.20	1.95	0.84
Control Delay	77.1	63.2	7.6	205.1	28.7	273.5	48.2	564.2	490.3	55.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	77.1	63.2	7.6	205.1	28.7	273.5	48.2	564.2	490.3	55.2
LOS	E	E	A	F	C	F	D	F	F	E
Approach Delay		58.3			125.5		410.9			147.1
Approach LOS		E			F		F			F

Intersection Summary	
Cycle Length: 144.5	
Actuated Cycle Length: 142.8	
Natural Cycle: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 2.20	
Intersection Signal Delay: 225.4	Intersection LOS: F
Intersection Capacity Utilization 130.6%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 90: Highland Drive & Barnett Road

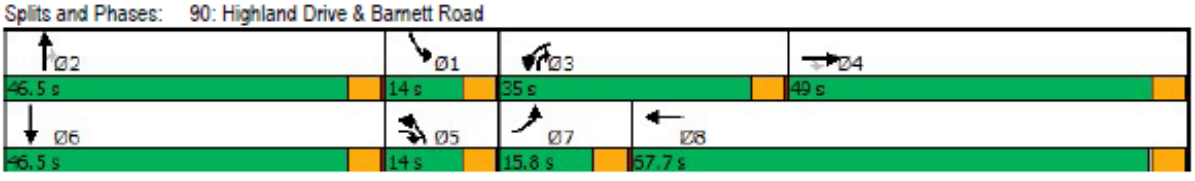


Figure D-50: AM Peak Barnett Road at Highland Drive Signal Phasing

Phasings

90: Highland Drive & Barnett Road 02/10/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Protected Phases	7	4	5	3	8	5	2	3	1	6
Permitted Phases			4					2		
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	49.0	10.0	10.0	38.0	10.0	43.0	10.0	10.0	45.0
Total Split (s)	15.8	49.0	14.0	35.0	67.7	14.0	46.5	35.0	14.0	46.5
Total Split (%)	10.9%	33.9%	9.7%	24.2%	46.9%	9.7%	32.2%	24.2%	9.7%	32.2%
Maximum Green (s)	11.3	44.5	9.5	30.5	63.2	9.5	42.0	30.5	9.5	42.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	1.5	4.2	1.5	1.5	4.2	1.5	2.5	1.5	1.5	2.5
Minimum Gap (s)	1.5	2.0	1.5	1.5	3.0	1.5	1.0	1.5	1.5	1.0
Time Before Reduce (s)	0.0	5.0	0.0	0.0	5.0	0.0	10.0	0.0	0.0	10.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	Min	None	None	Min	None	Max	None	None	Max
Walk Time (s)		5.0			5.0		7.0			7.0
Flash Dont Walk (s)		26.0			26.0		22.0			22.0
Pedestrian Calls (#/hr)		0			0		0			0
90th %ile Green (s)	11.3	44.5	9.5	30.5	63.7	9.5	42.0	30.5	9.5	42.0
90th %ile Term Code	Max	Max	Max	Max	Hold	Max	MaxR	Max	Max	MaxR
70th %ile Green (s)	10.6	44.5	9.5	30.5	64.4	9.5	42.0	30.5	9.5	42.0
70th %ile Term Code	Gap	Max	Max	Max	Hold	Max	MaxR	Max	Max	MaxR
50th %ile Green (s)	9.3	44.5	9.5	30.5	65.7	9.5	42.0	30.5	9.5	42.0
50th %ile Term Code	Gap	Max	Max	Max	Hold	Max	MaxR	Max	Max	MaxR
30th %ile Green (s)	8.0	43.4	9.5	30.5	65.9	9.5	42.0	30.5	9.5	42.0
30th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Max	MaxR
10th %ile Green (s)	6.1	37.3	9.5	30.5	61.7	9.5	42.0	30.5	9.5	42.0
10th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Max	MaxR

Intersection Summary
Cycle Length: 144.5
Actuated Cycle Length: 142.8
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 144.5
70th %ile Actuated Cycle: 144.5
50th %ile Actuated Cycle: 144.5
30th %ile Actuated Cycle: 143.4
10th %ile Actuated Cycle: 137.3

Figure D-51: PM Peak Barnett Road at Highland Drive Signal Timing

Timings

90: Highland Drive & Barnett Road 02/10/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	210	630	295	955	845	200	605	870	100	720
Future Volume (vph)	210	630	295	955	845	200	605	870	100	720
Turn Type	Prot	NA	pm+ov	Prot	NA	Prot	NA	pm+ov	Prot	NA
Protected Phases	7	4	5	3	8	5	2	3	1	6
Permitted Phases			4					2		
Detector Phase	7	4	5	3	8	5	2	3	1	6
Switch Phase										
Minimum Initial (s)	5.0	8.0	5.0	5.0	8.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	49.0	10.0	10.0	38.0	10.0	33.5	10.0	10.0	33.5
Total Split (s)	60.0	50.0	30.0	60.0	50.0	30.0	40.0	60.0	30.0	40.0
Total Split (%)	33.3%	27.8%	16.7%	33.3%	27.8%	16.7%	22.2%	33.3%	16.7%	22.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lag	Lead	Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	None	Max	None	None	None
Act Effct Green (s)	17.0	45.5	75.5	55.5	84.0	25.5	35.5	95.5	25.5	35.5
Actuated g/C Ratio	0.09	0.25	0.42	0.31	0.47	0.14	0.20	0.53	0.14	0.20
v/c Ratio	0.76	1.00	0.50	1.81	0.70	1.02	1.06	1.09	0.51	1.58
Control Delay	96.1	96.6	33.1	403.9	41.4	138.3	120.1	92.1	80.5	312.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	96.1	96.6	33.1	403.9	41.4	138.3	120.1	92.1	80.5	312.6
LOS	F	F	C	F	D	F	F	F	F	F
Approach Delay		81.6			236.6		108.3			289.0
Approach LOS		F			F		F			F

Intersection Summary	
Cycle Length: 180	
Actuated Cycle Length: 180	
Natural Cycle: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.81	
Intersection Signal Delay: 177.0	Intersection LOS: F
Intersection Capacity Utilization 106.6%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 90: Highland Drive & Barnett Road

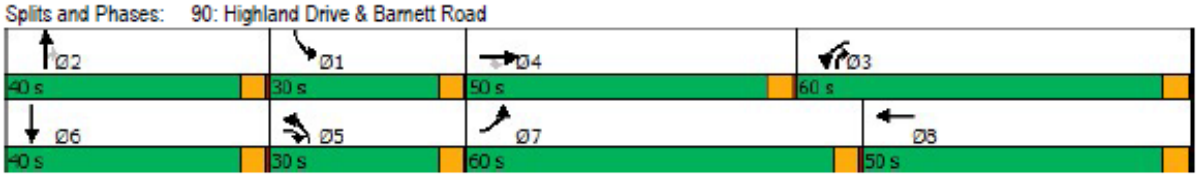
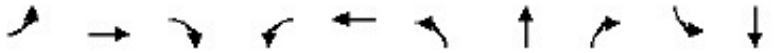


Figure D-52: PM Peak Barnett Road at Highland Drive Signal Phasing

Phasings

90: Highland Drive & Barnett Road 02/10/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Protected Phases	7	4	5	3	8	5	2	3	1	6
Permitted Phases			4					2		
Minimum Initial (s)	5.0	8.0	5.0	5.0	8.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	49.0	10.0	10.0	38.0	10.0	33.5	10.0	10.0	33.5
Total Split (s)	60.0	50.0	30.0	60.0	50.0	30.0	40.0	60.0	30.0	40.0
Total Split (%)	33.3%	27.8%	16.7%	33.3%	27.8%	16.7%	22.2%	33.3%	16.7%	22.2%
Maximum Green (s)	55.5	45.5	25.5	55.5	45.5	25.5	35.5	55.5	25.5	35.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lag	Lead	Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	1.5	4.2	1.5	1.5	4.2	1.5	2.5	1.5	1.5	2.5
Minimum Gap (s)	1.5	2.0	1.5	1.5	2.0	1.5	1.0	1.5	1.5	1.0
Time Before Reduce (s)	0.0	5.0	0.0	0.0	5.0	0.0	10.0	0.0	0.0	10.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	Min	None	None	Min	None	Max	None	None	None
Walk Time (s)		5.0			5.0		7.0			7.0
Flash Dont Walk (s)		26.0			26.0		22.0			22.0
Pedestrian Calls (#/hr)		0			0		0			0
90th %ile Green (s)	22.1	45.5	25.5	55.5	78.9	25.5	35.5	55.5	25.5	35.5
90th %ile Term Code	Gap	Max	Max	Max	Hold	Max	MaxR	Max	Hold	Max
70th %ile Green (s)	19.1	45.5	25.5	55.5	81.9	25.5	35.5	55.5	25.5	35.5
70th %ile Term Code	Gap	Max	Max	Max	Hold	Max	MaxR	Max	Hold	Max
50th %ile Green (s)	17.0	45.5	25.5	55.5	84.0	25.5	35.5	55.5	25.5	35.5
50th %ile Term Code	Gap	Max	Max	Max	Hold	Max	MaxR	Max	Hold	Max
30th %ile Green (s)	14.9	45.5	25.5	55.5	86.1	25.5	35.5	55.5	25.5	35.5
30th %ile Term Code	Gap	Max	Max	Max	Hold	Max	MaxR	Max	Hold	Max
10th %ile Green (s)	11.9	45.5	25.5	55.5	89.1	25.5	35.5	55.5	25.5	35.5
10th %ile Term Code	Gap	Max	Max	Max	Hold	Max	MaxR	Max	Hold	Max

Intersection Summary
Cycle Length: 180
Actuated Cycle Length: 180
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 180
70th %ile Actuated Cycle: 180
50th %ile Actuated Cycle: 180
30th %ile Actuated Cycle: 180
10th %ile Actuated Cycle: 180

Figure D-53: AM Peak Barnett Road at Ellendale Drive Signal Timing

Timings

94: Ellendale Drive & Barnett Road 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	15	1980	25	1415	120	15	55	25
Future Volume (vph)	15	1980	25	1415	120	15	55	25
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases					2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	12.0	26.5	12.0	29.5	12.0	30.5	12.0	34.5
Total Split (s)	12.0	85.0	12.0	85.0	12.0	35.0	12.0	35.0
Total Split (%)	8.3%	59.0%	8.3%	59.0%	8.3%	24.3%	8.3%	24.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	6.7	85.3	6.9	87.7	38.9	32.9	37.7	30.5
Actuated g/C Ratio	0.05	0.59	0.05	0.61	0.27	0.23	0.26	0.21
v/c Ratio	0.22	1.22	0.38	0.81	0.44	0.11	0.17	0.27
Control Delay	72.7	133.0	80.8	26.8	45.5	26.0	38.6	17.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.7	133.0	80.8	26.8	45.5	26.0	38.6	17.5
LOS	E	F	F	C	D	C	D	B
Approach Delay		132.6		27.7		41.1		25.2
Approach LOS		F		C		D		C

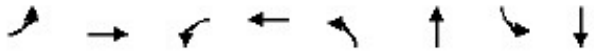
Intersection Summary	
Cycle Length: 144	
Actuated Cycle Length: 144	
Offset: 142 (99%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 120	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 85.3	Intersection LOS: F
Intersection Capacity Utilization 95.9%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 94: Ellendale Drive & Barnett Road

Figure D-54: AM Peak Barnett Road at Ellendale Drive Signal Phasing

Phasings

94: Ellendale Drive & Barnett Road 02/10/2021



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases					2		6	
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	12.0	26.5	12.0	29.5	12.0	30.5	12.0	34.5
Total Split (s)	12.0	85.0	12.0	85.0	12.0	35.0	12.0	35.0
Total Split (%)	8.3%	59.0%	8.3%	59.0%	8.3%	24.3%	8.3%	24.3%
Maximum Green (s)	7.5	80.5	7.5	80.5	7.5	30.5	7.5	30.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	C-Max	None	C-Max	None	Max	None	Max
Walk Time (s)		7.0		7.0		7.0		7.0
Flash Dont Walk (s)		15.0		18.0		19.0		23.0
Pedestrian Calls (#/hr)		0		0		0		0
90th %ile Green (s)	7.5	80.5	7.5	80.5	7.5	30.5	7.5	30.5
90th %ile Term Code	Max	Coord	Max	Coord	Max	MaxR	Max	MaxR
70th %ile Green (s)	7.5	80.5	7.5	80.5	7.5	30.5	7.5	30.5
70th %ile Term Code	Max	Coord	Max	Coord	Max	MaxR	Max	MaxR
50th %ile Green (s)	0.0	80.5	7.5	92.5	7.5	30.5	7.5	30.5
50th %ile Term Code	Skip	Coord	Max	Coord	Max	MaxR	Max	MaxR
30th %ile Green (s)	0.0	92.5	0.0	92.5	7.5	30.5	7.5	30.5
30th %ile Term Code	Skip	Coord	Skip	Coord	Max	MaxR	Max	MaxR
10th %ile Green (s)	0.0	92.5	0.0	92.5	7.5	42.5	0.0	30.5
10th %ile Term Code	Skip	Coord	Skip	Coord	Max	MaxR	Skip	MaxR

Intersection Summary
Cycle Length: 144
Actuated Cycle Length: 144
Offset: 142 (99%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow
Control Type: Actuated-Coordinated

Figure D-55: PM Peak Barnett Road at Ellendale Drive Signal Timing

Timings

94: Ellendale Drive & Barnett Road 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	30	1345	55	1695	185	30	35	15
Future Volume (vph)	30	1345	55	1695	185	30	35	15
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases					2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	12.0	26.5	12.0	29.5	12.0	30.5	12.0	34.5
Total Split (s)	12.0	80.0	12.0	80.0	17.0	40.0	12.0	35.0
Total Split (%)	8.3%	55.6%	8.3%	55.6%	11.8%	27.8%	8.3%	24.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	7.3	75.5	7.3	75.5	49.9	40.5	40.1	33.2
Actuated g/C Ratio	0.05	0.52	0.05	0.52	0.35	0.28	0.28	0.23
v/c Ratio	0.67	0.96	0.69	1.02	0.45	0.16	0.10	0.13
Control Delay	123.3	46.9	104.2	61.5	39.9	20.7	34.3	20.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	123.3	46.9	104.2	61.5	39.9	20.7	34.3	20.7
LOS	F	D	F	E	D	C	C	C
Approach Delay		48.4		62.8		34.4		26.3
Approach LOS		D		E		C		C

Intersection Summary	
Cycle Length: 144	
Actuated Cycle Length: 144	
Offset: 127.5 (89%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Natural Cycle: 120	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.02	
Intersection Signal Delay: 53.8	Intersection LOS: D
Intersection Capacity Utilization 83.9%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 94: Ellendale Drive & Barnett Road

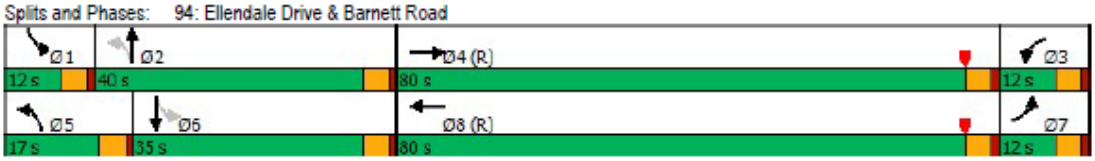


Figure D-56: PM Peak Barnett Road at Ellendale Drive Signal Phasing

Phasings

94: Ellendale Drive & Barnett Road 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases					2		6	
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	12.0	26.5	12.0	29.5	12.0	30.5	12.0	34.5
Total Split (s)	12.0	80.0	12.0	80.0	17.0	40.0	12.0	35.0
Total Split (%)	8.3%	55.6%	8.3%	55.6%	11.8%	27.8%	8.3%	24.3%
Maximum Green (s)	7.5	75.5	7.5	75.5	12.5	35.5	7.5	30.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	C-Max	None	C-Max	None	Max	None	Max
Walk Time (s)		7.0		7.0		7.0		7.0
Flash Dont Walk (s)		15.0		18.0		19.0		23.0
Pedestrian Calls (#/hr)		0		0		0		0
90th %ile Green (s)	7.5	75.5	7.5	75.5	12.5	35.5	7.5	30.5
90th %ile Term Code	Max	Coord	Max	Coord	Max	MaxR	Max	MaxR
70th %ile Green (s)	7.5	75.5	7.5	75.5	12.5	35.5	7.5	30.5
70th %ile Term Code	Max	Coord	Max	Coord	Max	MaxR	Max	MaxR
50th %ile Green (s)	7.5	75.5	7.5	75.5	12.5	35.5	7.5	30.5
50th %ile Term Code	Max	Coord	Max	Coord	Max	MaxR	Max	MaxR
30th %ile Green (s)	7.5	75.5	7.5	75.5	12.5	36.4	6.6	30.5
30th %ile Term Code	Max	Coord	Max	Coord	Max	MaxR	Gap	MaxR
10th %ile Green (s)	0.0	75.5	0.0	75.5	11.0	59.5	0.0	44.0
10th %ile Term Code	Skip	Coord	Skip	Coord	Gap	MaxR	Skip	MaxR

Intersection Summary
Cycle Length: 144
Actuated Cycle Length: 144
Offset: 127.5 (89%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow
Control Type: Actuated-Coordinated

Figure D-57: AM Peak Garfield Street at I-5 Exit 27 Interchange Signal Timing

Timings

826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

Lane Group	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	815	730	395	375	500	700	490	405	645	510
Future Volume (vph)	815	730	395	375	500	700	490	405	645	510
Turn Type	Prot	Free	Prot	Free	Prot	NA	Free	Prot	NA	custom
Protected Phases	2		6		3	8		7	4	
Permitted Phases		Free		Free			Free			6
Detector Phase	2		6		3	8		7	4	6
Switch Phase										
Minimum Initial (s)	6.0		6.0		6.0	10.0		6.0	10.0	6.0
Minimum Split (s)	14.3		20.0		28.7	30.3		28.7	26.3	20.0
Total Split (s)	78.3		78.3		38.7	37.3		38.7	37.3	78.3
Total Split (%)	50.7%		50.7%		25.1%	24.2%		25.1%	24.2%	50.7%
Yellow Time (s)	4.0		4.0		4.5	4.5		4.5	4.5	4.0
All-Red Time (s)	4.3		4.3		4.2	2.8		4.2	2.8	4.3
Lost Time Adjust (s)	0.0		0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	8.3		8.3		8.7	7.3		8.7	7.3	8.3
Lead/Lag					Lead	Lag		Lead	Lag	
Lead-Lag Optimize?					Yes	Yes		Yes	Yes	
Recall Mode	None		None		None	Min		None	Min	None
Act Effct Green (s)	68.5	152.0	68.5	152.0	29.2	33.3	152.0	25.9	30.0	68.5
Actuated g/C Ratio	0.45	1.00	0.45	1.00	0.19	0.22	1.00	0.17	0.20	0.45
v/c Ratio	0.98	0.61	0.31	0.29	0.94	1.08	0.39	0.84	1.11	0.58
Control Delay	67.4	2.1	27.4	0.5	85.7	111.3	0.9	76.1	125.2	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.4	2.1	27.4	0.5	85.7	111.3	0.9	76.1	125.2	4.6
LOS	E	A	C	A	F	F	A	E	F	A
Approach Delay						71.7			73.1	
Approach LOS						E			E	

Intersection Summary	
Cycle Length: 154.3	
Actuated Cycle Length: 152	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.11	
Intersection Signal Delay: 54.4	Intersection LOS: D
Intersection Capacity Utilization 81.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 826: Garfield Street & SB off ramp/NB off ramp

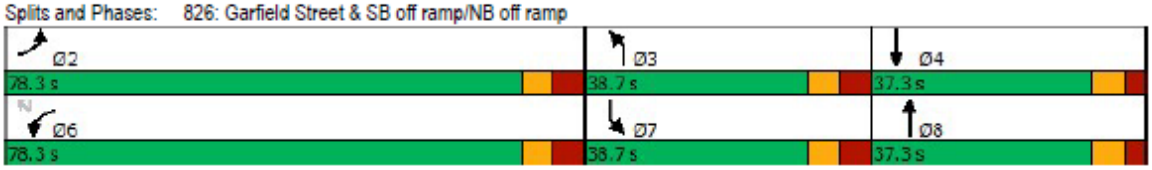


Figure D-58: AM Peak Garfield Street at I-5 Exit 27 Interchange Signal Phasing

Phasings

826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

Lane Group	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Protected Phases	2		6		3	8		7	4	
Permitted Phases		Free		Free			Free			6
Minimum Initial (s)	6.0		6.0		6.0	10.0		6.0	10.0	6.0
Minimum Split (s)	14.3		20.0		28.7	30.3		28.7	26.3	20.0
Total Split (s)	78.3		78.3		38.7	37.3		38.7	37.3	78.3
Total Split (%)	50.7%		50.7%		25.1%	24.2%		25.1%	24.2%	50.7%
Maximum Green (s)	70.0		70.0		30.0	30.0		30.0	30.0	70.0
Yellow Time (s)	4.0		4.0		4.5	4.5		4.5	4.5	4.0
All-Red Time (s)	4.3		4.3		4.2	2.8		4.2	2.8	4.3
Lead/Lag					Lead	Lag		Lead	Lag	
Lead-Lag Optimize?					Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.5		2.5		2.5	4.2		2.5	4.2	2.5
Minimum Gap (s)	1.0		1.0		1.0	2.2		1.0	2.2	1.0
Time Before Reduce (s)	10.0		10.0		10.0	15.0		10.0	15.0	10.0
Time To Reduce (s)	10.0		5.0		5.0	20.0		5.0	20.0	5.0
Recall Mode	None		None		None	Min		None	Min	None
Walk Time (s)					8.0	8.0		8.0	8.0	
Flash Dont Walk (s)					12.0	15.0		12.0	11.0	
Pedestrian Calls (#/hr)					0	0		0	0	
90th %ile Green (s)	70.0		70.0		30.0	30.0		30.0	30.0	70.0
90th %ile Term Code	Max		Hold		Max	Max		Max	Max	Hold
70th %ile Green (s)	70.0		70.0		30.0	30.6		29.4	30.0	70.0
70th %ile Term Code	Max		Hold		Max	Hold		Gap	Max	Hold
50th %ile Green (s)	70.0		70.0		30.0	33.2		26.8	30.0	70.0
50th %ile Term Code	Max		Hold		Max	Hold		Gap	Max	Hold
30th %ile Green (s)	70.0		70.0		30.0	35.7		24.3	30.0	70.0
30th %ile Term Code	Max		Hold		Max	Hold		Gap	Max	Hold
10th %ile Green (s)	62.7		62.7		25.9	36.4		19.5	30.0	62.7
10th %ile Term Code	Gap		Hold		Gap	Hold		Gap	Max	Hold

Intersection Summary
Cycle Length: 154.3
Actuated Cycle Length: 152
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 154.3
70th %ile Actuated Cycle: 154.3
50th %ile Actuated Cycle: 154.3
30th %ile Actuated Cycle: 154.3
10th %ile Actuated Cycle: 142.9

Figure D-59: PM Peak Garfield Street at I-5 Exit 27 Interchange Signal Timing

Timings

826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

Lane Group	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	420	685	455	525	630	730	540	405	765	800
Future Volume (vph)	420	685	455	525	630	730	540	405	765	800
Turn Type	Perm	Free	Perm	Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases					3	8		7	4	
Permitted Phases	2	Free	6	Free			8			4
Detector Phase	2		6		3	8	8	7	4	4
Switch Phase										
Minimum Initial (s)	6.0		6.0		6.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	24.3		24.3		28.7	30.3	30.3	28.7	26.3	26.3
Total Split (s)	53.3		53.3		43.7	52.3	52.3	43.7	52.3	52.3
Total Split (%)	35.7%		35.7%		29.3%	35.0%	35.0%	29.3%	35.0%	35.0%
Yellow Time (s)	4.0		4.0		4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	4.3		4.3		4.2	2.8	2.8	4.2	2.8	2.8
Lost Time Adjust (s)	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.3		8.3		8.7	7.3	7.3	8.7	7.3	7.3
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None		None		None	None	None	Min	Min	Min
Act Effct Green (s)	30.9	130.2	30.9	130.2	31.2	52.5	52.5	22.2	43.4	43.4
Actuated g/C Ratio	0.24	1.00	0.24	1.00	0.24	0.40	0.40	0.17	0.33	0.33
v/c Ratio	0.83	0.49	0.63	0.37	0.87	0.57	0.62	0.77	0.73	0.92
Control Delay	62.5	1.2	48.9	0.7	62.2	33.9	6.0	62.7	44.2	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.5	1.2	48.9	0.7	62.2	33.9	6.0	62.7	44.2	27.9
LOS	E	A	D	A	E	C	A	E	D	C
Approach Delay						35.3			41.4	
Approach LOS						D			D	

Intersection Summary	
Cycle Length: 149.3	
Actuated Cycle Length: 130.2	
Natural Cycle: 85	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 33.3	Intersection LOS: C
Intersection Capacity Utilization 86.6%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 826: Garfield Street & SB off ramp/NB off ramp

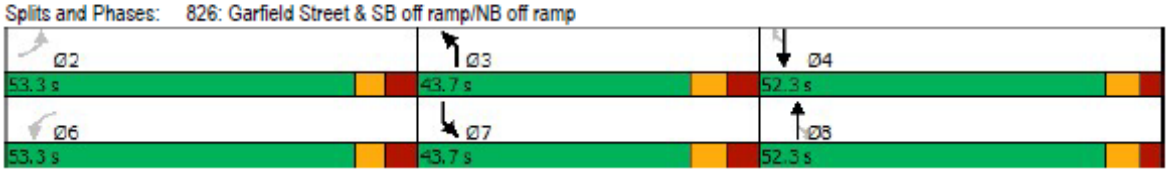


Figure D-60: PM Peak Garfield Street at I-5 Exit 27 Interchange Signal Phasing

Phasings

826: Garfield Street & SB off ramp/NB off ramp 02/10/2021

Lane Group	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Protected Phases					3	8		7	4	
Permitted Phases	2	Free	6	Free			8			4
Minimum Initial (s)	6.0		6.0		6.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	24.3		24.3		28.7	30.3	30.3	28.7	26.3	26.3
Total Split (s)	53.3		53.3		43.7	52.3	52.3	43.7	52.3	52.3
Total Split (%)	35.7%		35.7%		29.3%	35.0%	35.0%	29.3%	35.0%	35.0%
Maximum Green (s)	45.0		45.0		35.0	45.0	45.0	35.0	45.0	45.0
Yellow Time (s)	4.0		4.0		4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	4.3		4.3		4.2	2.8	2.8	4.2	2.8	2.8
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	2.5		2.5		2.5	4.2	4.2	2.5	4.2	4.2
Minimum Gap (s)	1.0		1.0		1.0	4.2	4.2	1.0	4.2	4.2
Time Before Reduce (s)	10.0		10.0		10.0	15.0	15.0	10.0	15.0	15.0
Time To Reduce (s)	10.0		5.0		5.0	20.0	20.0	5.0	20.0	20.0
Recall Mode	None		None		None	None	None	Min	Min	Min
Walk Time (s)					8.0	8.0	8.0	8.0	8.0	8.0
Flash Dont Walk (s)					12.0	15.0	15.0	12.0	11.0	11.0
Pedestrian Calls (#/hr)					10	0	0	0	0	0
90th %ile Green (s)	42.1		42.1		35.0	50.3	50.3	29.7	45.0	45.0
90th %ile Term Code	Gap		Hold		Max	Hold	Hold	Gap	Max	Max
70th %ile Green (s)	35.6		35.6		35.0	54.8	54.8	25.2	45.0	45.0
70th %ile Term Code	Gap		Hold		Max	Hold	Hold	Gap	Max	Max
50th %ile Green (s)	31.4		31.4		33.7	56.3	56.3	22.4	45.0	45.0
50th %ile Term Code	Gap		Hold		Gap	Hold	Hold	Gap	Max	Max
30th %ile Green (s)	27.0		27.0		29.3	54.8	54.8	19.5	45.0	45.0
30th %ile Term Code	Gap		Hold		Gap	Hold	Hold	Gap	Max	Max
10th %ile Green (s)	20.7		20.7		23.5	44.5	44.5	15.3	36.3	36.3
10th %ile Term Code	Gap		Hold		Gap	Hold	Hold	Gap	Gap	Gap

Intersection Summary
Cycle Length: 149.3
Actuated Cycle Length: 130.2
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 146.4
70th %ile Actuated Cycle: 139.9
50th %ile Actuated Cycle: 134.4
30th %ile Actuated Cycle: 125.6
10th %ile Actuated Cycle: 104.8

Figure D-61: AM Peak Garfield Street at Center Drive Signal Timing

Timings

827: Center Drive & Garfield Street 02/10/2021

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBL	SBT	Ø3
Lane Configurations									
Traffic Volume (vph)	75	1420	1285	485	20	0	230	65	
Future Volume (vph)	75	1420	1285	485	20	0	230	65	
Turn Type	pm+pt	NA	NA	pm+ov	Prot	NA	Prot	NA	
Protected Phases	7	4	8	1	5	2	1	6	3
Permitted Phases	4			8					
Detector Phase	7	4	8	1	5	2	1	6	
Switch Phase									
Minimum Initial (s)	5.0	10.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	13.0	28.5	43.5	9.5	9.5	46.5	9.5	45.5	13.0
Total Split (s)	19.5	44.5	44.5	29.5	29.5	46.5	29.5	45.5	29.5
Total Split (%)	13.0%	29.7%	29.7%	19.7%	19.7%	31.0%	19.7%	30.3%	20%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	Min	None	None	None	None	None	None
Act Effct Green (s)	53.0	53.0	43.3	61.5	6.6	10.6	11.9	20.4	
Actuated g/C Ratio	0.61	0.61	0.50	0.71	0.08	0.12	0.14	0.23	
v/c Ratio	0.43	0.93	0.99	0.54	0.20	0.11	0.68	0.40	
Control Delay	20.2	29.1	46.8	8.7	50.6	0.5	47.6	25.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	20.2	29.1	46.8	8.7	50.6	0.5	47.6	25.8	
LOS	C	C	D	A	D	A	D	C	
Approach Delay		28.7	36.3			17.5		39.9	
Approach LOS		C	D			B		D	

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 87.2	
Natural Cycle: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.99	
Intersection Signal Delay: 33.2	Intersection LOS: C
Intersection Capacity Utilization 75.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 827: Center Drive & Garfield Street

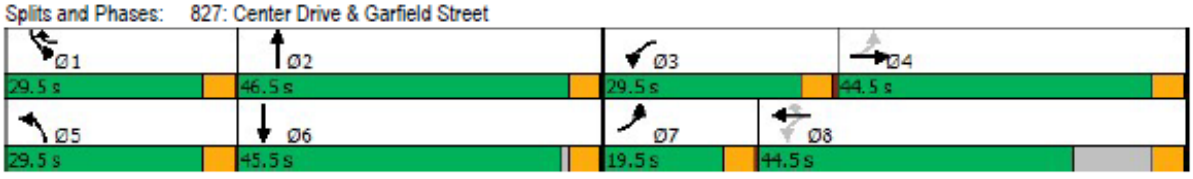
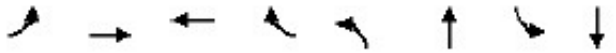


Figure D-62: AM Peak Garfield Street at Center Drive Signal Phasing

Phasings

827: Center Drive & Garfield Street 02/10/2021



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBL	SBT	Ø3
Protected Phases	7	4	8	1	5	2	1	6	3
Permitted Phases	4			8					
Minimum Initial (s)	5.0	10.0	10.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	13.0	28.5	43.5	9.5	9.5	46.5	9.5	45.5	13.0
Total Split (s)	19.5	44.5	44.5	29.5	29.5	46.5	29.5	45.5	29.5
Total Split (%)	13.0%	29.7%	29.7%	19.7%	19.7%	31.0%	19.7%	30.3%	20%
Maximum Green (s)	15.0	40.0	40.0	25.0	25.0	42.0	25.0	41.0	25.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	1.5	4.2	4.2	2.5	2.5	2.5	2.5	1.5	2.5
Minimum Gap (s)	1.5	1.7	1.7	1.0	1.0	1.0	1.0	0.5	1.0
Time Before Reduce (s)	0.0	10.0	10.0	5.0	5.0	5.0	5.0	0.0	5.0
Time To Reduce (s)	0.0	10.0	10.0	5.0	5.0	5.0	5.0	0.0	5.0
Recall Mode	None	Min	Min	None	None	None	None	None	None
Walk Time (s)		8.0	8.0			8.0		8.0	
Flash Dont Walk (s)		16.0	31.0			34.0		33.0	
Pedestrian Calls (#/hr)		10	10			10		10	
90th %ile Green (s)	14.2	58.7	40.0	21.3	9.4	42.0	21.3	53.9	0.0
90th %ile Term Code	Gap	Hold	Max	Gap	Gap	Ped	Gap	Hold	Skip
70th %ile Green (s)	8.0	52.5	40.0	12.5	6.8	7.1	12.5	12.8	0.0
70th %ile Term Code	Gap	Hold	Max	Gap	Gap	Hold	Gap	Gap	Skip
50th %ile Green (s)	6.8	51.3	40.0	10.8	0.0	5.0	10.8	20.3	0.0
50th %ile Term Code	Gap	Hold	Max	Gap	Skip	Min	Gap	Hold	Skip
30th %ile Green (s)	5.8	50.3	40.0	9.4	0.0	5.0	9.4	18.9	0.0
30th %ile Term Code	Gap	Hold	Max	Gap	Skip	Min	Gap	Hold	Skip
10th %ile Green (s)	0.0	40.0	40.0	7.1	0.0	0.0	7.1	7.1	0.0
10th %ile Term Code	Skip	Max	Max	Gap	Skip	Skip	Gap	Hold	Skip

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 87.2
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 135.5
70th %ile Actuated Cycle: 85.6
50th %ile Actuated Cycle: 80.6
30th %ile Actuated Cycle: 78.2
10th %ile Actuated Cycle: 56.1

Figure D-63: PM Peak Garfield Street at Center Drive Signal Timing

Timings

827: Center Drive & Garfield Street 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	160	1195	115	1130	660	30	15	605	35
Future Volume (vph)	160	1195	115	1130	660	30	15	605	35
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Prot	NA	Prot	NA
Protected Phases	7	4	3	8	1	5	2	1	6
Permitted Phases	4		8		8				
Detector Phase	7	4	3	8	1	5	2	1	6
Switch Phase									
Minimum Initial (s)	5.0	10.0	5.0	10.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	28.5	9.5	43.5	9.5	9.5	46.5	9.5	45.5
Total Split (s)	29.5	59.5	29.5	59.5	29.5	29.5	46.5	29.5	45.5
Total Split (%)	17.9%	36.1%	17.9%	36.1%	17.9%	17.9%	28.2%	17.9%	27.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	Min	None	None	None	None	None
Act Effct Green (s)	72.0	59.1	67.5	56.8	87.2	7.5	17.5	25.8	40.6
Actuated g/C Ratio	0.55	0.45	0.51	0.43	0.66	0.06	0.13	0.20	0.31
v/c Ratio	0.72	0.87	0.64	0.82	0.62	0.34	0.42	1.01	0.59
Control Delay	43.1	43.0	43.5	41.8	10.5	76.7	16.0	90.5	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.1	43.0	43.5	41.8	10.5	76.7	16.0	90.5	14.7
LOS	D	D	D	D	B	E	B	F	B
Approach Delay		43.0		31.1			28.6		61.8
Approach LOS		D		C			C		E

Intersection Summary	
Cycle Length: 165	
Actuated Cycle Length: 131.7	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.01	
Intersection Signal Delay: 41.6	Intersection LOS: D
Intersection Capacity Utilization 82.8%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 827: Center Drive & Garfield Street

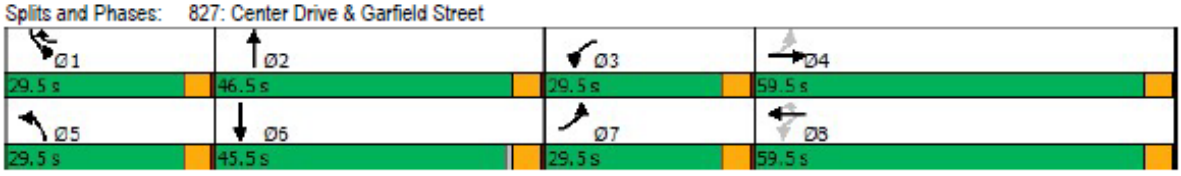


Figure D-64: PM Peak Garfield Street at Center Drive Signal Phasing

Phasings

827: Center Drive & Garfield Street 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Protected Phases	7	4	3	8	1	5	2	1	6
Permitted Phases	4		8		8				
Minimum Initial (s)	5.0	10.0	5.0	10.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	28.5	9.5	43.5	9.5	9.5	46.5	9.5	45.5
Total Split (s)	29.5	59.5	29.5	59.5	29.5	29.5	46.5	29.5	45.5
Total Split (%)	17.9%	36.1%	17.9%	36.1%	17.9%	17.9%	28.2%	17.9%	27.6%
Maximum Green (s)	25.0	55.0	25.0	55.0	25.0	25.0	42.0	25.0	41.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	1.5	4.2	2.5	4.2	2.5	2.5	2.5	2.5	1.5
Minimum Gap (s)	1.5	1.7	1.0	1.7	1.0	1.0	1.0	1.0	0.5
Time Before Reduce (s)	0.0	10.0	5.0	10.0	5.0	5.0	5.0	5.0	0.0
Time To Reduce (s)	0.0	10.0	5.0	10.0	5.0	5.0	5.0	5.0	0.0
Recall Mode	None	Min	None	Min	None	None	None	None	None
Walk Time (s)		8.0		8.0			8.0		8.0
Flash Dont Walk (s)		16.0		31.0			34.0		33.0
Pedestrian Calls (#/hr)		10		10			10		10
90th %ile Green (s)	23.7	59.9	18.8	55.0	25.0	11.2	42.0	25.0	55.8
90th %ile Term Code	Gap	Hold	Gap	Max	Max	Gap	Ped	Max	Hold
70th %ile Green (s)	18.5	59.0	14.5	55.0	25.0	9.1	42.0	25.0	57.9
70th %ile Term Code	Gap	Hold	Gap	Max	Max	Gap	Ped	Max	Hold
50th %ile Green (s)	11.2	57.3	8.9	55.0	25.0	7.0	6.2	25.0	24.2
50th %ile Term Code	Gap	Hold	Gap	Max	Max	Gap	Gap	Max	Hold
30th %ile Green (s)	8.7	56.3	7.4	55.0	25.0	0.0	5.0	25.0	34.5
30th %ile Term Code	Gap	Hold	Gap	Max	Max	Skip	Min	Max	Hold
10th %ile Green (s)	6.4	55.1	6.3	55.0	25.0	0.0	5.0	25.0	34.5
10th %ile Term Code	Gap	Hold	Gap	Max	Max	Skip	Min	Max	Hold

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 131.7
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 163.7
70th %ile Actuated Cycle: 158.5
50th %ile Actuated Cycle: 115.4
30th %ile Actuated Cycle: 111.7
10th %ile Actuated Cycle: 109.4

Figure D-65: AM and PM Peak Garfield Street at Riverside/OR 99 Signal Timing

Timings

87: Riverside/OR99 & Garfield Street 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations											
Traffic Volume (vph)	170	460	635	540	320	385	890	110	115	1040	560
Future Volume (vph)	170	460	635	540	320	385	890	110	115	1040	560
Turn Type	Prot	NA	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	3	8	1	1	6	7	5	2	3
Permitted Phases					8			6			2
Detector Phase	7	4	3	8	1	1	6	7	5	2	3
Switch Phase											
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	10.0	5.0
Minimum Split (s)	10.4	10.0	9.0	10.0	9.0	9.0	15.4	10.4	9.0	16.0	9.0
Total Split (s)	25.4	34.5	39.0	79.5	28.0	28.0	35.4	25.4	29.0	35.4	39.0
Total Split (%)	15.0%	20.4%	23.0%	47.0%	16.5%	16.5%	20.9%	15.0%	17.1%	20.9%	23.0%
Yellow Time (s)	3.5	4.0	3.5	4.0	3.5	3.5	4.7	3.5	3.5	4.7	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.5	0.7	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	4.0	4.5	4.0	4.0	5.4	4.0	4.0	5.4	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Min	None	None	Min	None
Act Effct Green (s)	19.0	38.6	35.4	55.0	81.7	22.1	37.2	61.6	15.3	30.3	71.2
Actuated g/C Ratio	0.13	0.27	0.24	0.38	0.57	0.15	0.26	0.43	0.11	0.21	0.49
v/c Ratio	0.85	0.72	0.87	0.88	0.40	0.84	1.11	0.17	0.70	1.59	0.76
Control Delay	94.4	50.5	65.9	58.0	15.1	76.3	113.1	6.1	85.1	307.5	32.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	94.4	50.5	65.9	58.0	15.1	76.3	113.1	6.1	85.1	307.5	32.3
LOS	F	D	E	E	B	E	F	A	F	F	C
Approach Delay		60.4		52.2			94.4			202.7	
Approach LOS		E		D			F			F	

Intersection Summary	
Cycle Length: 169.3	
Actuated Cycle Length: 144.6	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.59	
Intersection Signal Delay: 112.6	Intersection LOS: F
Intersection Capacity Utilization 97.5%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 87: Riverside/OR99 & Garfield Street

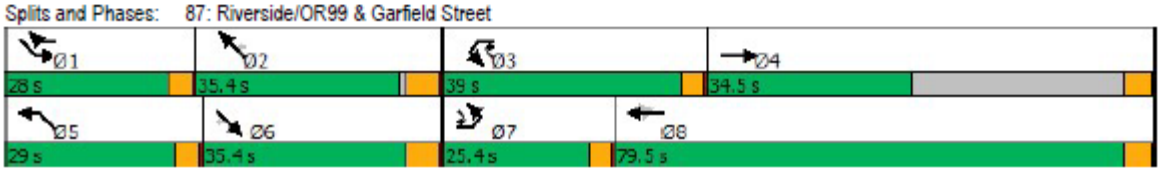


Figure D-66: AM and PM Peak Garfield Street at Riverside/OR 99 Signal Phasing

Phasings

87: Riverside/OR99 & Garfield Street 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4	3	8	1	1	6	7	5	2	3
Permitted Phases					8			6			2
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	10.0	5.0
Minimum Split (s)	10.4	10.0	9.0	10.0	9.0	9.0	15.4	10.4	9.0	16.0	9.0
Total Split (s)	25.4	34.5	39.0	79.5	28.0	28.0	35.4	25.4	29.0	35.4	39.0
Total Split (%)	15.0%	20.4%	23.0%	47.0%	16.5%	16.5%	20.9%	15.0%	17.1%	20.9%	23.0%
Maximum Green (s)	21.4	30.0	35.0	75.0	24.0	24.0	30.0	21.4	25.0	30.0	35.0
Yellow Time (s)	3.5	4.0	3.5	4.0	3.5	3.5	4.7	3.5	3.5	4.7	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.5	0.7	0.5
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	2.5	2.5	2.1	2.5	2.1	2.1	4.7	2.5	2.1	4.7	2.1
Minimum Gap (s)	1.0	1.0	2.1	1.0	2.1	2.1	2.3	1.0	2.1	2.3	2.1
Time Before Reduce (s)	10.0	10.0	0.0	10.0	0.0	0.0	10.0	10.0	0.0	10.0	0.0
Time To Reduce (s)	5.0	5.0	0.0	5.0	0.0	0.0	10.0	5.0	0.0	10.0	0.0
Recall Mode	None	None	None	None	None	None	Min	None	None	Min	None
Walk Time (s)											
Flash Dont Walk (s)											
Pedestrian Calls (#/hr)											
90th %ile Green (s)	21.4	59.8	35.0	73.4	24.0	24.0	30.7	21.4	23.3	30.0	35.0
90th %ile Term Code	Max	Hold	Max	Gap	Max	Max	Hold	Max	Gap	Max	Max
70th %ile Green (s)	21.4	47.2	35.0	60.8	24.0	24.0	35.8	21.4	18.2	30.0	35.0
70th %ile Term Code	Max	Hold	Max	Gap	Max	Max	Hold	Max	Gap	Max	Max
50th %ile Green (s)	21.4	39.6	35.0	53.2	24.0	24.0	38.8	21.4	15.2	30.0	35.0
50th %ile Term Code	Max	Hold	Max	Gap	Max	Max	Hold	Max	Gap	Max	Max
30th %ile Green (s)	17.8	28.8	35.0	46.0	21.1	21.1	38.7	17.8	12.4	30.0	35.0
30th %ile Term Code	Gap	Hold	Max	Gap	Gap	Gap	Hold	Gap	Gap	Max	Max
10th %ile Green (s)	13.5	22.6	35.0	44.1	17.5	17.5	38.5	13.5	9.0	30.0	35.0
10th %ile Term Code	Gap	Gap	Max	Hold	Gap	Gap	Hold	Gap	Gap	Max	Max

Intersection Summary
Cycle Length: 169.3
Actuated Cycle Length: 144.6
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 166.7
70th %ile Actuated Cycle: 154.1
50th %ile Actuated Cycle: 146.5
30th %ile Actuated Cycle: 132.8
10th %ile Actuated Cycle: 123

Figure D-67: AM and PM Peak Riverside/OR 99 at Stewart Avenue Signal Timing

Timings

84: Riverside/OR99 & Stewart 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	530	305	75	445	130	1085	695	615	220
Future Volume (vph)	530	305	75	445	130	1085	695	615	220
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	pt+ov
Protected Phases	7	4	3	8	1	6	5	2	2 3
Permitted Phases									
Detector Phase	7	4	3	8	1	6	5	2	2 3
Switch Phase									
Minimum Initial (s)	5.0	6.0	5.0	6.0	5.0	13.0	5.0	13.0	
Minimum Split (s)	9.0	41.5	9.0	41.0	9.0	42.4	9.0	41.4	
Total Split (s)	25.0	41.5	26.0	41.0	24.0	42.4	24.0	41.4	
Total Split (%)	18.7%	31.0%	19.4%	30.6%	17.9%	31.7%	17.9%	30.9%	
Yellow Time (s)	3.5	4.0	3.5	4.0	3.5	4.7	3.5	4.7	
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.7	
Lost Time Adjust (s)	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	
Total Lost Time (s)	5.0	4.5	5.0	4.5	5.0	5.4	5.0	5.4	
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	Max	None	Max	
Act Effct Green (s)	20.0	46.0	8.4	34.4	15.1	37.0	19.0	40.9	54.3
Actuated g/C Ratio	0.15	0.35	0.06	0.26	0.12	0.28	0.15	0.31	0.42
v/c Ratio	2.44	0.52	0.82	0.92	0.85	1.61	1.75	0.69	0.34
Control Delay	682.7	27.5	109.1	59.2	94.5	312.4	378.5	44.7	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	682.7	27.5	109.1	59.2	94.5	312.4	378.5	44.7	5.1
LOS	F	C	F	E	F	F	F	D	A
Approach Delay		354.8		64.0		292.5		190.6	
Approach LOS		F		E		F		F	

Intersection Summary	
Cycle Length: 133.9	
Actuated Cycle Length: 130.4	
Natural Cycle: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 2.44	
Intersection Signal Delay: 237.1	Intersection LOS: F
Intersection Capacity Utilization 131.3%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 84: Riverside/OR99 & Stewart

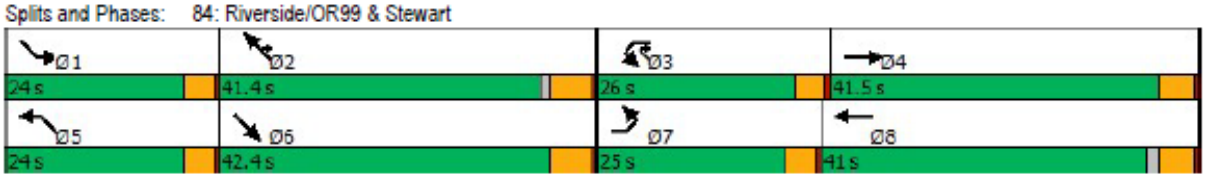


Figure D-68: AM and PM Peak Riverside/OR 99 at Stewart Avenue Signal Phasing

Phasings

84: Riverside/OR99 & Stewart 02/10/2021

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Protected Phases	7	4	3	8	1	6	5	2	2 3
Permitted Phases									
Minimum Initial (s)	5.0	6.0	5.0	6.0	5.0	13.0	5.0	13.0	
Minimum Split (s)	9.0	41.5	9.0	41.0	9.0	42.4	9.0	41.4	
Total Split (s)	25.0	41.5	26.0	41.0	24.0	42.4	24.0	41.4	
Total Split (%)	18.7%	31.0%	19.4%	30.6%	17.9%	31.7%	17.9%	30.9%	
Maximum Green (s)	21.0	37.0	22.0	36.5	20.0	37.0	20.0	36.0	
Yellow Time (s)	3.5	4.0	3.5	4.0	3.5	4.7	3.5	4.7	
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.7	
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	2.5	2.5	1.5	2.5	1.5	4.7	1.5	4.7	
Minimum Gap (s)	2.5	1.0	1.5	1.0	1.5	2.3	1.5	2.3	
Time Before Reduce (s)	0.0	5.0	0.0	10.0	0.0	10.0	0.0	10.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None	None	None	None	Max	None	Max	
Walk Time (s)		7.0		7.0		7.0		7.0	
Flash Dont Walk (s)		30.0		25.0		30.0		29.0	
Pedestrian Calls (#/hr)		10		10		10		10	
90th %ile Green (s)	21.0	43.1	14.4	36.5	20.0	37.0	20.0	37.0	
90th %ile Term Code	Max	Hold	Gap	Max	Max	MaxR	Max	Hold	
70th %ile Green (s)	21.0	46.1	11.4	36.5	20.0	37.0	20.0	37.0	
70th %ile Term Code	Max	Hold	Gap	Max	Max	MaxR	Max	Hold	
50th %ile Green (s)	21.0	48.1	9.4	36.5	17.1	37.0	20.0	39.9	
50th %ile Term Code	Max	Hold	Gap	Max	Gap	MaxR	Max	Hold	
30th %ile Green (s)	21.0	48.7	7.2	34.9	14.2	37.0	20.0	42.8	
30th %ile Term Code	Max	Hold	Gap	Gap	Gap	MaxR	Max	Hold	
10th %ile Green (s)	21.0	44.1	5.0	28.1	9.7	37.0	20.0	47.3	
10th %ile Term Code	Max	Hold	Min	Gap	Gap	MaxR	Max	Hold	

Intersection Summary
Cycle Length: 133.9
Actuated Cycle Length: 130.4
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 132.4
70th %ile Actuated Cycle: 132.4
50th %ile Actuated Cycle: 132.4
30th %ile Actuated Cycle: 130.8
10th %ile Actuated Cycle: 124

Freeway Analysis

Figure D-69: AM Peak NB Off-ramp Diverge

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, NB off ramp diverge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Deceleration Length (LA),ft		1500	1270
Terrain Type		Level	Specific Grade
Percent Grade, %		-	-2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		3080	770
Peak Hour Factor (PHF)		0.91	0.91
Total Trucks, %		11.10	33.30
Single-Unit Trucks (SUT), %		-	90
Tractor-Trailers (TT), %		-	10
Heavy Vehicle Adjustment Factor (fHV)		0.900	0.783
Flow Rate (vi),pc/h		3761	1081
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.84	0.54
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.395
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	52.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	65.8
Flow in Lanes 1 and 2 (v12), pc/h	3761	Ramp Junction Speed (S), mi/h	52.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	25.2

Figure D-70: AM Peak SB Off-ramp Diverge

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, SB off ramp diverge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Deceleration Length (LA),ft		1500	1200
Terrain Type		Level	Specific Grade
Percent Grade, %		-	-2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		4200	1545
Peak Hour Factor (PHF)		0.91	0.91
Total Trucks, %		11.10	6.40
Single-Unit Trucks (SUT), %		-	94
Tractor-Trailers (TT), %		-	6
Heavy Vehicle Adjustment Factor (fHV)		0.900	0.936
Flow Rate (vi),pc/h		5128	1814
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		1.15	0.91
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	-
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	51.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	-
Flow in Lanes 1 and 2 (v12), pc/h	5128	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	37.6

Figure D-71: AM Peak NB On-ramp Merge

HCS7 Freeway Merge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, NB on ramp merge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Acceleration Length (LA),ft		1500	305
Terrain Type		Level	Specific Grade
Percent Grade, %		-	2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		2310	1010
Peak Hour Factor (PHF)		0.91	0.91
Total Trucks, %		11.10	1.90
Single-Unit Trucks (SUT), %		-	97
Tractor-Trailers (TT), %		-	3
Heavy Vehicle Adjustment Factor (fHV)		0.900	0.968
Flow Rate (vi),pc/h		2821	1147
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.89	0.57
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.500
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	51.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	60.0
Flow in Lanes 1 and 2 (v12), pc/h	2821	Ramp Junction Speed (S), mi/h	51.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3968	Average Density (D), pc/mi/ln	38.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.1

Figure D-72: AM Peak SB On-ramp Merge

HCS7 Freeway Merge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, SB on ramp merge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Acceleration Length (LA),ft		1500	305
Terrain Type		Level	Specific Grade
Percent Grade, %		-	2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		2655	895
Peak Hour Factor (PHF)		0.91	0.91
Total Trucks, %		11.10	9.30
Single-Unit Trucks (SUT), %		-	89
Tractor-Trailers (TT), %		-	11
Heavy Vehicle Adjustment Factor (fHV)		0.900	0.909
Flow Rate (vi),pc/h		3242	1082
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.97	0.54
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.588
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	49.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	60.0
Flow in Lanes 1 and 2 (v12), pc/h	3242	Ramp Junction Speed (S), mi/h	49.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	4324	Average Density (D), pc/mi/ln	43.8
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.9

Figure D-73: AM Peak NB Mainline Upstream of Exit 27

HCS7 Basic Freeway Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, I-5 upstream of interchange	Unit	United States Customary
General Purpose Geometric Data			
Number of General Purpose Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	9		
General Purpose Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000
General Purpose Demand and Capacity			
Demand Volume veh/h	3080	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.91	Flow Rate (Vp,GP), pc/h/ln	1880
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (ET)	2.000		
General Purpose Speed and Density			
Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	56.3
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (DGP), pc/mi/ln	33.4
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1062	1731	2498	3173	-
One Direction DSV, 1000 veh/day	15	25	36	45	-
Bi-Directional DSV, 1000 veh/day	31	50	73	93	-

Figure D-74: AM Peak NB Mainline Past Exit 27

HCS7 Basic Freeway Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, NB I-5 past interchange	Unit	United States Customary
Geometric Data			
Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000
Demand and Capacity			
Demand Volume veh/h	2310	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.91	Flow Rate (Vp), pc/h/ln	1410
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	58.7
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (D), pc/mi/ln	24.0
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table					
Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1062	1731	2498	3173	-
One Direction DSV, 1000 veh/day	15	25	36	45	-
Bi-Directional DSV, 1000 veh/day	31	50	73	93	-

Figure D-75: AM Peak NB Mainline Downstream of Exit 27

HCS7 Basic Freeway Report

Project Information

Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, NB I-5 after interchange	Unit	United States Customary

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3320	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.91	Flow Rate (Vp), pc/h/ln	2027
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.92
Passenger Car Equivalent (ET)	2.000		

Speed and Density

Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	53.8
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (D), pc/mi/ln	37.7
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1062	1731	2498	3173	-
One Direction DSV, 1000 veh/day	15	25	36	45	-
Bi-Directional DSV, 1000 veh/day	31	50	73	93	-

Figure D-76: AM Peak SB Mainline Upstream of Exit 27

HCS7 Basic Freeway Report

Project Information

Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, SB I-5 upstream of interchange	Unit	United States Customary

General Purpose Geometric Data

Number of General Purpose Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

General Purpose Demand and Capacity

Demand Volume veh/h	4200	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.91	Flow Rate ($V_{p,GP}$), pc/h/ln	2564
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.16
Passenger Car Equivalent (Et)	2.000		

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	-
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D_{GP}), pc/mi/ln	-
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1062	1731	2498	3173	-
One Direction DSV, 1000 veh/day	13	22	31	40	-
Bi-Directional DSV, 1000 veh/day	26	42	61	78	-

Figure D-77: AM Peak SB Mainline Past Exit 27

HCS7 Basic Freeway Report					
Project Information					
Analyst	Dejan Dudich PE	Date	2/01/2021		
Agency	ODOT TPAU	Analysis Year	2045		
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak		
Project Description	Exit 27 AMT, SB I-5 past interchange	Unit	United States Customary		
Geometric Data					
Number of Lanes, ln	2	Terrain Type	Level		
Segment Length (L), ft	-	Percent Grade, %	-		
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-		
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33		
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7		
Right-Side Lateral Clearance, ft	10				
Adjustment Factors					
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000		
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968		
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000		
Demand and Capacity					
Demand Volume veh/h	2655	Heavy Vehicle Adjustment Factor (f_{HV})	0.900		
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1621		
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287		
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2214		
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.73		
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.6		
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.7		
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	D		
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	58.7				
Service Volume Table					
Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1062	1731	2498	3173	-
One Direction DSV, 1000 veh/day	13	22	31	40	-
Bi-Directional DSV, 1000 veh/day	26	42	61	78	-

Figure D-78: AM Peak SB Mainline Downstream of Exit 27

HCS7 Basic Freeway Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/01/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 AM peak
Project Description	Exit 27 AMT, SB I-5 after interchange	Unit	United States Customary
Geometric Data			
Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000
Demand and Capacity			
Demand Volume veh/h	3550	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	2168
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.98
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	50.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	42.9
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	58.7		

Service Volume Table					
Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1062	1731	2498	3173	-
One Direction DSV, 1000 veh/day	13	22	31	40	-
Bi-Directional DSV, 1000 veh/day	26	42	61	78	-

Figure D-79: PM Peak NB Off-ramp Diverge

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, NB off ramp diverge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Deceleration Length (LA),ft		1500	1270
Terrain Type		Level	Specific Grade
Percent Grade, %		-	-2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		3470	980
Peak Hour Factor (PHF)		0.97	0.97
Total Trucks, %		11.10	0.00
Single-Unit Trucks (SUT), %		-	92
Tractor-Trailers (TT), %		-	8
Heavy Vehicle Adjustment Factor (fHV)		0.900	1.000
Flow Rate (vi),pc/h		3975	1010
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.89	0.51
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.389
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	53.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	65.8
Flow in Lanes 1 and 2 (v12), pc/h	3975	Ramp Junction Speed (S), mi/h	53.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	37.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.0

Figure D-80: PM Peak SB Off-ramp Diverge

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, SB off ramp diverge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Deceleration Length (LA),ft		1500	1200
Terrain Type		Level	Specific Grade
Percent Grade, %		-	-2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		3295	1105
Peak Hour Factor (PHF)		0.97	0.97
Total Trucks, %		11.10	3.80
Single-Unit Trucks (SUT), %		-	94
Tractor-Trailers (TT), %		-	6
Heavy Vehicle Adjustment Factor (fHV)		0.900	0.957
Flow Rate (vi),pc/h		3774	1190
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.85	0.60
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.405
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	52.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	65.8
Flow in Lanes 1 and 2 (v12), pc/h	3774	Ramp Junction Speed (S), mi/h	52.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	25.9

Figure D-81: PM Peak NB On-ramp Merge

HCS7 Freeway Merge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	02/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, NB on ramp merge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Acceleration Length (LA),ft		1500	305
Terrain Type		Level	Specific Grade
Percent Grade, %		-	2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		2490	1430
Peak Hour Factor (PHF)		0.97	0.97
Total Trucks, %		11.10	2.80
Single-Unit Trucks (SUT), %		-	74
Tractor-Trailers (TT), %		-	26
Heavy Vehicle Adjustment Factor (fHV)		0.900	0.957
Flow Rate (vi),pc/h		2852	1540
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.99	0.77
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.609
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	49.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	60.0
Flow in Lanes 1 and 2 (v12), pc/h	2852	Ramp Junction Speed (S), mi/h	49.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	4392	Average Density (D), pc/mi/ln	44.8
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	37.2

Figure D-82: PM Peak SB On-ramp Merge

HCS7 Freeway Merge Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, SB on ramp merge	Unit	United States Customary
Geometric Data			
		Freeway	Ramp
Number of Lanes (N), ln		2	1
Free-Flow Speed (FFS), mi/h		60.0	45.0
Segment Length (L) / Acceleration Length (LA),ft		1500	305
Terrain Type		Level	Specific Grade
Percent Grade, %		-	2.00
Segment Type / Ramp Side		Freeway	Right
Adjustment Factors			
Driver Population		All Familiar	All Familiar
Weather Type		Non-Severe Weather	Non-Severe Weather
Incident Type		No Incident	-
Final Speed Adjustment Factor (SAF)		1.000	1.000
Final Capacity Adjustment Factor (CAF)		0.968	0.950
Demand Adjustment Factor (DAF)		1.000	1.000
Demand and Capacity			
Demand Volume (Vi)		2190	945
Peak Hour Factor (PHF)		0.97	0.97
Total Trucks, %		11.10	6.80
Single-Unit Trucks (SUT), %		-	94
Tractor-Trailers (TT), %		-	6
Heavy Vehicle Adjustment Factor (fHV)		0.900	0.927
Flow Rate (vi),pc/h		2509	1051
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.80	0.53
Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.431
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	52.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	60.0
Flow in Lanes 1 and 2 (v12), pc/h	2509	Ramp Junction Speed (S), mi/h	52.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	3560	Average Density (D), pc/mi/ln	34.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.9

Figure D-83: PM Peak NB Mainline Upstream of Exit 27

HCS7 Basic Freeway Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, I-5 upstream of interchange	Unit	United States Customary
Geometric Data			
Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	9		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000
Demand and Capacity			
Demand Volume veh/h	3470	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.97	Flow Rate (Vp), pc/h/ln	1988
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.90
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	54.5
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (D), pc/mi/ln	36.5
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1132	1845	2662	3383	-
One Direction DSV, 1000 veh/day	13	20	30	38	-
Bi-Directional DSV, 1000 veh/day	26	42	60	77	-

Figure D-84: PM Peak NB Mainline Past Exit 27

HCS7 Basic Freeway Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, NB I-5 past interchange	Unit	United States Customary
Geometric Data			
Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000
Demand and Capacity			
Demand Volume veh/h	2490	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.97	Flow Rate (Vp), pc/h/ln	1426
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	58.7
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (D), pc/mi/ln	24.3
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1132	1845	2662	3383	-
One Direction DSV, 1000 veh/day	13	20	30	38	-
Bi-Directional DSV, 1000 veh/day	26	42	60	77	-

Figure D-85: PM Peak NB Mainline Downstream of Exit 27

HCS7 Basic Freeway Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, NB I-5 after interchange	Unit	United States Customary
Geometric Data			
Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000
Demand and Capacity			
Demand Volume veh/h	3920	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.97	Flow Rate (Vp), pc/h/ln	2245
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.01
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	-
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (D), pc/mi/ln	-
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1132	1845	2662	3383	-
One Direction DSV, 1000 veh/day	13	20	30	38	-
Bi-Directional DSV, 1000 veh/day	26	42	60	77	-

Figure D-86: PM Peak SB Mainline Upstream of Exit 27

HCS7 Basic Freeway Report

Project Information

Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, SB I-5 upstream of interchange	Unit	United States Customary

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3295	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.97	Flow Rate (Vp), pc/h/ln	1887
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (ET)	2.000		

Speed and Density

Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	56.2
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (D), pc/mi/ln	33.6
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1132	1845	2662	3383	-
One Direction DSV, 1000 veh/day	16	26	38	48	-
Bi-Directional DSV, 1000 veh/day	32	52	75	95	-

Figure D-87: PM Peak SB Mainline Past Exit 27

HCS7 Basic Freeway Report			
Project Information			
Analyst	Dejan Dudich PE	Date	2/02/2021
Agency	ODOT TPAU	Analysis Year	2045
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak
Project Description	Exit 27 AMT, SB I-5 past interchange	Unit	United States Customary
Geometric Data			
Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7
Right-Side Lateral Clearance, ft	10		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000
Demand and Capacity			
Demand Volume veh/h	2190	Heavy Vehicle Adjustment Factor (fHV)	0.900
Peak Hour Factor	0.97	Flow Rate (Vp), pc/h/ln	1254
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2214
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (fLW)	0.0	Average Speed (S), mi/h	58.7
Right-Side Lateral Clearance Adj. (fRLC)	0.0	Density (D), pc/mi/ln	21.4
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	58.7		

Service Volume Table

Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1132	1845	2662	3383	-
One Direction DSV, 1000 veh/day	16	26	38	48	-
Bi-Directional DSV, 1000 veh/day	32	52	75	95	-

Figure D-88: PM Peak SB Mainline Downstream of Exit 27

HCS7 Basic Freeway Report					
Project Information					
Analyst	Dejan Dudich PE	Date	2/02/2021		
Agency	ODOT TPAU	Analysis Year	2045		
Jurisdiction	ODOT	Time Period Analyzed	2045 PM peak		
Project Description	Exit 27 AMT, SB I-5 after interchange	Unit	United States Customary		
Geometric Data					
Number of Lanes, ln	2	Terrain Type	Level		
Segment Length (L), ft	-	Percent Grade, %	-		
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-		
Base Free-Flow Speed (BFFS), mi/h	60.0	Total Ramp Density (TRD), ramps/mi	0.33		
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	58.7		
Right-Side Lateral Clearance, ft	10				
Adjustment Factors					
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000		
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968		
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000		
Demand and Capacity					
Demand Volume veh/h	3135	Heavy Vehicle Adjustment Factor (f_{HV})	0.900		
Peak Hour Factor	0.97	Flow Rate (V_p), pc/h/ln	1796		
Total Trucks, %	11.10	Capacity (c), pc/h/ln	2287		
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2214		
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81		
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	57.4		
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.3		
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	D		
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	58.7				
Service Volume Table					
Target LOS	A	B	C	D	E
Max Service Flow Rate (MSF), pc/h/ln	648	1057	1525	1937	-
Service Flow Rate (SF), veh/h	1167	1902	2745	3487	-
Service Volume, veh/h	1132	1845	2662	3383	-
One Direction DSV, 1000 veh/day	16	26	38	48	-
Bi-Directional DSV, 1000 veh/day	32	52	75	95	-

Queuing and Blocking Report

Figure D-89: AM Peak Barnett Road at Stewart Avenue Queuing and Blocking Report

Intersection: 83: Stewart Avenue & Barnett Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	R	L	T	T	L	R	R
Maximum Queue (ft)	188	153	77	224	227	245	178	171	93
Average Queue (ft)	98	68	30	100	90	114	80	58	31
95th Queue (ft)	158	130	64	187	177	197	148	118	68
Link Distance (ft)	1162	1162			1406	1406		633	633
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			200	237			151		
Storage Blk Time (%)		0		0	0		2	0	
Queuing Penalty (veh)		0		1	1		5	0	

Figure D-90: AM Peak Barnett Road at Alba Drive Queuing and Blocking Report

Intersection: 91: Alba Drive & Barnett Road

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	33	208	227	162	163	39	45
Average Queue (ft)	3	50	51	50	50	7	14
95th Queue (ft)	19	125	134	120	119	27	43
Link Distance (ft)		1406	1406	711	711	654	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	85						32
Storage Blk Time (%)		2		2		1	2
Queuing Penalty (veh)		0		0		0	0

Figure D-91: AM Peak Barnett Road at Highland Drive Queuing and Blocking Report

Intersection: 90: Highland Drive & Barnett Road

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	L	T	TR	L	T	T
Maximum Queue (ft)	113	389	559	577	390	405	450	939	948	265	1318	1384
Average Queue (ft)	42	97	279	297	93	400	448	911	568	110	980	1297
95th Queue (ft)	90	245	476	498	275	426	456	941	1182	221	1758	1632
Link Distance (ft)			711	711				905	905		1263	1263
Upstream Blk Time (%)			1	1				29	7		2	61
Queuing Penalty (veh)			3	4				233	57		22	583
Storage Bay Dist (ft)	300	300			300	360	360			465		
Storage Blk Time (%)		0	10	12		31	68	0				1
Queuing Penalty (veh)		0	12	16		92	196	1				10

Intersection: 90: Highland Drive & Barnett Road

Movement	NB	SB	SB	SB
Directions Served	R	L	T	TR
Maximum Queue (ft)	690	340	893	891
Average Queue (ft)	685	339	861	816
95th Queue (ft)	748	343	947	1067
Link Distance (ft)			852	852
Upstream Blk Time (%)			81	33
Queuing Penalty (veh)			0	0
Storage Bay Dist (ft)	600	250		
Storage Blk Time (%)	59	97	9	
Queuing Penalty (veh)	142	261	13	

Figure D-92: AM Peak Barnett Road at Ellendale Drive Queuing and Blocking Report

Intersection: 94: Ellendale Drive & Barnett Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	106	590	605	158	1274	1257	194	614	141	218
Average Queue (ft)	17	385	409	36	1224	1212	149	270	44	65
95th Queue (ft)	65	569	581	128	1341	1353	236	688	98	155
Link Distance (ft)		905	905		1213	1213		614		735
Upstream Blk Time (%)					86	37		18		
Queuing Penalty (veh)					0	0		0		
Storage Bay Dist (ft)	82			80			105		95	
Storage Blk Time (%)	0	31		1	70		58	1	1	7
Queuing Penalty (veh)	0	4		8	17		20	2	1	4

Figure D-93: AM Peak Garfield Street at I-5 Exit 27 Interchange Queuing and Blocking Report

Intersection: 826: Garfield Street & SB off ramp/NB off ramp

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	>	L	L	>	L	L	T	T	>	L
Maximum Queue (ft)	459	550	1718	300	445	1454	320	445	1292	1269	445	248
Average Queue (ft)	288	521	1407	137	401	1220	146	263	1103	1152	373	125
95th Queue (ft)	561	640	2248	307	574	1874	301	526	1567	1529	642	224
Link Distance (ft)			1648			1407			1237	1237		
Upstream Blk Time (%)			47			56			20	37		
Queuing Penalty (veh)			0			0			181	322		
Storage Bay Dist (ft)	375	375		270	270		270	270			270	200
Storage Blk Time (%)	3	33	40	3	10	76	2	4	38	87	0	1
Queuing Penalty (veh)	21	251	319	10	36	304	6	14	192	429	0	4

Intersection: 826: Garfield Street & SB off ramp/NB off ramp

Movement	SB	SB	SB	SB
Directions Served	L	T	T	>
Maximum Queue (ft)	324	1010	1039	325
Average Queue (ft)	189	512	595	179
95th Queue (ft)	342	1177	1274	442
Link Distance (ft)		1263	1263	
Upstream Blk Time (%)		3	4	
Queuing Penalty (veh)		23	34	
Storage Bay Dist (ft)	200			200
Storage Blk Time (%)	4	30	53	0
Queuing Penalty (veh)	14	120	267	1

Figure D-94: AM Peak Garfield Street at Center Drive Queuing and Blocking Report

Intersection: 827: Center Drive & Garfield Street

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	T	T	R	L	TR	L	L	TR
Maximum Queue (ft)	235	981	988	1278	1363	210	81	168	226	801	629
Average Queue (ft)	80	926	930	946	1098	190	22	47	121	356	187
95th Queue (ft)	238	1066	1060	1588	1648	281	61	136	251	911	704
Link Distance (ft)		940	940	1237	1237			342		950	950
Upstream Blk Time (%)		31	41	4	22			0		14	8
Queuing Penalty (veh)		248	323	37	193			0		0	0
Storage Bay Dist (ft)	186					175	51		190		
Storage Blk Time (%)		57		9	46	0	6	22	6	34	
Queuing Penalty (veh)		43		0	223	1	3	5	8	40	

Note: Garfield is E-W in Synchro, Center N-S

Figure D-95: AM Peak Garfield Street at Riverside/OR 99 Queuing and Blocking Report

Intersection: 87: Riverside/OR99 & Garfield Street

Movement	EB	EB	EB	WB	WB	WB	WB	SE	SE	SE	SE	NW
Directions Served	L	T	TR	L	L	T	R	L	L	T	T	L
Maximum Queue (ft)	280	340	727	228	382	592	324	282	315	2486	2508	350
Average Queue (ft)	128	327	684	97	125	205	131	266	305	1963	1778	137
95th Queue (ft)	316	382	706	183	263	443	307	316	349	3270	3408	376
Link Distance (ft)			664		940	940				2428	2428	
Upstream Blk Time (%)			79			0				39	36	
Queuing Penalty (veh)			0			0				164	149	
Storage Bay Dist (ft)	220	220		300			300	250	250			220
Storage Blk Time (%)	0	75	87	0	0	3	0	55	81	0	0	0
Queuing Penalty (veh)	0	311	393	0	0	18	1	114	165	2	0	0

Intersection: 87: Riverside/OR99 & Garfield Street

Movement	NW	NW	NW
Directions Served	T	T	R
Maximum Queue (ft)	1267	1288	480
Average Queue (ft)	1034	1189	475
95th Queue (ft)	1670	1477	527
Link Distance (ft)	1227	1227	
Upstream Blk Time (%)	18	71	
Queuing Penalty (veh)	0	0	
Storage Bay Dist (ft)			330
Storage Blk Time (%)	50	33	71
Queuing Penalty (veh)	36	158	244

Figure D-96: AM Peak Riverside/OR 99 at Stewart Avenue Queuing and Blocking Report

Intersection: 84: Riverside/OR99 & Stewart

Movement	EB	EB	EB	B3429	B3429	WB	WB	WB	SE	SE	SE	NW
Directions Served	L	T	TR	T	T	L	T	TR	L	T	TR	L
Maximum Queue (ft)	360	1163	1177	197	200	79	193	158	175	1105	1098	227
Average Queue (ft)	259	719	738	71	71	23	98	56	94	725	712	101
95th Queue (ft)	456	1402	1410	275	276	70	170	136	215	1364	1362	195
Link Distance (ft)		1212	1212	272	272		745	745		1052	1052	
Upstream Blk Time (%)		19	24	17	18					44	39	
Queuing Penalty (veh)		0	0	0	0					0	0	
Storage Bay Dist (ft)	247					218			128			298
Storage Blk Time (%)	19	30					0		5	69		0
Queuing Penalty (veh)	63	65					0		13	58		0

Intersection: 84: Riverside/OR99 & Stewart

Movement	NW	NW	NW
Directions Served	L	T	T
Maximum Queue (ft)	250	350	357
Average Queue (ft)	129	159	182
95th Queue (ft)	223	309	326
Link Distance (ft)		2428	2428
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	298		
Storage Blk Time (%)	0	1	
Queuing Penalty (veh)	1	6	

Figure D-97: PM Peak Barnett Road at Stewart Avenue Queuing and Blocking Report

Intersection: 83: Stewart Avenue & Barnett Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	T	T	R	L	T	T	L	R	R
Maximum Queue (ft)	341	361	225	323	529	492	228	485	416
Average Queue (ft)	181	171	79	225	233	222	159	137	85
95th Queue (ft)	284	282	188	358	471	404	248	374	278
Link Distance (ft)	1165	1165			1406	1406		631	631
Upstream Blk Time (%)								0	
Queuing Penalty (veh)								0	
Storage Bay Dist (ft)			200	237			151		
Storage Blk Time (%)		4	0	16	5		27	0	
Queuing Penalty (veh)		9	0	64	23		53	0	

Figure D-98: PM Peak Barnett Road at Alba Drive Queuing and Blocking Report

Intersection: 91: Alba Drive & Barnett Road

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	71	439	508	299	302	91	54
Average Queue (ft)	10	117	135	78	78	22	20
95th Queue (ft)	46	400	433	205	203	62	52
Link Distance (ft)		1406	1406	712	712	650	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	85						32
Storage Blk Time (%)	0	9		4		8	4
Queuing Penalty (veh)	0	1		0		2	1

Figure D-99: PM Peak Barnett Road at Highland Drive Queuing and Blocking Report

Intersection: 90: Highland Drive & Barnett Road

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	L	T	TR	L	T	T
Maximum Queue (ft)	226	390	718	724	390	405	450	922	912	410	540	839
Average Queue (ft)	119	193	398	417	260	365	414	615	363	217	243	302
95th Queue (ft)	197	384	727	741	455	480	522	1081	753	367	399	629
Link Distance (ft)			712	712				905	905		1263	1263
Upstream Blk Time (%)			6	6				4	1			0
Queuing Penalty (veh)			35	38				39	6			0
Storage Bay Dist (ft)	300	300			300	360	360			465		
Storage Blk Time (%)	0	0	24	26	5	9	30	2		0	0	0
Queuing Penalty (veh)	0	0	51	79	18	38	129	19		0	1	0

Intersection: 90: Highland Drive & Barnett Road

Movement	NB	SB	SB	SB
Directions Served	R	L	T	TR
Maximum Queue (ft)	676	340	894	890
Average Queue (ft)	362	115	865	876
95th Queue (ft)	666	320	950	889
Link Distance (ft)			857	857
Upstream Blk Time (%)			52	90
Queuing Penalty (veh)			0	0
Storage Bay Dist (ft)	600	250		
Storage Blk Time (%)	3	0	56	
Queuing Penalty (veh)	11	2	57	

Figure D-100:PM Peak Barnett Road at Ellendale Drive Queuing and Blocking Report

Intersection: 94: Ellendale Drive & Barnett Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	158	695	730	169	1270	1257	194	344	79	111
Average Queue (ft)	41	414	444	55	1235	1231	122	94	25	35
95th Queue (ft)	115	659	696	140	1248	1255	202	256	62	79
Link Distance (ft)		905	905		1214	1214		620		738
Upstream Blk Time (%)					77	31		0		
Queuing Penalty (veh)					0	0		0		
Storage Bay Dist (ft)	82			80			105		95	
Storage Blk Time (%)	3	36		5	51		24	2	0	1
Queuing Penalty (veh)	20	11		42	28		18	4	0	0

Figure D-101:PM Peak Garfield Street at I-5 Exit 27 Interchange Queuing and Blocking Report

Intersection: 826: Garfield Street & SB off ramp/NB off ramp

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	>	L	L	>	L	L	T	T	>	L
Maximum Queue (ft)	267	550	1710	334	445	986	344	426	685	752	424	226
Average Queue (ft)	125	497	1362	180	244	316	189	217	219	276	54	105
95th Queue (ft)	217	703	2150	306	425	733	298	354	450	523	272	195
Link Distance (ft)			1648			1407			1237	1237		
Upstream Blk Time (%)			35			1						
Queuing Penalty (veh)			0			0						
Storage Bay Dist (ft)	375	375		270	270		270	270			270	200
Storage Blk Time (%)			60	2	7	16	1	3	5	12	0	0
Queuing Penalty (veh)			250	12	36	71	5	11	33	63	0	1

Intersection: 826: Garfield Street & SB off ramp/NB off ramp

Movement	SB	SB	SB	SB
Directions Served	L	T	T	>
Maximum Queue (ft)	309	822	927	325
Average Queue (ft)	141	232	323	139
95th Queue (ft)	262	572	770	383
Link Distance (ft)		1263	1263	
Upstream Blk Time (%)		0	0	
Queuing Penalty (veh)		1	3	
Storage Bay Dist (ft)	200			200
Storage Blk Time (%)	2	9	21	3
Queuing Penalty (veh)	6	38	168	10

Figure D-102: PM Peak Garfield Street at Center Drive Queuing and Blocking Report

Intersection: 827: Center Drive & Garfield Street

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	L	TR
Maximum Queue (ft)	235	545	559	430	1204	1309	210	98	175	226	955	937
Average Queue (ft)	116	283	303	123	748	923	194	33	72	221	850	745
95th Queue (ft)	240	509	520	341	1384	1526	275	79	143	242	1149	1262
Link Distance (ft)		960	960		1237	1237			345		910	910
Upstream Blk Time (%)					1	7					59	28
Queuing Penalty (veh)					12	66					0	0
Storage Bay Dist (ft)	186			400			175	51		190		
Storage Blk Time (%)	0	19		0	11	36	1	11	22	36	62	
Queuing Penalty (veh)	3	30		0	13	240	5	13	7	109	186	

Note: Garfield is E-W in Synchro, Center N-S

Figure D-103: PM Peak Garfield Street at Riverside/OR 99 Queuing and Blocking Report

Intersection: 87: Riverside/OR99 & Garfield Street

Movement	EB	EB	EB	WB	WB	WB	WB	SE	SE	SE	SE	NW
Directions Served	L	T	TR	L	L	T	R	L	L	T	T	L
Maximum Queue (ft)	276	340	594	382	430	730	325	185	273	333	334	350
Average Queue (ft)	169	226	281	204	226	364	184	102	107	184	201	220
95th Queue (ft)	274	357	469	326	361	654	396	167	197	326	340	457
Link Distance (ft)			666		960	960				2422	2422	
Upstream Blk Time (%)			0			0						
Queuing Penalty (veh)			0			0						
Storage Bay Dist (ft)	220	220		300			300	250	250			220
Storage Blk Time (%)	6	7	19	1	3	15	0		0	4		0
Queuing Penalty (veh)	21	23	79	4	9	50	2		0	15		1

Intersection: 87: Riverside/OR99 & Garfield Street

Movement	NW	NW	NW
Directions Served	T	T	R
Maximum Queue (ft)	1271	1296	480
Average Queue (ft)	1250	1257	465
95th Queue (ft)	1287	1274	586
Link Distance (ft)	1234	1234	
Upstream Blk Time (%)	43	67	
Queuing Penalty (veh)	0	0	
Storage Bay Dist (ft)			330
Storage Blk Time (%)	78	72	1
Queuing Penalty (veh)	90	405	4

Figure D-104: PM Peak Riverside/OR 99 at Stewart Avenue Queuing and Blocking Report

Intersection: 84: Riverside/OR99 & Stewart

Movement	EB	EB	EB	B3429	B3429	WB	WB	WB	SE	SE	SE	NW
Directions Served	L	T	TR	T	T	L	T	TR	L	T	TR	L
Maximum Queue (ft)	360	1322	1292	330	307	253	438	480	175	1114	1113	360
Average Queue (ft)	360	1291	835	295	282	89	233	257	115	1074	1073	354
95th Queue (ft)	360	1305	1700	311	342	207	363	417	217	1093	1092	388
Link Distance (ft)		1212	1212	272	272		743	743		1050	1050	
Upstream Blk Time (%)		99	14	97	50					80	72	
Queuing Penalty (veh)		0	0	0	0					0	0	
Storage Bay Dist (ft)	247					218			128			298
Storage Blk Time (%)	88	0				0	12		7	69		55
Queuing Penalty (veh)	134	0				0	9		40	89		168

Intersection: 84: Riverside/OR99 & Stewart

Movement	NW	NW	NW	NW
Directions Served	L	T	T	R
Maximum Queue (ft)	422	2105	2006	13
Average Queue (ft)	414	1467	797	0
95th Queue (ft)	464	2431	2034	14
Link Distance (ft)		2422	2422	
Upstream Blk Time (%)		0	0	
Queuing Penalty (veh)		3	0	
Storage Bay Dist (ft)	298			488
Storage Blk Time (%)	77		0	
Queuing Penalty (veh)	234		0	

Contact Information

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