Calibration Notes

SimTraffic calibration was done separately for AM peak and PM peak, using raw counts seasonally adjusted to January, when the site visit was made. Vehicles entering and exiting needed to meet ±1% calibration limits for intersection overall, ±5% for any movements with input volume > 100 veh/hr. Up to date signal timing from the City of Medford and from ODOT Region 3 were critical inputs to achieving calibration. Adjustments were made to saturated flows, speeds, and PHF to bring the network into calibration. Queues observed during the January 2019 site visit were compared to the SimTraffic runs.

AM peak calibration adjustments were made primarily at the intersection of Barnett Road and Highland Drive. Saturated flows were adjusted to reduce WBL queues to more closely match observed queues, and to lengthen the NBR queues, observed to at times back up into the SPUI. Saturated flows were adjusted from 1900 vphpl (veh/hr/lane) in the file provided by Medford to 1740 for SB movements, 1850 for WB movements, 1750 for NBL and NBT, 1700 for NBR, and 1790 for EB movements. NB speed was reduced from 35 to 30 mph. Will Fitzgerald from ODOT Region 3 recommended using individual movement PHF's at this intersection; adjustments from the count movement PHF's were made for NBR (changed from 0.91 to 0.80); WBL (changed from 0.90 to 0.95). The WBL lane utilization factor was set at 0.9 for the AM peak.

Other AM peak calibration changes included some saturation flow changes at Barnett Road and Ellendale Drive: NB and SB saturated flows set at 1825 vphpl; EB, WBL, WBR at 1775, and WBT at 1765. EB saturated flow on the SB off-ramp at the SPUI was changed from 1750 to 1650 vplph to increase back-up to more closely match observed queues, and the speed was reduced from 35 to 30 mph. Saturated flow adjustments were also made at the Garfield Street OR 99 intersection SE direction, changing from 1795 to 1780 vphpl; and at the OR 99 Stewart Avenue intersection, changing NW saturated flow from 1750 to 1700 vphpl, SE saturated flow from 1750 to 1725 vphpl. The Center Street Garfield Street intersection ratio of exiting to entering vehicles was at 102%; trying to tune this in caused more locations to go further out from calibration so this was used for the calibration run.

PM peak adjustments to achieve calibration were also primarily made at the intersection of Barnett Road and Highland Drive. Saturated flows were adjusted to 1725 vphpl for NB, EBT, EBR, and WBR; 1700 vphpl for SB, EBL, WBL, and WBT. Individual movement PHF's were slightly adjusted from those from the count data: WBL (changed from 0.96 to 0.80) and WBT (changed from 0.93 to 0.96) PHF were adjusted to help increase WBL queue length to more closely match observed queues; NBL PHF was changed from 0.85 to 0.89. The WBL lane utilization factor was set at calculated value of 0.67 for the PM peak. Saturated flows were adjusted to 1750 vphpl at Barnett Road and Ellendale Drive, 1000 for EBL. Saturated flows were also slightly adjusted at the

OR 99 Stewart Avenue intersection, changing EBL saturated flow from 1750 to 1740 vphpl, SE saturated flow from 1750 to 1740 vphpl.

Figure G-1: AM Peak Calibration

SimTraffic Performance Report

06/18/2020

83: Stewart Avenue & Barnett Road Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Vehicles Entered	252	53	161	410	98	308	1282
Vehicles Exited	253	53	163	412	99	308	1288
Hourly Exit Rate	253	53	163	412	99	308	1288
Input Volume	246	53	165	400	97	309	1270
% of Volume	103	100	99	103	102	100	101

84: Riverside/OR99 & Stewart Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Vehicles Entered	110	426	224	7	152	32	47	272	92	277	536	12
Vehicles Exited	112	429	224	7	152	33	47	272	92	280	533	12
Hourly Exit Rate	112	429	224	7	152	33	47	272	92	280	533	12
Input Volume	113	431	218	8	146	29	49	272	93	271	530	11
% of Volume	99	99	103	85	104	115	96	100	99	103	101	112

84: Riverside/OR99 & Stewart Performance by movement

Movement	All
Vehicles Entered	2187
Vehicles Exited	2193
Hourly Exit Rate	2193
Input Volume	2171
% of Volume	101

87: Riverside/OR99 & Garfield Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Vehicles Entered	53	373	51	337	314	271	180	304	19	41	422	364
Vehicles Exited	54	373	52	339	317	272	181	303	19	41	425	365
Hourly Exit Rate	54	373	52	339	317	272	181	303	19	41	425	365
Input Volume	57	380	54	327	305	264	184	294	20	41	421	362
% of Volume	95	98	96	104	104	103	99	103	94	101	101	101

87: Riverside/OR99 & Garfield Street Performance by movement

Movement	All
Vehicles Entered	2729
Vehicles Exited	2741
Hourly Exit Rate	2741
Input Volume	2708
% of Volume	101

Figure G-2: AM Peak Calibration, continued

SimTraffic Performance Report

06/18/2020

90: Highland Drive & Barnett Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Entered	80	484	102	485	388	52	95	455	890	72	378	108
Vehicles Exited	82	483	102	490	387	52	99	457	905	74	378	110
Hourly Exit Rate	82	483	102	490	387	52	99	457	905	74	378	110
Input Volume	82	472	106	490	390	53	93	454	895	73	373	105
% of Volume	100	102	96	100	99	98	107	101	101	101	101	105

90: Highland Drive & Barnett Road Performance by movement

Movement	All
Vehicles Entered	3589
Vehicles Exited	3619
Hourly Exit Rate	3619
Input Volume	3584
% of Volume	101

91: Alba Drive & Barnett Road Performance by movement

Movement	EBL	EBT	WBL	WBT	WBR	SBL	SBR	All
Vehicles Entered	4	648	1	560	15	11	16	1255
Vehicles Exited	5	648	1	559	15	11	16	1255
Hourly Exit Rate	5	648	1	559	15	11	16	1255
Input Volume	5	642	1	552	14	11	16	1241
% of Volume	95	101	100	101	109	102	100	101

94: Ellendale Drive & Barnett Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Entered	10	1326	112	16	792	26	90	14	18	37	22	43
Vehicles Exited	10	1332	113	16	791	26	90	14	18	38	22	43
Hourly Exit Rate	10	1332	113	16	791	26	90	14	18	38	22	43
Input Volume	12	1302	110	20	792	25	97	14	17	39	20	44
% of Volume	82	102	103	81	100	104	93	102	107	97	111	98

94: Ellendale Drive & Barnett Road Performance by movement

Movement	All
Vehicles Entered	2506
Vehicles Exited	2513
Hourly Exit Rate	2513
Input Volume	2491
% of Volume	101

Figure G-3: AM Peak Calibration, continued

SimTraffic Performance Report

06/18/2020

826: Garfield Street & SB off ramp/NB off ramp Performance by movement

Movement	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2	All
Vehicles Entered	640	527	256	278	385	482	264	202	412	362	3808
Vehicles Exited	643	528	258	279	386	487	265	203	410	362	3821
Hourly Exit Rate	643	528	258	279	386	487	265	203	410	362	3821
Input Volume	651	524	262	277	378	481	264	209	398	367	3812
% of Volume	99	101	99	101	102	101	100	97	103	99	100

827: Center Drive & Garfield Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Entered	62	862	3	1	849	439	2	1	4	186	7	58
Vehicles Exited	62	865	3	1	858	444	2	1	4	188	7	60
Hourly Exit Rate	62	865	3	1	858	444	2	1	4	188	7	60
Input Volume	66	863	3	2	838	434	3	1	3	180	7	53
% of Volume	94	100	92	50	102	102	62	100	123	104	104	113

827: Center Drive & Garfield Street Performance by movement

Movement	All
Vehicles Entered	2474
Vehicles Exited	2495
Hourly Exit Rate	2495
Input Volume	2454
% of Volume	102

Total Network Performance

Vehicles Entered	7491
Vehicles Exited	7606
Hourly Exit Rate	7606
Input Volume	28000
% of Volume	27

Figure G-2: PM Peak Calibration

SimTraffic Performance Report

06/16/2020

83: Stewart Avenue & Barnett Road Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Vehicles Entered	418	160	296	737	201	322	2134
Vehicles Exited	420	162	294	736	203	322	2137
Hourly Exit Rate	420	162	294	736	203	322	2137
Input Volume	424	155	303	743	204	319	2148
% of Volume	99	105	97	99	100	101	99

84: Riverside/OR99 & Stewart Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Vehicles Entered	185	259	224	65	397	64	82	688	183	404	667	78
Vehicles Exited	186	259	225	66	398	63	84	693	186	406	665	78
Hourly Exit Rate	186	259	225	66	398	63	84	693	186	406	665	78
Input Volume	181	264	221	65	384	60	86	709	177	402	652	78
% of Volume	103	98	102	102	104	105	98	98	105	101	102	100

84: Riverside/OR99 & Stewart Performance by movement

Movement	All
Vehicles Entered	3296
Vehicles Exited	3309
Hourly Exit Rate	3309
Input Volume	3279
% of Volume	101

87: Riverside/OR99 & Garfield Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Vehicles Entered	66	270	60	543	407	214	276	659	49	62	541	417
Vehicles Exited	67	271	60	545	409	214	277	662	48	61	547	418
Hourly Exit Rate	67	271	60	545	409	214	277	662	48	61	547	418
Input Volume	68	273	63	541	398	208	280	666	49	64	535	424
% of Volume	99	99	96	101	103	103	99	99	97	96	102	99

87: Riverside/OR99 & Garfield Street Performance by movement

Movement	All
Vehicles Entered	3564
Vehicles Exited	3579
Hourly Exit Rate	3579
Input Volume	3568
% of Volume	100

Figure G-2: PM Peak Calibration, continued

SimTraffic Performance Report

06/16/2020

90: Highland Drive & Barnett Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Entered	142	480	259	730	621	72	164	420	503	44	542	148
Vehicles Exited	142	482	261	740	622	72	167	423	504	44	538	145
Hourly Exit Rate	142	482	261	740	622	72	167	423	504	44	538	145
Input Volume	140	486	255	719	633	70	170	423	502	46	528	146
% of Volume	101	99	102	103	98	103	98	100	100	96	102	99

90: Highland Drive & Barnett Road Performance by movement

Movement	All
Vehicles Entered	4125
Vehicles Exited	4140
Hourly Exit Rate	4140
Input Volume	4118
% of Volume	101

91: Alba Drive & Barnett Road Performance by movement

Movement	EBL	EBT	WBL	WBT	WBR	SBL	SBR	All
Vehicles Entered	13	855	0	1004	32	27	22	1953
Vehicles Exited	12	855	0	1006	32	27	22	1954
Hourly Exit Rate	12	855	0	1006	32	27	22	1954
Input Volume	14	853	1	1022	32	28	20	1969
% of Volume	84	100	0	98	101	97	111	99

94: Ellendale Drive & Barnett Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Entered	25	833	82	14	1174	15	152	29	31	28	12	33
Vehicles Exited	25	836	82	15	1180	15	153	29	31	28	12	33
Hourly Exit Rate	25	836	82	15	1180	15	153	29	31	28	12	33
Input Volume	27	832	83	16	1172	13	157	27	30	28	12	32
% of Volume	92	100	99	94	101	115	98	106	102	99	100	102

94: Ellendale Drive & Barnett Road Performance by movement

Movement	All
Vehicles Entered	2428
Vehicles Exited	2439
Hourly Exit Rate	2439
Input Volume	2430
% of Volume	100

Figure G-2: PM Peak Calibration, continued

SimTraffic Performance Report

06/16/2020

826: Garfield Street & SB off ramp/NB off ramp Performance by movement

Movement	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2	All
Vehicles Entered	331	580	306	325	528	469	394	300	578	680	4491
Vehicles Exited	332	582	308	325	526	468	394	301	579	678	4493
Hourly Exit Rate	332	582	308	325	526	468	394	301	579	678	4493
Input Volume	331	573	309	322	529	476	389	295	555	672	4452
% of Volume	100	102	100	101	99	98	101	102	104	101	101

827: Center Drive & Garfield Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Entered	137	822	25	39	835	558	23	12	34	517	25	299
Vehicles Exited	138	823	25	38	838	560	23	12	33	524	24	302
Hourly Exit Rate	138	823	25	38	838	560	23	12	33	524	24	302
Input Volume	139	829	27	40	828	541	23	13	33	519	25	288
% of Volume	99	99	92	94	101	104	99	92	99	101	95	105

827: Center Drive & Garfield Street Performance by movement

Movement	All
Vehicles Entered	3326
Vehicles Exited	3340
Hourly Exit Rate	3340
Input Volume	3307
% of Volume	101

Total Network Performance

Vehicles Entered	10182
Vehicles Exited	10268
Hourly Exit Rate	10268
Input Volume	36410
% of Volume	28

Operations Analysis

After calibration, balanced 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 G-3 through G-34, used for V/C calculation and LOS at ODOT intersections. Figures G-35 through G-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 intersection; the HCM 2000 report was used for 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 G-45 through G-68.
Freeway analysis HCS7 reports can be found in Figures G-69 through G-88.
Queuing and blocking reports are in Figures G-89 through G-104.

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

Intersection Analysis Reports from Synchro

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

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 06/19/2020

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	295	60	200	455	115	410
Future Volume (vph)	295	60	200	455	115	410
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)	317	65	215	489	124	441
RTOR Reduction (vph)	0	51	0	0	0	156
Lane Group Flow (vph)	317	14	215	489	124	285
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)	14.5	14.5	21.9	21.9	9.4	45.8
Effective Green, g (s)	14.5	14.5	21.9	21.9	8.4	44.8
Actuated g/C Ratio	0.21	0.21	0.32	0.32	0.12	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)	668	302	515	1010	197	1675
v/s Ratio Prot	c0.10		0.13	c0.15	c0.08	c0.11
v/s Ratio Perm		0.01				
v/c Ratio	0.47	0.05	0.42	0.48	0.63	0.17
Uniform Delay, d1	24.1	21.9	18.7	19.1	29.0	4.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1	0.2	0.1	4.5	0.0
Delay (s)	24.9	22.0	18.9	19.3	33.4	4.9
Level of Service	C	C	B	B	C	A
Approach Delay (s)	24.4			19.2	11.2	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	69.3	Sum of lost time (s)	19.5
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary
83: Stewart Avenue & Barnett Road 06/19/2020

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

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

HCM Signalized Intersection Capacity Analysis
91: Alba Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	700	0	1	635	15	0	0	0	15	0	20
Future Volume (vph)	5	700	0	1	635	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		4.0	5.0					5.5		4.5
Lane Util. Factor	1.00	0.95		1.00	0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		1.00
Frt	1.00	1.00		1.00	1.00					1.00		0.85
Flt Protected	0.95	1.00		0.95	1.00					0.95		1.00
Satd. Flow (prot)	1645	3197		1628	3153					1625		1454
Flt Permitted	0.33	1.00		0.95	1.00					0.95		1.00
Satd. Flow (perm)	572	3197		1628	3153					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	814	0	1	738	17	0	0	0	17	0	23
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	18
Lane Group Flow (vph)	6	814	0	1	753	0	0	0	0	17	0	5
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)	24.3	23.4		0.6	23.1					9.4		10.4
Effective Green, g (s)	23.3	23.4		0.6	23.1					8.9		9.9
Actuated g/C Ratio	0.49	0.49		0.01	0.49					0.19		0.21
Clearance Time (s)	4.0	5.0		4.0	5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0		5.0	5.0					0.2		5.0
Lane Grp Cap (vph)	290	1578		20	1536					305		303
v/s Ratio Prot	0.00	c0.25		c0.00	0.24							
v/s Ratio Perm	0.01									c0.01		0.00
v/c Ratio	0.02	0.52		0.05	0.49					0.06		0.02
Uniform Delay, d1	6.2	8.2		23.1	8.2					15.8		14.9
Progression Factor	1.00	1.00		1.00	1.00					1.00		1.00
Incremental Delay, d2	0.1	0.6		2.2	0.5					0.0		0.0
Delay (s)	6.3	8.7		25.3	8.7					15.8		14.9
Level of Service	A	A		C	A					B		B
Approach Delay (s)		8.7			8.7			0.0			15.3	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	47.4	Sum of lost time (s)	14.5
Intersection Capacity Utilization	33.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

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

HCM 6th Signalized Intersection Summary
91: Alba Drive & Barnett Road 06/19/2020

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

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

HCM Signalized Intersection Capacity Analysis
90: Highland Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	495	125	570	415	60	115	430	1080	85	435	120
Future Volume (vph)	95	495	125	570	415	60	115	430	1080	85	435	120
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	0.98		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	3383		1554	3292	1417	1637	3137	
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	3383		1554	3292	1417	1637	3137	
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)	101	669	133	600	456	68	144	581	1350	120	512	146
RTOR Reduction (vph)	0	0	54	0	9	0	0	0	30	0	18	0
Lane Group Flow (vph)	101	669	79	600	515	0	144	581	1320	120	640	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)	8.0	33.0	42.5	30.6	55.6		9.5	42.1	72.7	9.5	42.1	
Effective Green, g (s)	8.0	33.0	42.5	30.6	55.6		9.5	42.1	72.7	9.5	42.1	
Actuated g/C Ratio	0.06	0.25	0.32	0.23	0.42		0.07	0.32	0.55	0.07	0.32	
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)	196	825	471	760	1412		110	1040	773	116	991	
v/s Ratio Prot	0.03	c0.20	0.01	0.18	0.15		c0.09	0.18	c0.39	0.07	0.20	
v/s Ratio Perm			0.04						0.54			
v/c Ratio	0.52	0.81	0.17	0.79	0.36		1.31	0.56	1.71	1.03	0.65	
Uniform Delay, d1	60.7	47.2	32.6	48.3	26.7		61.8	37.8	30.2	61.8	39.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	6.5	0.1	5.1	0.2		189.9	2.2	324.0	93.1	3.2	
Delay (s)	61.7	53.7	32.7	53.3	26.9		251.7	40.0	354.2	155.0	42.4	
Level of Service	E	D	C	D	C		F	D	F	F	D	
Approach Delay (s)		51.5			41.0			259.1			59.8	
Approach LOS		D			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	138.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	133.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	105.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary
90: Highland Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	95	495	125	570	415	60	115	430	1080	85	435	120
Future Volume (veh/h)	95	495	125	570	415	60	115	430	1080	85	435	120
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	101	669	133	600	456	68	144	581	1350	120	512	146
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	148	857	490	655	1230	182	118	1092	748	123	835	237
Arrive On Green	0.05	0.26	0.26	0.20	0.41	0.41	0.07	0.33	0.33	0.07	0.33	0.33
Sat Flow, veh/h	3281	3348	1481	3338	3022	448	1576	3299	1418	1644	2522	716
Grp Volume(v), veh/h	101	669	133	600	260	264	144	581	1350	120	332	326
Grp Sat Flow(s),veh/h/ln	1641	1674	1481	1669	1730	1740	1576	1650	1418	1644	1640	1598
Q Serve(g_s), s	3.8	23.6	2.9	22.3	13.3	13.5	9.5	18.1	41.2	9.2	21.5	21.7
Cycle Q Clear(g_c), s	3.8	23.6	2.9	22.3	13.3	13.5	9.5	18.1	41.2	9.2	21.5	21.7
Prop In Lane	1.00		1.00	1.00		0.26	1.00		1.00	1.00		0.45
Lane Grp Cap(c), veh/h	148	857	490	655	704	708	118	1092	748	123	543	529
V/C Ratio(X)	0.68	0.78	0.27	0.92	0.37	0.37	1.22	0.53	1.81	0.97	0.61	0.62
Avail Cap(c_a), veh/h	292	1175	631	803	862	867	118	1092	748	123	543	529
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	59.7	43.9	13.1	50.0	26.2	26.3	58.7	34.4	13.0	58.5	35.6	35.6
Incr Delay (d2), s/veh	2.1	3.1	0.5	12.2	0.5	0.5	153.6	1.9	367.7	72.6	5.1	5.3
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	1.6	10.0	1.5	10.3	5.5	5.6	8.8	7.6	87.7	6.3	9.3	9.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	61.7	47.0	13.6	62.1	26.7	26.8	212.3	36.3	380.7	131.1	40.6	40.9
LnGrp LOS	E	D	B	E	C	C	F	D	F	F	D	D
Approach Vol, veh/h		903			1124			2075			778	
Approach Delay, s/veh		43.7			45.7			272.6			54.7	
Approach LOS		D			D			F			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	46.5	29.4	37.0	14.0	46.5	10.2	56.1
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	11.2	43.2	24.3	25.6	11.5	23.7	5.8	15.5
Green Ext Time (p_c), s	0.0	0.0	0.5	6.9	0.0	3.1	0.0	5.5

Intersection Summary	
HCM 6th Ctrl Delay	143.2
HCM 6th LOS	F

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

HCM Signalized Intersection Capacity Analysis
94: Ellendale Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	1505	140	25	880	30	115	15	20	45	25	50
Future Volume (vph)	15	1505	140	25	880	30	115	15	20	45	25	50
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	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1670	3236		1547	3268		1608	1502		1697	1577	
Flt Permitted	0.95	1.00		0.95	1.00		0.65	1.00		0.73	1.00	
Satd. Flow (perm)	1670	3236		1547	3268		1098	1502		1307	1577	
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	1672	156	28	978	33	128	17	22	50	28	56
RTOR Reduction (vph)	0	5	0	0	2	0	0	17	0	0	44	0
Lane Group Flow (vph)	17	1823	0	28	1009	0	128	22	0	50	40	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	1856		48	1908		334	343		355	343	
v/s Ratio Prot	0.01	c0.56		0.02	c0.31		c0.02	0.01		0.01	0.03	
v/s Ratio Perm							c0.09			0.03		
v/c Ratio	0.50	0.98		0.58	0.53		0.38	0.06		0.14	0.12	
Uniform Delay, d1	69.8	30.0		68.8	18.0		40.9	43.5		40.7	45.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	11.1	17.1		16.8	1.1		0.7	0.4		0.2	0.7	
Delay (s)	80.9	47.1		85.6	19.1		41.6	43.9		40.8	45.9	
Level of Service	F	D		F	B		D	D		D	D	
Approach Delay (s)		47.4			20.9			42.1			44.0	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

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

HCM 6th Signalized Intersection Summary

94: Ellendale Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	1505	140	25	880	30	115	15	20	45	25	50
Future Volume (veh/h)	15	1505	140	25	880	30	115	15	20	45	25	50
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	1672	156	28	978	33	128	17	22	50	28	56
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	1805	166	37	1821	61	352	165	214	405	109	219
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	3071	283	1572	3257	110	1643	711	920	1725	517	1034
Grp Volume(v), veh/h	17	894	934	28	496	515	128	0	39	50	0	84
Grp Sat Flow(s),veh/h/ln	1677	1660	1694	1572	1651	1717	1643	0	1631	1725	0	1550
Q Serve(g_s), s	1.4	69.3	73.0	2.6	27.2	27.2	7.5	0.0	2.7	3.3	0.0	6.5
Cycle Q Clear(g_c), s	1.4	69.3	73.0	2.6	27.2	27.2	7.5	0.0	2.7	3.3	0.0	6.5
Prop In Lane	1.00		0.17	1.00		0.06	1.00		0.56	1.00		0.67
Lane Grp Cap(c), veh/h	87	976	995	37	923	960	352	0	379	405	0	328
V/C Ratio(X)	0.19	0.92	0.94	0.76	0.54	0.54	0.36	0.00	0.10	0.12	0.00	0.26
Avail Cap(c_a), veh/h	87	976	995	82	923	960	352	0	379	440	0	328
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	26.5	27.3	69.9	20.0	20.0	43.1	0.0	43.5	42.4	0.0	47.3
Incr Delay (d2), s/veh	0.1	1.7	2.3	27.0	2.2	2.2	0.6	0.0	0.5	0.1	0.0	1.9
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	0.6	26.4	28.5	1.3	10.9	11.3	0.6	0.0	1.2	1.4	0.0	2.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	65.5	28.3	29.6	96.9	22.2	22.2	43.7	0.0	44.0	42.6	0.0	49.2
LnGrp LOS	E	C	C	F	C	C	D	A	D	D	A	D
Approach Vol, veh/h		1845			1039			167			134	
Approach Delay, s/veh		29.3			24.2			43.8			46.7	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.1	37.9	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	5.3	4.7	4.6	75.0	9.5	8.5	3.4	29.2
Green Ext Time (p_c), s	0.0	0.2	0.0	4.6	0.0	0.4	0.0	7.9

Intersection Summary	
HCM 6th Ctrl Delay	29.1
HCM 6th LOS	C

Figure G-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 06/19/2020

Movement	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	760	625	315	325	450	540	315	250	440	440
Future Volume (vph)	760	625	315	325	450	540	315	250	440	440
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)	835	687	346	357	495	593	346	275	484	484
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	268
Lane Group Flow (vph)	835	687	346	357	495	593	346	275	484	216
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)	60.6	136.1	60.6	136.1	26.4	33.7	136.1	17.5	24.8	60.6
Effective Green, g (s)	60.6	136.1	60.6	136.1	26.4	33.7	136.1	17.5	24.8	60.6
Actuated g/C Ratio	0.45	1.00	0.45	1.00	0.19	0.25	1.00	0.13	0.18	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)	899	1323	1394	1444	590	807	1365	398	588	649
v/s Ratio Prot	c0.41		0.11		c0.16	c0.18		0.09	c0.15	
v/s Ratio Perm		0.52		0.25			0.25			0.15
v/c Ratio	0.93	0.52	0.25	0.25	0.84	0.73	0.25	0.69	0.82	0.33
Uniform Delay, d1	35.7	0.0	23.5	0.0	52.8	47.1	0.0	56.7	53.5	24.6
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	15.4	1.5	0.1	0.4	10.0	3.8	0.4	4.7	9.7	0.2
Delay (s)	51.1	1.5	23.6	0.4	62.8	50.9	0.4	61.4	63.2	24.8
Level of Service	D	A	C	A	E	D	A	E	E	C
Approach Delay (s)						42.8			47.9	
Approach LOS						D			D	

Intersection Summary			
HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	136.1	Sum of lost time (s)	24.3
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Figure G-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 06/19/2020

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

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

HCM Signalized Intersection Capacity Analysis

827: Center Drive & Garfield Street 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	1070	5	1	905	475	5	1	5	230	10	60
Future Volume (vph)	75	1070	5	1	905	475	5	1	5	230	10	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	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	1.00		1.00	1.00	0.85	1.00	0.87		1.00	0.87	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1599	3226		1554	3228	1444	1630	1456		3072	1442	
Flt Permitted	0.15	1.00		0.14	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	253	3226		237	3228	1444	1630	1456		3072	1442	
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	1321	6	1	1117	586	6	1	6	284	12	74
RTOR Reduction (vph)	0	0	0	0	0	143	0	6	0	0	59	0
Lane Group Flow (vph)	93	1327	0	1	1117	443	6	1	0	284	27	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)	56.4	51.3		46.5	45.9	57.5	0.8	7.0		11.6	17.8	
Effective Green, g (s)	56.4	51.3		46.5	45.9	57.5	0.8	7.0		11.6	17.8	
Actuated g/C Ratio	0.64	0.58		0.53	0.52	0.65	0.01	0.08		0.13	0.20	
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)	252	1869		133	1674	1011	14	115		402	290	
v/s Ratio Prot	c0.02	c0.41		0.00	0.35	c0.06	0.00	0.00		c0.09	c0.02	
v/s Ratio Perm	0.21			0.00		0.25						
v/c Ratio	0.37	0.71		0.01	0.67	0.44	0.43	0.01		0.71	0.09	
Uniform Delay, d1	9.3	13.3		11.0	15.7	7.6	43.6	37.6		36.8	28.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	1.4		0.0	1.2	0.2	14.6	0.0		5.2	0.1	
Delay (s)	9.6	14.7		11.1	16.8	7.8	58.2	37.6		42.0	28.8	
Level of Service	A	B		B	B	A	E	D		D	C	
Approach Delay (s)		14.4			13.7			47.1			38.9	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	88.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary

827: Center Drive & Garfield Street 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	75	1070	5	1	905	475	5	1	5	230	10	60
Future Volume (veh/h)	75	1070	5	1	905	475	5	1	5	230	10	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	1321	6	1	1117	586	6	1	6	284	12	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	263	1890	9	212	1670	931	13	12	74	400	37	226
Arrive On Green	0.06	0.57	0.57	0.00	0.51	0.51	0.01	0.06	0.06	0.13	0.18	0.18
Sat Flow, veh/h	1615	3315	15	1576	3247	1448	1641	212	1269	3107	205	1263
Grp Volume(v), veh/h	93	647	680	1	1117	586	6	0	7	284	0	86
Grp Sat Flow(s),veh/h/ln	1615	1624	1706	1576	1624	1448	1641	0	1481	1554	0	1468
Q Serve(g_s), s	1.9	21.2	21.2	0.0	19.0	18.1	0.3	0.0	0.3	6.5	0.0	3.8
Cycle Q Clear(g_c), s	1.9	21.2	21.2	0.0	19.0	18.1	0.3	0.0	0.3	6.5	0.0	3.8
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.86	1.00		0.86
Lane Grp Cap(c), veh/h	263	926	973	212	1670	931	13	0	87	400	0	263
V/C Ratio(X)	0.35	0.70	0.70	0.00	0.67	0.63	0.47	0.00	0.08	0.71	0.00	0.33
Avail Cap(c_a), veh/h	495	926	973	738	1742	963	550	0	834	1042	0	807
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	10.8	11.5	11.5	10.7	13.4	8.0	36.8	0.0	33.2	31.2	0.0	26.7
Incr Delay (d2), s/veh	0.3	2.6	2.5	0.0	1.1	1.5	18.3	0.0	0.3	1.7	0.0	0.3
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	6.9	7.2	0.0	6.2	4.6	0.2	0.0	0.1	2.5	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.1	14.1	14.0	10.7	14.5	9.5	55.1	0.0	33.5	32.9	0.0	26.9
LnGrp LOS	B	B	B	B	B	A	E	A	C	C	A	C
Approach Vol, veh/h		1420			1704			13			370	
Approach Delay, s/veh		13.8			12.8			43.5			31.5	
Approach LOS		B			B			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.1	8.9	4.6	47.0	5.1	17.9	8.8	42.8
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	25.0	42.0	25.0	40.0	25.0	41.0	15.0	40.0
Max Q Clear Time (g_c+I1), s	8.5	2.3	2.0	23.2	2.3	5.8	3.9	21.0
Green Ext Time (p_c), s	1.1	0.0	0.0	14.5	0.0	0.2	0.1	17.3

Intersection Summary	
HCM 6th Ctrl Delay	15.3
HCM 6th LOS	B

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

HCM Signalized Intersection Capacity Analysis

87: Riverside/OR99 & Garfield Street 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	65	480	65	370	280	320	225	270	25	50	520	445
Future Volume (vph)	65	480	65	370	280	320	225	270	25	50	520	445
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	0.98		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	3227		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	3227		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)	77	571	77	440	333	381	268	321	30	60	619	530
RTOR Reduction (vph)	0	8	0	0	0	113	0	0	17	0	0	66
Lane Group Flow (vph)	77	640	0	440	333	268	268	321	13	60	619	464
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)	8.8	26.3		19.9	37.4	52.0	14.6	38.2	47.0	7.7	31.3	51.2
Effective Green, g (s)	8.8	26.3		19.9	37.4	52.0	14.6	38.2	47.0	7.7	31.3	51.2
Actuated g/C Ratio	0.08	0.24		0.18	0.34	0.47	0.13	0.35	0.43	0.07	0.28	0.47
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)	132	771		566	583	676	418	1140	593	110	937	685
v/s Ratio Prot	0.05	c0.20		c0.14	0.19	0.05	c0.08	0.10	0.00	0.04	0.19	c0.12
v/s Ratio Perm						0.13			0.01			0.19
v/c Ratio	0.58	0.83		0.78	0.57	0.40	0.64	0.28	0.02	0.55	0.66	0.68
Uniform Delay, d1	48.8	39.7		42.9	29.7	18.8	45.2	26.0	18.2	49.5	34.7	23.0
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	5.3	7.4		6.1	1.1	0.2	2.6	0.3	0.0	3.2	2.2	2.2
Delay (s)	54.2	47.2		49.1	30.8	19.0	47.8	26.2	18.2	52.7	36.9	25.1
Level of Service	D	D		D	C	B	D	C	B	D	D	C
Approach Delay (s)		47.9			33.9			35.2			32.5	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	36.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary

87: Riverside/OR99 & Garfield Street 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	65	480	65	370	280	320	225	270	25	50	520	445
Future Volume (veh/h)	65	480	65	370	280	320	225	270	25	50	520	445
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	77	571	77	440	333	381	268	321	0	60	619	530
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	99	662	89	534	579	640	347	1233		75	1031	709
Arrive On Green	0.06	0.23	0.23	0.17	0.34	0.34	0.11	0.37	0.00	0.05	0.31	0.31
Sat Flow, veh/h	1673	2934	395	3169	1729	1442	3186	3303	1403	1607	3312	1477
Grp Volume(v), veh/h	77	322	326	440	333	381	268	321	0	60	619	530
Grp Sat Flow(s),veh/h/ln	1673	1656	1672	1585	1729	1442	1593	1651	1403	1607	1656	1477
Q Serve(g_s), s	4.4	18.0	18.1	12.9	15.3	19.2	7.9	6.5	0.0	3.6	15.3	28.0
Cycle Q Clear(g_c), s	4.4	18.0	18.1	12.9	15.3	19.2	7.9	6.5	0.0	3.6	15.3	28.0
Prop In Lane	1.00		0.24	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	99	373	377	534	579	640	347	1233		75	1031	709
V/C Ratio(X)	0.78	0.86	0.87	0.82	0.57	0.60	0.77	0.26		0.80	0.60	0.75
Avail Cap(c_a), veh/h	372	516	521	1151	1346	1279	794	1233		417	1031	709
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	44.7	35.9	35.9	38.7	26.4	20.2	41.8	21.0	0.0	45.5	28.1	20.3
Incr Delay (d2), s/veh	9.5	9.6	9.9	1.5	0.7	0.7	1.7	0.2	0.0	8.5	1.4	5.0
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	2.0	8.0	8.2	5.0	6.2	6.2	3.0	2.4	0.0	1.5	5.9	9.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	54.2	45.4	45.8	40.2	27.1	20.9	43.5	21.2	0.0	54.0	29.5	25.4
LnGrp LOS	D	D	D	D	C	C	D	C		D	C	C
Approach Vol, veh/h		725			1154			589	A		1209	
Approach Delay, s/veh		46.5			30.0			31.3			28.9	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.5	35.4	20.2	26.2	8.5	41.4	9.7	36.8
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	9.9	30.0	14.9	20.1	5.6	8.5	6.4	21.2
Green Ext Time (p_c), s	0.6	0.0	1.3	1.6	0.1	6.3	0.1	2.7

Intersection Summary	
HCM 6th Ctrl Delay	33.1
HCM 6th LOS	C

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

HCM Signalized Intersection Capacity Analysis

84: Riverside/OR99 & Stewart 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	130	500	225	10	170	35	55	285	110	315	575	15
Future Volume (vph)	130	500	225	10	170	35	55	285	110	315	575	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	3068		1630	3110		1366	2870		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	3068		1630	3110		1366	2870		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)	153	588	265	12	200	41	65	335	129	371	676	18
RTOR Reduction (vph)	0	36	0	0	14	0	0	28	0	0	0	9
Lane Group Flow (vph)	153	817	0	12	227	0	65	436	0	371	676	9
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)	15.2	37.0		2.8	24.6		8.1	38.5		17.6	48.0	56.2
Effective Green, g (s)	14.2	37.0		1.8	24.6		7.1	38.5		16.6	48.0	56.2
Actuated g/C Ratio	0.12	0.33		0.02	0.22		0.06	0.34		0.15	0.42	0.49
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)	195	997		25	672		85	970		435	1285	699
v/s Ratio Prot	c0.10	c0.27		0.01	0.07		0.05	0.15		c0.12	c0.22	0.01
v/s Ratio Perm												
v/c Ratio	0.78	0.82		0.48	0.34		0.76	0.45		0.85	0.53	0.01
Uniform Delay, d1	48.3	35.3		55.5	37.7		52.5	29.4		47.4	24.4	14.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.8	5.2		5.2	0.2		30.0	1.5		14.4	1.5	0.0
Delay (s)	66.2	40.5		60.7	37.9		82.6	30.9		61.8	26.0	14.7
Level of Service	E	D		E	D		F	C		E	C	B
Approach Delay (s)		44.4			39.0			37.2			38.3	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	113.8	Sum of lost time (s)	19.9
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary

84: Riverside/OR99 & Stewart 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	130	500	225	10	170	35	55	285	110	315	575	15
Future Volume (veh/h)	130	500	225	10	170	35	55	285	110	315	575	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	153	588	265	12	200	41	65	335	129	371	676	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	169	693	312	7	583	117	65	755	286	408	1356	
Arrive On Green	0.11	0.32	0.32	0.00	0.22	0.22	0.05	0.35	0.35	0.14	0.44	0.00
Sat Flow, veh/h	1589	2177	980	1641	2694	541	1387	2144	811	3018	3079	1418
Grp Volume(v), veh/h	153	438	415	12	119	122	65	234	230	371	676	0
Grp Sat Flow(s),veh/h/ln	1589	1624	1533	1641	1624	1612	1387	1511	1444	1509	1539	1418
Q Serve(g_s), s	10.0	26.5	26.5	0.5	6.5	6.7	4.9	12.5	12.9	12.7	16.5	0.0
Cycle Q Clear(g_c), s	10.0	26.5	26.5	0.5	6.5	6.7	4.9	12.5	12.9	12.7	16.5	0.0
Prop In Lane	1.00		0.64	1.00		0.34	1.00		0.56	1.00		1.00
Lane Grp Cap(c), veh/h	169	517	488	7	352	349	65	532	509	408	1356	
V/C Ratio(X)	0.90	0.85	0.85	1.61	0.34	0.35	1.00	0.44	0.45	0.91	0.50	
Avail Cap(c_a), veh/h	302	572	540	328	495	491	251	532	509	546	1356	
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	46.4	33.4	33.4	52.3	34.8	34.9	50.0	26.1	26.2	44.8	21.1	0.0
Incr Delay (d2), s/veh	13.1	10.3	10.9	318.6	0.4	0.4	30.4	2.6	2.9	13.5	1.3	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	4.5	11.5	11.0	0.9	2.6	2.6	2.2	4.8	4.7	5.3	5.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.5	43.7	44.4	370.9	35.2	35.3	80.4	28.7	29.1	58.3	22.4	0.0
LnGrp LOS	E	D	D	F	D	D	F	C	C	E	C	
Approach Vol, veh/h		1006			253			529			1047	A
Approach Delay, s/veh		46.4			51.2			35.2			35.1	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.9	51.7	5.5	38.0	19.2	42.4	16.2	27.2
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	6.9	18.5	2.5	28.5	14.7	14.9	12.0	8.7
Green Ext Time (p_c), s	0.1	10.7	0.0	4.9	0.5	7.6	0.3	2.3

Intersection Summary	
HCM 6th Ctrl Delay	40.6
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 G-19: PM Peak Barnett Road at Stewart Avenue HCM 2000 Report

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 06/17/2020

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	565	210	365	695	205	325
Future Volume (vph)	565	210	365	695	205	325
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)	595	221	384	732	216	342
RTOR Reduction (vph)	0	160	0	0	0	136
Lane Group Flow (vph)	595	61	384	732	216	206
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)	22.0	22.0	22.4	22.4	15.0	49.3
Effective Green, g (s)	22.0	22.0	22.4	22.4	14.0	48.3
Actuated g/C Ratio	0.27	0.27	0.28	0.28	0.17	0.60
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)	901	403	459	900	286	1559
v/s Ratio Prot	c0.18		c0.23	0.23	c0.13	c0.08
v/s Ratio Perm		0.04				
v/c Ratio	0.66	0.15	0.84	0.81	0.76	0.13
Uniform Delay, d1	25.8	22.1	27.2	27.0	31.5	6.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	0.3	12.0	5.4	9.6	0.0
Delay (s)	27.9	22.3	39.2	32.4	41.2	7.0
Level of Service	C	C	D	C	D	A
Approach Delay (s)	26.4			34.7	20.2	
Approach LOS	C			C	C	

Intersection Summary			
HCM 2000 Control Delay	28.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.3	Sum of lost time (s)	19.5
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary
83: Stewart Avenue & Barnett Road 06/17/2020

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

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

HCM Signalized Intersection Capacity Analysis
91: Alba Drive & Barnett Road 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	875	0	1	1035	40	0	0	0	35	0	25
Future Volume (vph)	15	875	0	1	1035	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		4.0	5.0					5.5		4.5
Lane Util. Factor	1.00	0.95		1.00	0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		1.00
Frt	1.00	1.00		1.00	0.99					1.00		0.85
Flt Protected	0.95	1.00		0.95	1.00					0.95		1.00
Satd. Flow (prot)	1553	3292		1628	3268					1624		1454
Flt Permitted	0.20	1.00		0.95	1.00					0.95		1.00
Satd. Flow (perm)	320	3292		1628	3268					1624		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	941	0	1	1113	43	0	0	0	38	0	27
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	23
Lane Group Flow (vph)	16	941	0	1	1154	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)	39.4	38.5		0.6	38.2					9.4		10.4
Effective Green, g (s)	38.4	38.5		0.6	38.2					8.9		9.9
Actuated g/C Ratio	0.61	0.62		0.01	0.61					0.14		0.16
Clearance Time (s)	4.0	5.0		4.0	5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0		5.0	5.0					0.2		5.0
Lane Grp Cap (vph)	204	2027		15	1997					231		230
v/s Ratio Prot	0.00	0.29		c0.00	c0.35							
v/s Ratio Perm	0.05									c0.02		0.00
v/c Ratio	0.08	0.46		0.07	0.58					0.16		0.02
Uniform Delay, d1	5.2	6.5		30.7	7.3					23.5		22.2
Progression Factor	1.00	1.00		1.00	1.00					1.00		1.00
Incremental Delay, d2	0.3	0.4		3.9	0.7					0.1		0.1
Delay (s)	5.5	6.8		34.6	8.0					23.7		22.3
Level of Service	A	A		C	A					C		C
Approach Delay (s)		6.8			8.0			0.0			23.1	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	7.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	62.5	Sum of lost time (s)	14.5
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

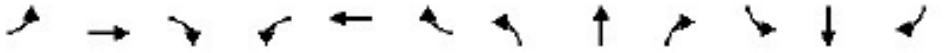
Figure G-22: PM Peak Barnett Road at Alba Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary
91: Alba Drive & Barnett Road 06/17/2020

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

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

HCM Signalized Intersection Capacity Analysis
90: Highland Drive & Barnett Road 06/17/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	175	440	295	830	705	80	200	495	585	55	615	170
Future Volume (vph)	175	440	295	830	705	80	200	495	585	55	615	170
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	0.97	
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)	3102	3245	1452	2143	3129		1561	3245	1452	1553	3090	
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	3129		1561	3245	1452	1553	3090	
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)	186	571	321	1038	734	100	225	556	616	62	647	187
RTOR Reduction (vph)	0	0	41	0	4	0	0	0	112	0	14	0
Lane Group Flow (vph)	186	571	280	1038	830	0	225	556	504	62	820	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)	14.3	36.1	62.7	55.6	77.4		26.6	41.9	97.5	20.2	35.5	
Effective Green, g (s)	14.3	36.1	62.7	55.6	77.4		26.6	41.9	97.5	20.2	35.5	
Actuated g/C Ratio	0.08	0.21	0.36	0.32	0.45		0.15	0.24	0.57	0.12	0.21	
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)	258	681	567	693	1409		241	791	862	182	638	
v/s Ratio Prot	0.06	c0.18	0.08	c0.48	0.27		c0.14	0.17	0.19	0.04	c0.27	
v/s Ratio Perm			0.12						0.16			
v/c Ratio	0.72	0.84	0.49	1.50	0.59		0.93	0.70	0.59	0.34	1.28	
Uniform Delay, d1	76.8	65.1	42.3	58.1	35.3		71.7	59.3	24.1	69.7	68.2	
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	8.1	9.4	0.2	231.6	0.8		39.5	5.2	0.7	0.4	139.8	
Delay (s)	84.9	74.5	42.5	289.7	36.1		111.2	64.5	24.7	70.1	208.0	
Level of Service	F	E	D	F	D		F	E	C	E	F	
Approach Delay (s)		66.8			176.7			54.5			198.4	
Approach LOS		E			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	125.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	171.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Exit 27 South Medford Interchange Project 03/16/2020
Dejan Dudich, TPAU

Synchro 10 Report
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Figure G-24: PM Peak Barnett Road at Highland Drive HCM 6th Edition Report

HCM 6th Signalized Intersection Summary

90: Highland Drive & Barnett Road 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	440	295	830	705	80	200	495	585	55	615	170
Future Volume (veh/h)	175	440	295	830	705	80	200	495	585	55	615	170
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	186	571	321	1038	734	100	225	556	616	62	647	187
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	224	700	528	697	1324	180	235	674	770	233	508	147
Arrive On Green	0.07	0.22	0.22	0.32	0.47	0.47	0.15	0.21	0.21	0.15	0.21	0.21
Sat Flow, veh/h	3116	3252	1450	2153	2834	386	1579	3252	1450	1569	2453	708
Grp Volume(v), veh/h	186	571	321	1038	415	419	225	556	616	62	422	412
Grp Sat Flow(s),veh/h/ln	1558	1626	1450	1076	1602	1617	1579	1626	1450	1569	1602	1559
Q Serve(g_s), s	10.1	28.6	5.5	55.5	31.9	31.9	24.2	28.0	3.8	6.0	35.5	35.5
Cycle Q Clear(g_c), s	10.1	28.6	5.5	55.5	31.9	31.9	24.2	28.0	3.8	6.0	35.5	35.5
Prop In Lane	1.00		1.00	1.00		0.24	1.00		1.00	1.00		0.45
Lane Grp Cap(c), veh/h	224	700	528	697	749	756	235	674	770	233	332	323
V/C Ratio(X)	0.83	0.82	0.61	1.49	0.55	0.55	0.96	0.83	0.80	0.27	1.27	1.27
Avail Cap(c_a), veh/h	1009	863	601	697	749	756	235	674	770	233	332	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)	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	78.5	64.0	44.5	57.9	32.8	32.8	72.4	65.0	32.8	64.6	67.9	67.9
Incr Delay (d2), s/veh	3.0	5.8	2.0	227.7	1.2	1.2	46.5	11.1	8.5	0.2	144.2	145.5
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	4.2	12.4	11.6	37.1	12.8	13.0	12.8	12.7	22.6	2.4	27.8	27.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	81.5	69.8	46.5	285.6	34.0	34.0	118.9	76.1	41.3	64.9	212.1	213.4
LnGrp LOS	F	E	D	F	C	C	F	E	D	E	F	F
Approach Vol, veh/h		1078			1872			1397			896	
Approach Delay, s/veh		64.9			173.5			67.6			202.5	
Approach LOS		E			F			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	30.0	40.0	60.0	41.4	30.0	40.0	16.8	84.6
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	8.0	30.0	57.5	30.6	26.2	37.5	12.1	33.9
Green Ext Time (p_c), s	0.0	2.5	0.0	6.2	0.0	0.0	0.2	5.6

Intersection Summary	
HCM 6th Ctrl Delay	127.9
HCM 6th LOS	F

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

HCM Signalized Intersection Capacity Analysis
94: Ellendale Drive & Barnett Road 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	955	95	20	1395	15	185	30	35	35	15	35
Future Volume (vph)	30	955	95	20	1395	15	185	30	35	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	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)	922	3232		1646	3283		1633	1569		1629	1521	
Flt Permitted	0.95	1.00		0.95	1.00		0.64	1.00		0.71	1.00	
Satd. Flow (perm)	922	3232		1646	3283		1099	1569		1223	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	985	98	21	1438	15	191	31	36	36	15	36
RTOR Reduction (vph)	0	5	0	0	0	0	0	26	0	0	27	0
Lane Group Flow (vph)	31	1078	0	21	1453	0	191	41	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)	6.9	75.2		4.5	72.8		50.8	40.5		39.9	34.1	
Effective Green, g (s)	6.9	75.2		4.5	72.8		50.8	40.5		39.9	34.1	
Actuated g/C Ratio	0.05	0.52		0.03	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)	44	1687		51	1659		432	441		355	360	
v/s Ratio Prot	c0.03	0.33		0.01	c0.44		c0.04	0.03		0.00	0.02	
v/s Ratio Perm							c0.12			0.02		
v/c Ratio	0.70	0.64		0.41	0.88		0.44	0.09		0.10	0.07	
Uniform Delay, d1	67.5	24.7		68.5	31.6		34.3	38.2		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	40.4	1.9		5.3	6.8		0.7	0.4		0.1	0.3	
Delay (s)	107.9	26.5		73.8	38.4		35.0	38.6		38.6	42.9	
Level of Service	F	C		E	D		D	D		D	D	
Approach Delay (s)		28.8			38.9			35.9			41.1	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

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

HCM 6th Signalized Intersection Summary

94: Ellendale Drive & Barnett Road 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	955	95	20	1395	15	185	30	35	35	15	35
Future Volume (veh/h)	30	955	95	20	1395	15	185	30	35	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	985	98	21	1438	15	191	31	36	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	1587	158	86	1753	18	443	198	230	375	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	3027	301	1654	3344	35	1654	728	845	1654	448	1076
Grp Volume(v), veh/h	31	537	546	21	709	744	191	0	67	36	0	51
Grp Sat Flow(s),veh/h/ln	930	1650	1679	1654	1650	1730	1654	0	1573	1654	0	1524
Q Serve(g_s), s	4.7	33.0	33.1	1.8	51.6	51.7	12.5	0.0	4.7	2.4	0.0	3.9
Cycle Q Clear(g_c), s	4.7	33.0	33.1	1.8	51.6	51.7	12.5	0.0	4.7	2.4	0.0	3.9
Prop In Lane	1.00		0.18	1.00		0.02	1.00		0.54	1.00		0.71
Lane Grp Cap(c), veh/h	48	865	880	86	865	907	443	0	428	375	0	323
V/C Ratio(X)	0.64	0.62	0.62	0.24	0.82	0.82	0.43	0.00	0.16	0.10	0.00	0.16
Avail Cap(c_a), veh/h	48	865	880	86	865	907	443	0	428	417	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)	0.64	0.64	0.64	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	24.1	24.2	65.5	28.6	28.6	38.8	0.0	39.8	42.7	0.0	46.3
Incr Delay (d2), s/veh	16.7	2.2	2.1	1.4	8.6	8.2	0.7	0.0	0.8	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	1.3	13.2	13.4	0.8	21.8	22.8	5.4	0.0	1.9	1.0	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	83.6	26.3	26.3	67.0	37.1	36.8	39.4	0.0	40.6	42.8	0.0	47.3
LnGrp LOS	F	C	C	E	D	D	D	A	D	D	A	D
Approach Vol, veh/h		1114			1474			258			87	
Approach Delay, s/veh		27.9			37.4			39.7			45.5	
Approach LOS		C			D			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	6.7	3.8	35.1	14.5	5.9	6.7	53.7
Green Ext Time (p_c), s	0.0	0.3	0.0	8.7	0.0	0.2	0.0	10.7

Intersection Summary	
HCM 6th Ctrl Delay	34.2
HCM 6th LOS	C

Figure G-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 06/17/2020

Movement	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	395	685	370	385	630	500	465	350	590	800
Future Volume (vph)	395	685	370	385	630	500	465	350	590	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)	407	706	381	397	649	515	479	361	608	825
RTOR Reduction (vph)	0	0	0	0	0	0	277	0	0	418
Lane Group Flow (vph)	407	706	381	397	649	515	202	361	608	407
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)	28.6	124.8	28.6	124.8	30.5	52.5	52.5	19.4	41.4	41.4
Effective Green, g (s)	28.6	124.8	28.6	124.8	30.5	52.5	52.5	19.4	41.4	41.4
Actuated g/C Ratio	0.23	1.00	0.23	1.00	0.24	0.42	0.42	0.16	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)	500	1430	717	1458	757	1384	584	496	1081	479
v/s Ratio Prot					c0.21	0.16		0.11	0.19	
v/s Ratio Perm	c0.19	c0.49	0.12	0.27			0.14			c0.28
v/c Ratio	0.81	0.49	0.53	0.27	0.86	0.37	0.35	0.73	0.56	0.85
Uniform Delay, d1	45.6	0.0	42.2	0.0	45.1	24.8	24.5	50.2	34.3	38.8
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	9.6	1.2	0.6	0.5	9.4	0.3	0.5	5.0	0.9	14.2
Delay (s)	55.2	1.2	42.8	0.5	54.4	25.1	25.0	55.1	35.1	53.0
Level of Service	E	A	D	A	D	C	C	E	D	D
Approach Delay (s)						36.7			47.4	
Approach LOS						D			D	

Intersection Summary			
HCM 2000 Control Delay	34.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	124.8	Sum of lost time (s)	24.3
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Figure G-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 06/17/2020

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

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

HCM Signalized Intersection Capacity Analysis

827: Center Drive & Garfield Street 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	950	30	45	960	640	25	15	40	605	30	335
Future Volume (vph)	160	950	30	45	960	640	25	15	40	605	30	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	1.00		1.00	1.00	0.85	1.00	0.89		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	3277		1646	3292	1444	1614	1485		3162	1465	
Flt Permitted	0.09	1.00		0.17	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	162	3277		296	3292	1444	1614	1485		3162	1465	
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	979	31	46	990	660	26	15	41	624	31	345
RTOR Reduction (vph)	0	1	0	0	0	184	0	35	0	0	214	0
Lane Group Flow (vph)	165	1009	0	46	990	476	26	21	0	624	162	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)	58.1	48.2		46.1	40.7	68.6	4.3	16.0		27.9	39.6	
Effective Green, g (s)	58.1	48.2		46.1	40.7	68.6	4.3	16.0		27.9	39.6	
Actuated g/C Ratio	0.50	0.42		0.40	0.35	0.59	0.04	0.14		0.24	0.34	
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)	245	1367		181	1160	913	60	205		763	502	
v/s Ratio Prot	c0.08	0.31		0.01	c0.30	0.13	0.02	0.01		c0.20	c0.11	
v/s Ratio Perm	0.26			0.09		0.20						
v/c Ratio	0.67	0.74		0.25	0.85	0.52	0.43	0.10		0.82	0.32	
Uniform Delay, d1	22.4	28.3		22.7	34.6	13.8	54.4	43.5		41.4	28.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.6	2.3		0.5	6.6	0.4	3.6	0.2		6.6	0.1	
Delay (s)	28.0	30.7		23.2	41.2	14.2	58.0	43.6		48.0	28.2	
Level of Service	C	C		C	D	B	E	D		D	C	
Approach Delay (s)		30.3			30.2			48.2			40.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	115.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary
827: Center Drive & Garfield Street 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	950	30	45	960	640	25	15	40	605	30	335
Future Volume (veh/h)	160	950	30	45	960	640	25	15	40	605	30	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	979	31	46	990	660	26	15	41	624	31	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	252	1645	52	285	1545	988	40	35	96	682	33	371
Arrive On Green	0.07	0.50	0.50	0.03	0.47	0.47	0.02	0.09	0.09	0.21	0.28	0.28
Sat Flow, veh/h	1641	3264	103	1654	3299	1448	1628	408	1114	3183	121	1346
Grp Volume(v), veh/h	165	495	515	46	990	660	26	0	56	624	0	376
Grp Sat Flow(s),veh/h/ln	1641	1650	1718	1654	1650	1448	1628	0	1522	1591	0	1467
Q Serve(g_s), s	5.6	23.7	23.7	1.6	25.5	29.7	1.8	0.0	3.9	21.4	0.0	27.9
Cycle Q Clear(g_c), s	5.6	23.7	23.7	1.6	25.5	29.7	1.8	0.0	3.9	21.4	0.0	27.9
Prop In Lane	1.00		0.06	1.00		1.00	1.00		0.73	1.00		0.92
Lane Grp Cap(c), veh/h	252	832	866	285	1545	988	40	0	132	682	0	405
V/C Ratio(X)	0.65	0.59	0.59	0.16	0.64	0.67	0.64	0.00	0.43	0.91	0.00	0.93
Avail Cap(c_a), veh/h	504	832	866	599	1624	1024	364	0	572	712	0	538
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	19.5	19.6	19.6	16.1	22.6	10.3	54.0	0.0	48.4	42.9	0.0	39.4
Incr Delay (d2), s/veh	1.1	1.4	1.4	0.2	1.0	1.9	12.1	0.0	1.6	15.9	0.0	16.9
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	2.0	9.0	9.4	0.6	9.7	8.7	0.9	0.0	1.6	9.8	0.0	11.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.6	21.1	21.0	16.3	23.5	12.2	66.0	0.0	50.0	58.8	0.0	56.3
LnGrp LOS	C	C	C	B	C	B	E	A	D	E	A	E
Approach Vol, veh/h		1175			1696			82			1000	
Approach Delay, s/veh		21.0			19.0			55.1			57.8	
Approach LOS		C			B			E			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	28.4	14.2	8.3	60.8	7.3	35.3	12.3	56.8
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	25.0	42.0	25.0	55.0	25.0	41.0	25.0	55.0
Max Q Clear Time (g_c+I1), s	23.4	5.9	3.6	25.7	3.8	29.9	7.6	31.7
Green Ext Time (p_c), s	0.5	0.2	0.1	18.7	0.0	0.9	0.3	20.6

Intersection Summary	
HCM 6th Ctrl Delay	30.1
HCM 6th LOS	C

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

HCM Signalized Intersection Capacity Analysis
87: Riverside/OR99 & Garfield Street 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	90	320	75	605	435	280	325	615	65	75	715	495
Future Volume (vph)	90	320	75	605	435	280	325	615	65	75	715	495
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	3206		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	3206		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)	97	344	81	651	468	301	349	661	70	81	769	532
RTOR Reduction (vph)	0	16	0	0	0	84	0	0	42	0	0	116
Lane Group Flow (vph)	97	409	0	651	468	217	349	661	28	81	769	416
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)	10.8	22.0		31.8	43.0	60.9	17.9	37.6	48.4	10.7	30.4	62.2
Effective Green, g (s)	10.8	22.0		31.8	43.0	60.9	17.9	37.6	48.4	10.7	30.4	62.2
Actuated g/C Ratio	0.09	0.18		0.27	0.36	0.51	0.15	0.31	0.40	0.09	0.25	0.52
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)	148	587		854	620	747	481	1052	611	149	850	763
v/s Ratio Prot	0.06	0.13		c0.20	c0.27	0.04	c0.11	0.20	0.00	0.05	c0.23	0.14
v/s Ratio Perm						0.10			0.01			0.14
v/c Ratio	0.66	0.70		0.76	0.75	0.29	0.73	0.63	0.05	0.54	0.90	0.55
Uniform Delay, d1	52.8	45.9		40.6	33.9	17.1	48.7	35.2	21.8	52.3	43.4	19.4
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	9.0	3.3		3.7	5.0	0.1	4.7	1.6	0.0	2.4	13.6	0.5
Delay (s)	61.8	49.2		44.3	38.8	17.2	53.4	36.8	21.8	54.7	57.0	19.9
Level of Service	E	D		D	D	B	D	D	C	D	E	B
Approach Delay (s)		51.5			36.8			41.2			42.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary
87: Riverside/OR99 & Garfield Street 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	90	320	75	605	435	280	325	615	65	75	715	495
Future Volume (veh/h)	90	320	75	605	435	280	325	615	65	75	715	495
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	97	344	81	651	468	301	349	661	0	81	769	532
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	123	423	98	752	549	661	430	1247		103	1008	785
Arrive On Green	0.07	0.16	0.16	0.23	0.31	0.31	0.13	0.37	0.00	0.06	0.30	0.30
Sat Flow, veh/h	1660	2689	625	3247	1743	1477	3247	3365	1513	1687	3365	1477
Grp Volume(v), veh/h	97	212	213	651	468	301	349	661	0	81	769	532
Grp Sat Flow(s),veh/h/ln	1660	1669	1645	1623	1743	1477	1623	1683	1513	1687	1683	1477
Q Serve(g_s), s	5.7	12.2	12.5	19.3	25.1	14.1	10.4	15.4	0.0	4.7	20.7	26.4
Cycle Q Clear(g_c), s	5.7	12.2	12.5	19.3	25.1	14.1	10.4	15.4	0.0	4.7	20.7	26.4
Prop In Lane	1.00		0.38	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	123	263	259	752	549	661	430	1247		103	1008	785
V/C Ratio(X)	0.79	0.81	0.82	0.87	0.85	0.46	0.81	0.53		0.78	0.76	0.68
Avail Cap(c_a), veh/h	356	501	494	1138	1309	1305	780	1247		422	1011	786
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	45.5	40.6	40.7	36.9	32.0	19.2	42.1	24.6	0.0	46.2	31.8	17.2
Incr Delay (d2), s/veh	8.2	4.4	4.9	3.4	2.9	0.4	1.8	0.7	0.0	5.8	4.0	2.9
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	2.6	5.2	5.3	7.8	10.6	4.7	4.1	5.8	0.0	2.1	8.5	8.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.6	45.0	45.6	40.2	34.9	19.5	43.9	25.3	0.0	52.1	35.7	20.1
LnGrp LOS	D	D	D	D	C	B	D	C		D	D	C
Approach Vol, veh/h		522			1420			1010	A		1382	
Approach Delay, s/veh		46.8			34.1			31.7			30.7	
Approach LOS		D			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.2	35.3	27.1	20.2	10.1	42.4	11.4	36.0
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	24.0	* 30	35.0	30.0	25.0	* 30	21.4	75.0
Max Q Clear Time (g_c+I1), s	12.4	28.4	21.3	14.5	6.7	17.4	7.7	27.1
Green Ext Time (p_c), s	0.8	1.6	1.9	1.2	0.1	8.4	0.2	2.9

Intersection Summary	
HCM 6th Ctrl Delay	34.0
HCM 6th LOS	C

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

HCM Signalized Intersection Capacity Analysis
84: Riverside/OR99 & Stewart 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	210	305	225	65	445	70	100	715	205	380	615	90
Future Volume (vph)	210	305	225	65	445	70	100	715	205	380	615	90
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	0.98		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1614	3039		1614	3159		1503	3133		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	3159		1503	3133		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)	239	347	256	74	506	80	114	812	233	432	699	102
RTOR Reduction (vph)	0	93	0	0	10	0	0	19	0	0	0	55
Lane Group Flow (vph)	239	510	0	74	576	0	114	1027	0	432	699	47
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	40.6		8.4	28.0		13.2	37.1		19.9	43.8	57.6
Effective Green, g (s)	20.0	40.6		7.4	28.0		12.2	37.1		18.9	43.8	57.6
Actuated g/C Ratio	0.16	0.33		0.06	0.23		0.10	0.30		0.15	0.35	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)	260	995		96	713		147	938		473	1141	658
v/s Ratio Prot	c0.15	0.17		0.05	c0.18		0.08	c0.33		c0.14	0.22	0.03
v/s Ratio Perm												
v/c Ratio	0.92	0.51		0.77	0.81		0.78	1.09		0.91	0.61	0.07
Uniform Delay, d1	51.2	33.7		57.4	45.4		54.5	43.4		51.7	33.0	18.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	34.6	0.3		28.6	6.5		20.4	58.8		21.6	2.5	0.0
Delay (s)	85.7	34.0		86.0	51.9		74.9	102.2		73.3	35.5	18.4
Level of Service	F	C		F	D		E	F		E	D	B
Approach Delay (s)		48.7			55.7			99.5			47.3	
Approach LOS		D			E			F			D	

Intersection Summary			
HCM 2000 Control Delay	64.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	123.9	Sum of lost time (s)	19.9
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary
84: Riverside/OR99 & Stewart 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	210	305	225	65	445	70	100	715	205	380	615	90
Future Volume (veh/h)	210	305	225	65	445	70	100	715	205	380	615	90
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	239	347	256	74	506	80	114	812	233	432	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	252	602	436	80	640	101	124	767	220	459	1210	
Arrive On Green	0.15	0.33	0.33	0.05	0.23	0.23	0.08	0.31	0.31	0.15	0.37	0.00
Sat Flow, veh/h	1628	1815	1315	1628	2833	446	1528	2495	716	3132	3247	1425
Grp Volume(v), veh/h	239	313	290	74	291	295	114	529	516	432	699	0
Grp Sat Flow(s),veh/h/ln	1628	1640	1490	1628	1637	1642	1528	1627	1584	1566	1624	1425
Q Serve(g_s), s	17.5	19.0	19.5	5.5	20.2	20.4	8.9	37.0	37.0	16.4	20.7	0.0
Cycle Q Clear(g_c), s	17.5	19.0	19.5	5.5	20.2	20.4	8.9	37.0	37.0	16.4	20.7	0.0
Prop In Lane	1.00		0.88	1.00		0.27	1.00		0.45	1.00		1.00
Lane Grp Cap(c), veh/h	252	544	494	80	370	371	124	500	487	459	1210	
V/C Ratio(X)	0.95	0.58	0.59	0.93	0.79	0.79	0.92	1.06	1.06	0.94	0.58	
Avail Cap(c_a), veh/h	270	544	494	284	496	498	241	500	487	494	1210	
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	50.4	33.2	33.4	57.0	43.9	44.0	54.9	41.7	41.7	50.8	30.2	0.0
Incr Delay (d2), s/veh	39.2	1.3	1.6	15.4	5.3	5.6	10.0	56.6	57.3	24.7	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	9.8	7.6	7.1	2.6	8.6	8.7	3.7	22.3	21.8	7.8	8.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	89.6	34.5	35.0	72.5	49.2	49.5	64.9	98.3	99.0	75.5	32.2	0.0
LnGrp LOS	F	C	C	E	D	D	E	F	F	E	C	
Approach Vol, veh/h		842			660			1159			1131	A
Approach Delay, s/veh		50.3			51.9			95.3			48.8	
Approach LOS		D			D			F			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.8	50.3	10.9	44.4	22.7	42.4	23.6	31.7
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	20.0	* 36	22.0	37.0	20.0	* 37	21.0	36.5
Max Q Clear Time (g_c+I1), s	10.9	22.7	7.5	21.5	18.4	39.0	19.5	22.4
Green Ext Time (p_c), s	0.1	8.8	0.1	5.4	0.2	0.0	0.1	4.8

Intersection Summary	
HCM 6th Ctrl Delay	63.9
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 G-35: AM Peak LOS for Barnett Road at Stewart Avenue, PHF = 1

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 06/19/2020

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	295	60	200	455	115	410
Future Volume (vph)	295	60	200	455	115	410
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)	295	60	200	455	115	410
RTOR Reduction (vph)	0	47	0	0	0	147
Lane Group Flow (vph)	295	13	200	455	115	263
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)	14.0	14.0	20.0	20.0	9.2	43.8
Effective Green, g (s)	14.0	14.0	20.0	20.0	8.2	42.8
Actuated g/C Ratio	0.21	0.21	0.30	0.30	0.12	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)	670	302	488	957	200	1660
v/s Ratio Prot	c0.09		0.12	c0.14	c0.07	c0.10
v/s Ratio Perm		0.01				
v/c Ratio	0.44	0.04	0.41	0.48	0.57	0.16
Uniform Delay, d1	23.0	21.1	18.7	19.1	27.7	4.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1	0.2	0.1	2.5	0.0
Delay (s)	23.7	21.1	18.9	19.3	30.1	4.8
Level of Service	C	C	B	B	C	A
Approach Delay (s)	23.3			19.1	10.4	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	66.8	Sum of lost time (s)	19.5
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM Signalized Intersection Capacity Analysis
91: Alba Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	700	0	1	635	15	0	0	0	15	0	20
Future Volume (vph)	5	700	0	1	635	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		4.0	5.0					5.5		4.5
Lane Util. Factor	1.00	0.95		1.00	0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		1.00
Frt	1.00	1.00		1.00	1.00					1.00		0.85
Flt Protected	0.95	1.00		0.95	1.00					0.95		1.00
Satd. Flow (prot)	1645	3197		1628	3152					1626		1454
Flt Permitted	0.38	1.00		0.95	1.00					0.95		1.00
Satd. Flow (perm)	662	3197		1628	3152					1626		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	700	0	1	635	15	0	0	0	15	0	20
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	16
Lane Group Flow (vph)	5	700	0	1	648	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)	21.5	20.6		0.5	20.2					9.4		10.4
Effective Green, g (s)	20.5	20.6		0.5	20.2					8.9		9.9
Actuated g/C Ratio	0.46	0.46		0.01	0.45					0.20		0.22
Clearance Time (s)	4.0	5.0		4.0	5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0		5.0	5.0					0.2		5.0
Lane Grp Cap (vph)	313	1479		18	1430					325		323
v/s Ratio Prot	0.00	c0.22		c0.00	0.21							
v/s Ratio Perm	0.01									c0.01		0.00
v/c Ratio	0.02	0.47		0.06	0.45					0.05		0.01
Uniform Delay, d1	6.5	8.2		21.8	8.4					14.4		13.5
Progression Factor	1.00	1.00		1.00	1.00					1.00		1.00
Incremental Delay, d2	0.0	0.5		2.7	0.5					0.0		0.0
Delay (s)	6.5	8.7		24.5	8.8					14.4		13.5
Level of Service	A	A		C	A					B		B
Approach Delay (s)		8.7			8.9			0.0			13.9	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	14.5
Intersection Capacity Utilization	33.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

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

HCM 6th Signalized Intersection Summary

90: Highland Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	95	495	125	570	415	60	115	430	1080	85	435	120
Future Volume (veh/h)	95	495	125	570	415	60	115	430	1080	85	435	120
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	95	495	125	570	415	60	115	430	1080	85	435	120
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	144	689	427	633	1067	153	130	1205	787	136	930	254
Arrive On Green	0.04	0.21	0.21	0.19	0.35	0.35	0.08	0.37	0.37	0.08	0.37	0.37
Sat Flow, veh/h	3281	3348	1481	3338	3037	436	1576	3299	1418	1644	2545	696
Grp Volume(v), veh/h	95	495	125	570	235	240	115	430	1080	85	279	276
Grp Sat Flow(s),veh/h/ln	1641	1674	1481	1669	1730	1743	1576	1650	1418	1644	1640	1601
Q Serve(g_s), s	3.3	15.8	2.4	19.2	11.7	11.9	8.3	10.9	35.1	5.7	14.9	15.2
Cycle Q Clear(g_c), s	3.3	15.8	2.4	19.2	11.7	11.9	8.3	10.9	35.1	5.7	14.9	15.2
Prop In Lane	1.00		1.00	1.00		0.25	1.00		1.00	1.00		0.43
Lane Grp Cap(c), veh/h	144	689	427	633	608	612	130	1205	787	136	599	585
V/C Ratio(X)	0.66	0.72	0.29	0.90	0.39	0.39	0.88	0.36	1.37	0.63	0.47	0.47
Avail Cap(c_a), veh/h	323	1296	696	886	951	958	130	1205	787	136	599	585
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	54.1	42.5	13.6	45.5	28.0	28.0	52.2	26.6	9.7	51.0	27.9	28.0
Incr Delay (d2), s/veh	1.9	2.2	0.6	7.6	0.6	0.6	44.4	0.8	175.6	6.6	2.6	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	1.4	6.7	1.4	8.5	4.9	5.0	4.9	4.4	46.7	2.6	6.2	6.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.0	44.7	14.1	53.1	28.6	28.7	96.6	27.4	185.3	57.6	30.5	30.7
LnGrp LOS	E	D	B	D	C	C	F	C	F	E	C	C
Approach Vol, veh/h		715			1045			1625			640	
Approach Delay, s/veh		40.9			42.0			137.2			34.2	
Approach LOS		D			D			F			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	46.5	26.3	28.2	14.0	46.5	9.6	44.9
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	7.7	37.1	21.2	17.8	10.3	17.2	5.3	13.9
Green Ext Time (p_c), s	0.0	2.9	0.6	5.8	0.0	2.7	0.0	4.9

Intersection Summary	
HCM 6th Ctrl Delay	79.0
HCM 6th LOS	E

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

HCM 6th Signalized Intersection Summary
94: Ellendale Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	1505	140	25	880	30	115	15	20	45	25	50
Future Volume (veh/h)	15	1505	140	25	880	30	115	15	20	45	25	50
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	1505	140	25	880	30	115	15	20	45	25	50
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	1809	167	34	1820	62	361	164	219	402	109	219
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	3070	283	1572	3256	111	1643	698	931	1725	517	1034
Grp Volume(v), veh/h	15	808	837	25	446	464	115	0	35	45	0	75
Grp Sat Flow(s),veh/h/ln	1677	1660	1693	1572	1651	1716	1643	0	1629	1725	0	1550
Q Serve(g_s), s	1.2	56.1	57.8	2.3	23.5	23.5	7.5	0.0	2.4	2.9	0.0	5.8
Cycle Q Clear(g_c), s	1.2	56.1	57.8	2.3	23.5	23.5	7.5	0.0	2.4	2.9	0.0	5.8
Prop In Lane	1.00		0.17	1.00		0.06	1.00		0.57	1.00		0.67
Lane Grp Cap(c), veh/h	87	978	998	34	923	959	361	0	383	402	0	328
V/C Ratio(X)	0.17	0.83	0.84	0.72	0.48	0.48	0.32	0.00	0.09	0.11	0.00	0.23
Avail Cap(c_a), veh/h	87	978	998	82	923	959	361	0	383	441	0	328
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	23.7	24.0	70.0	19.2	19.2	41.7	0.0	43.1	42.6	0.0	47.0
Incr Delay (d2), s/veh	0.1	0.8	0.8	24.7	1.8	1.7	0.5	0.0	0.5	0.1	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	21.2	22.3	1.2	9.3	9.7	3.3	0.0	1.0	1.3	0.0	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	65.4	24.5	24.9	94.7	21.0	20.9	42.2	0.0	43.5	42.7	0.0	48.6
LnGrp LOS	E	C	C	F	C	C	D	A	D	D	A	D
Approach Vol, veh/h		1660			935			150			120	
Approach Delay, s/veh		25.0			22.9			42.5			46.4	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.7	38.3	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	4.9	4.4	4.3	59.8	9.5	7.8	3.2	25.5
Green Ext Time (p_c), s	0.0	0.1	0.0	12.3	0.0	0.4	0.0	6.8

Intersection Summary	
HCM 6th Ctrl Delay	26.2
HCM 6th LOS	C

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

HCM 6th Signalized Intersection Summary
84: Riverside/OR99 & Stewart 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	130	500	225	10	170	35	55	285	110	315	575	15
Future Volume (veh/h)	130	500	225	10	170	35	55	285	110	315	575	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	130	500	225	10	170	35	55	285	110	315	575	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	145	644	288	3	554	112	41	816	308	357	1444	
Arrive On Green	0.09	0.30	0.30	0.00	0.21	0.21	0.03	0.38	0.38	0.12	0.47	0.00
Sat Flow, veh/h	1589	2181	976	1641	2693	542	1387	2146	809	3018	3079	1418
Grp Volume(v), veh/h	130	372	353	10	101	104	55	199	196	315	575	0
Grp Sat Flow(s),veh/h/ln	1589	1624	1533	1641	1624	1611	1387	1511	1445	1509	1539	1418
Q Serve(g_s), s	7.9	20.4	20.5	0.2	5.1	5.3	2.9	9.1	9.5	10.0	11.9	0.0
Cycle Q Clear(g_c), s	7.9	20.4	20.5	0.2	5.1	5.3	2.9	9.1	9.5	10.0	11.9	0.0
Prop In Lane	1.00		0.64	1.00		0.34	1.00		0.56	1.00		1.00
Lane Grp Cap(c), veh/h	145	479	453	3	334	332	41	574	549	357	1444	
V/C Ratio(X)	0.90	0.78	0.78	3.22	0.30	0.31	1.35	0.35	0.36	0.88	0.40	
Avail Cap(c_a), veh/h	326	617	583	354	534	530	271	574	549	589	1444	
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	43.8	31.3	31.4	48.6	32.7	32.8	47.2	21.5	21.6	42.2	16.9	0.0
Incr Delay (d2), s/veh	13.4	4.1	4.6	1060.5	0.4	0.4	168.1	1.6	1.8	5.0	0.8	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	3.6	8.2	7.9	1.0	2.0	2.1	2.9	3.4	3.4	3.8	4.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	57.2	35.5	36.0	1109.1	33.1	33.2	215.3	23.2	23.4	47.2	17.7	0.0
LnGrp LOS	E	D	D	F	C	C	F	C	C	D	B	
Approach Vol, veh/h		855			215			450			890	A
Approach Delay, s/veh		39.0			83.2			46.8			28.2	
Approach LOS		D			F			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.9	51.0	5.2	33.2	16.5	42.4	13.9	24.5
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	4.9	13.9	2.2	22.5	12.0	11.5	9.9	7.3
Green Ext Time (p_c), s	0.1	10.9	0.0	6.2	0.5	6.8	0.3	1.9

Intersection Summary	
HCM 6th Ctrl Delay	40.4
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.

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

HCM Signalized Intersection Capacity Analysis
83: Stewart Avenue & Barnett Road 06/17/2020

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	565	210	365	695	205	325
Future Volume (vph)	565	210	365	695	205	325
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)	565	210	365	695	205	325
RTOR Reduction (vph)	0	154	0	0	0	128
Lane Group Flow (vph)	565	56	365	695	205	197
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)	20.9	20.9	22.4	22.4	14.4	48.7
Effective Green, g (s)	20.9	20.9	22.4	22.4	13.4	47.7
Actuated g/C Ratio	0.27	0.27	0.28	0.28	0.17	0.61
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)	875	391	469	919	280	1573
v/s Ratio Prot	c0.17		c0.22	0.22	c0.12	c0.08
v/s Ratio Perm		0.04				
v/c Ratio	0.65	0.14	0.78	0.76	0.73	0.13
Uniform Delay, d1	25.6	22.0	25.8	25.6	30.9	6.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.3	7.3	3.2	8.2	0.0
Delay (s)	27.5	22.3	33.1	28.8	39.1	6.6
Level of Service	C	C	C	C	D	A
Approach Delay (s)	26.1			30.3	19.2	
Approach LOS	C			C	B	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	78.6	Sum of lost time (s)	19.5
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM Signalized Intersection Capacity Analysis

91: Alba Drive & Barnett Road 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	875	0	1	1035	40	0	0	0	35	0	25
Future Volume (vph)	15	875	0	1	1035	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		4.0	5.0					5.5		4.5
Lane Util. Factor	1.00	0.95		1.00	0.95					1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00					1.00		1.00
Frt	1.00	1.00		1.00	0.99					1.00		0.85
Flt Protected	0.95	1.00		0.95	1.00					0.95		1.00
Satd. Flow (prot)	1553	3292		1628	3268					1624		1454
Flt Permitted	0.22	1.00		0.95	1.00					0.95		1.00
Satd. Flow (perm)	353	3292		1628	3268					1624		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	875	0	1	1035	40	0	0	0	35	0	25
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	21
Lane Group Flow (vph)	15	875	0	1	1073	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)	35.8	34.9		0.6	34.6					9.4		10.4
Effective Green, g (s)	34.8	34.9		0.6	34.6					8.9		9.9
Actuated g/C Ratio	0.59	0.59		0.01	0.59					0.15		0.17
Clearance Time (s)	4.0	5.0		4.0	5.0					5.0		4.0
Vehicle Extension (s)	5.0	5.0		5.0	5.0					0.2		5.0
Lane Grp Cap (vph)	216	1950		16	1919					245		244
v/s Ratio Prot	0.00	0.27		c0.00	c0.33							
v/s Ratio Perm	0.04									c0.02		0.00
v/c Ratio	0.07	0.45		0.06	0.56					0.14		0.02
Uniform Delay, d1	5.3	6.7		28.9	7.5					21.7		20.4
Progression Factor	1.00	1.00		1.00	1.00					1.00		1.00
Incremental Delay, d2	0.3	0.3		3.4	0.6					0.1		0.1
Delay (s)	5.6	7.0		32.3	8.1					21.8		20.5
Level of Service	A	A		C	A					C		C
Approach Delay (s)		7.0			8.1			0.0			21.3	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	8.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	58.9	Sum of lost time (s)	14.5
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

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

HCM Signalized Intersection Capacity Analysis
90: Highland Drive & Barnett Road 06/17/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	175	440	295	830	705	80	200	495	585	55	615	170
Future Volume (vph)	175	440	295	830	705	80	200	495	585	55	615	170
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	0.97	
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)	3102	3245	1452	2143	3140		1561	3245	1452	1553	3094	
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	3140		1561	3245	1452	1553	3094	
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)	175	440	295	830	705	80	200	495	585	55	615	170
RTOR Reduction (vph)	0	0	43	0	3	0	0	0	125	0	13	0
Lane Group Flow (vph)	175	440	252	830	782	0	200	495	460	55	772	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)	13.1	28.0	52.5	55.6	70.5		24.5	40.5	96.1	19.6	35.6	
Effective Green, g (s)	13.1	28.0	52.5	55.6	70.5		24.5	40.5	96.1	19.6	35.6	
Actuated g/C Ratio	0.08	0.17	0.32	0.34	0.44		0.15	0.25	0.59	0.12	0.22	
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)	251	561	511	736	1369		236	812	903	188	681	
v/s Ratio Prot	0.06	c0.14	0.07	c0.39	0.25		c0.13	0.15	0.18	0.04	c0.25	
v/s Ratio Perm			0.10						0.14			
v/c Ratio	0.70	0.78	0.49	1.13	0.57		0.85	0.61	0.51	0.29	1.13	
Uniform Delay, d1	72.4	64.0	43.9	53.0	34.2		66.8	53.6	19.1	64.7	63.0	
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	6.6	7.7	0.3	74.2	0.7		22.7	3.4	0.2	0.3	77.4	
Delay (s)	79.0	71.6	44.2	127.2	35.0		89.5	57.0	19.3	65.0	140.4	
Level of Service	E	E	D	F	C		F	E	B	E	F	
Approach Delay (s)		64.1			82.4			44.8			135.5	
Approach LOS		E			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	78.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	161.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

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

HCM 6th Signalized Intersection Summary
94: Ellendale Drive & Barnett Road 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	955	95	20	1395	15	185	30	35	35	15	35
Future Volume (veh/h)	30	955	95	20	1395	15	185	30	35	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	955	95	20	1395	15	185	30	35	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	1587	158	86	1753	19	444	198	231	375	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	3027	301	1654	3343	36	1654	726	847	1654	458	1068
Grp Volume(v), veh/h	30	520	530	20	688	722	185	0	65	35	0	50
Grp Sat Flow(s),veh/h/ln	930	1650	1679	1654	1650	1729	1654	0	1573	1654	0	1526
Q Serve(g_s), s	4.5	31.6	31.6	1.7	49.0	49.1	12.5	0.0	4.5	2.4	0.0	3.8
Cycle Q Clear(g_c), s	4.5	31.6	31.6	1.7	49.0	49.1	12.5	0.0	4.5	2.4	0.0	3.8
Prop In Lane	1.00		0.18	1.00		0.02	1.00		0.54	1.00		0.70
Lane Grp Cap(c), veh/h	48	865	880	86	865	907	444	0	429	375	0	323
V/C Ratio(X)	0.62	0.60	0.60	0.23	0.80	0.80	0.42	0.00	0.15	0.09	0.00	0.15
Avail Cap(c_a), veh/h	48	865	880	86	865	907	444	0	429	418	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)	0.72	0.72	0.72	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	23.8	23.8	65.5	28.0	28.0	38.5	0.0	39.8	42.7	0.0	46.2
Incr Delay (d2), s/veh	16.0	2.2	2.2	1.4	7.5	7.2	0.6	0.0	0.7	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	1.3	12.6	12.9	0.7	20.6	21.5	5.2	0.0	1.9	1.0	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.9	26.0	26.0	66.8	35.4	35.2	39.1	0.0	40.5	42.8	0.0	47.3
LnGrp LOS	F	C	C	E	D	D	D	A	D	D	A	D
Approach Vol, veh/h		1080			1430			250			85	
Approach Delay, s/veh		27.6			35.7			39.5			45.4	
Approach LOS		C			D			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	6.5	3.7	33.6	14.5	5.8	6.5	51.1
Green Ext Time (p_c), s	0.0	0.3	0.0	8.3	0.0	0.2	0.0	10.9

Intersection Summary	
HCM 6th Ctrl Delay	33.3
HCM 6th LOS	C

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

HCM 6th Signalized Intersection Summary

84: Riverside/OR99 & Stewart 06/19/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (veh/h)	210	305	225	65	445	70	100	715	205	380	615	90
Future Volume (veh/h)	210	305	225	65	445	70	100	715	205	380	615	90
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	210	305	225	65	445	70	100	715	205	380	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	227	560	403	68	595	93	109	840	241	417	1294	
Arrive On Green	0.14	0.31	0.31	0.04	0.21	0.21	0.07	0.34	0.34	0.13	0.40	0.00
Sat Flow, veh/h	1628	1821	1309	1628	2836	443	1528	2496	715	3132	3247	1425
Grp Volume(v), veh/h	210	274	256	65	256	259	100	466	454	380	615	0
Grp Sat Flow(s),veh/h/ln	1628	1640	1491	1628	1637	1643	1528	1627	1584	1566	1624	1425
Q Serve(g_s), s	14.0	15.3	15.8	4.4	16.1	16.3	7.1	29.3	29.3	13.2	15.4	0.0
Cycle Q Clear(g_c), s	14.0	15.3	15.8	4.4	16.1	16.3	7.1	29.3	29.3	13.2	15.4	0.0
Prop In Lane	1.00		0.88	1.00		0.27	1.00		0.45	1.00		1.00
Lane Grp Cap(c), veh/h	227	505	459	68	344	345	109	548	533	417	1294	
V/C Ratio(X)	0.93	0.54	0.56	0.96	0.74	0.75	0.92	0.85	0.85	0.91	0.48	
Avail Cap(c_a), veh/h	296	552	502	311	543	546	264	548	533	541	1294	
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	46.7	31.6	31.8	52.6	40.7	40.7	50.7	33.9	33.9	47.0	24.5	0.0
Incr Delay (d2), s/veh	27.7	0.7	0.9	22.6	2.4	2.5	11.4	15.3	15.6	14.7	1.3	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	7.3	6.0	5.7	2.2	6.6	6.7	3.0	13.5	13.2	5.8	5.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.5	32.3	32.7	75.1	43.0	43.2	62.1	49.2	49.5	61.7	25.8	0.0
LnGrp LOS	E	C	C	E	D	D	E	D	D	E	C	
Approach Vol, veh/h		740			580			1020			995	A
Approach Delay, s/veh		44.4			46.7			50.6			39.5	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.8	49.2	9.6	38.3	19.6	42.4	20.3	27.6
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	9.1	17.4	6.4	17.8	15.2	31.3	16.0	18.3
Green Ext Time (p_c), s	0.1	10.3	0.1	5.2	0.5	4.6	0.3	4.8

Intersection Summary	
HCM 6th Ctrl Delay	45.2
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.

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Signal Timing and Phasing

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

Timings
83: Stewart Avenue & Barnett Road 06/19/2020

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø1	Ø2	Ø6
Lane Configurations									
Traffic Volume (vph)	295	60	200	455	115	410			
Future Volume (vph)	295	60	200	455	115	410			
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)	14.5	14.5	21.9	21.9	9.3	41.2			
Actuated g/C Ratio	0.22	0.22	0.33	0.33	0.14	0.62			
v/c Ratio	0.45	0.18	0.40	0.47	0.54	0.25			
Control Delay	26.1	8.8	25.7	23.9	39.6	1.0			
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0			
Total Delay	26.1	8.8	25.7	23.9	39.6	1.0			
LOS	C	A	C	C	D	A			
Approach Delay	23.2			24.5	9.5				
Approach LOS	C			C	A				

Intersection Summary	
Cycle Length: 133	
Actuated Cycle Length: 66.5	
Natural Cycle: 125	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.54	
Intersection Signal Delay: 19.0	Intersection LOS: B
Intersection Capacity Utilization 39.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 83: Stewart Avenue & Barnett Road

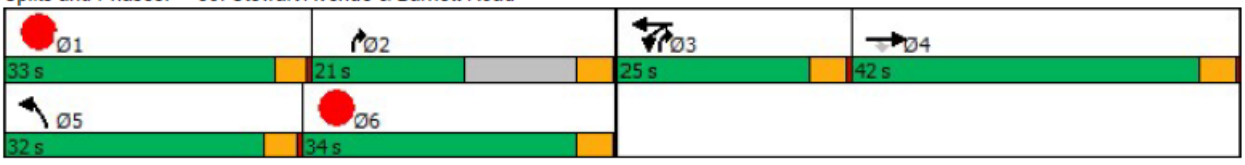


Figure G-46: AM and PM Peak Barnett Road at Stewart Avenue Signal Phasing

Phasings

83: Stewart Avenue & Barnett Road 06/19/2020

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)	28.0	28.0	20.5	20.5	16.0		0.0	49.0	29.0
90th %ile Term Code	Ped	Ped	Max	Max	Gap		Skip	Hold	Ped
70th %ile Green (s)	14.0	14.0	20.5	20.5	10.5		0.0	10.0	0.0
70th %ile Term Code	Gap	Gap	Max	Max	Hold		Skip	Min	Skip
50th %ile Green (s)	11.8	11.8	20.5	20.5	10.5		0.0	10.0	0.0
50th %ile Term Code	Gap	Gap	Max	Max	Hold		Skip	Min	Skip
30th %ile Green (s)	10.8	10.8	20.5	20.5	10.5		0.0	10.0	0.0
30th %ile Term Code	Gap	Gap	Max	Max	Hold		Skip	Min	Skip
10th %ile Green (s)	10.0	10.0	19.3	19.3	0.0		0.0	10.0	10.0
10th %ile Term Code	Min	Min	Gap	Gap	Skip		Skip	Min	Hold

Intersection Summary
Cycle Length: 133
Actuated Cycle Length: 66.5
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 111
70th %ile Actuated Cycle: 58
50th %ile Actuated Cycle: 55.8
30th %ile Actuated Cycle: 54.8
10th %ile Actuated Cycle: 52.8

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

Timings
91: Alba Drive & Barnett Road 06/19/2020

Lane Group	EBL	EBT	WBL	WBT	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	5	700	1	635	15	20
Future Volume (vph)	5	700	1	635	15	20
Turn Type	pm+pt	NA	Prot	NA	Perm	Perm
Protected Phases	7	4	3	8		
Permitted Phases	4				2	6
Detector Phase	7	4	3	8	2	6
Switch Phase						
Minimum Initial (s)	5.0	10.0	5.0	10.0	1.0	5.0
Minimum Split (s)	9.0	25.0	9.0	25.0	31.0	29.0
Total Split (s)	12.0	80.0	9.0	68.0	40.0	29.0
Total Split (%)	9.3%	62.0%	7.0%	52.7%	31.0%	22.5%
Yellow Time (s)	3.5	4.0	3.5	4.0	4.0	3.5
All-Red Time (s)	0.5	1.0	0.5	1.0	1.0	0.5
Lost Time Adjust (s)	0.5	0.0	0.0	0.0	0.5	0.5
Total Lost Time (s)	4.5	5.0	4.0	5.0	5.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	Min	None
Act Effct Green (s)	24.8	23.4	5.6	23.1	8.8	9.9
Actuated g/C Ratio	0.55	0.52	0.12	0.51	0.20	0.22
v/c Ratio	0.01	0.49	0.00	0.46	0.05	0.06
Control Delay	5.6	9.4	27.0	9.8	17.3	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.6	9.4	27.0	9.8	17.3	2.1
LOS	A	A	C	A	B	A
Approach Delay		9.4		9.8		
Approach LOS		A		A		

Intersection Summary	
Cycle Length: 129	
Actuated Cycle Length: 44.9	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.49	
Intersection Signal Delay: 9.6	Intersection LOS: A
Intersection Capacity Utilization 33.1%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 91: Alba Drive & Barnett Road

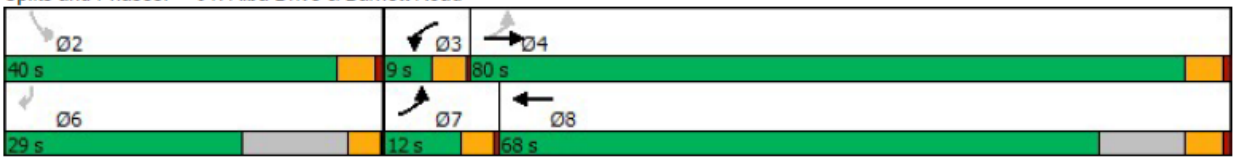
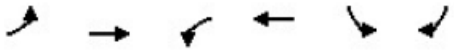


Figure G-48: AM and PM Peak Barnett Road at Alba Drive Signal Phasing

Phasings

91: Alba Drive & Barnett Road 06/19/2020



Lane Group	EBL	EBT	WBL	WBT	SBL	SBR
Protected Phases	7	4	3	8		
Permitted Phases	4				2	6
Minimum Initial (s)	5.0	10.0	5.0	10.0	1.0	5.0
Minimum Split (s)	9.0	25.0	9.0	25.0	31.0	29.0
Total Split (s)	12.0	80.0	9.0	68.0	40.0	29.0
Total Split (%)	9.3%	62.0%	7.0%	52.7%	31.0%	22.5%
Maximum Green (s)	8.0	75.0	5.0	63.0	35.0	25.0
Yellow Time (s)	3.5	4.0	3.5	4.0	4.0	3.5
All-Red Time (s)	0.5	1.0	0.5	1.0	1.0	0.5
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Vehicle Extension (s)	5.0	5.0	5.0	5.0	0.2	5.0
Minimum Gap (s)	1.5	2.0	1.5	2.0	0.2	1.0
Time Before Reduce (s)	5.0	0.0	5.0	5.0	0.0	5.0
Time To Reduce (s)	0.0	40.0	0.0	40.0	0.0	0.0
Recall Mode	None	None	None	None	Min	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)	7.9	36.2	5.0	33.3	25.0	26.0
90th %ile Term Code	Gap	Hold	Max	Gap	Ped	Hold
70th %ile Green (s)	0.0	23.2	0.0	23.2	6.5	7.5
70th %ile Term Code	Skip	Hold	Skip	Gap	Hold	Gap
50th %ile Green (s)	0.0	20.4	0.0	20.4	6.5	7.5
50th %ile Term Code	Skip	Hold	Skip	Gap	Hold	Hold
30th %ile Green (s)	0.0	18.6	0.0	18.6	6.5	7.5
30th %ile Term Code	Skip	Hold	Skip	Gap	Hold	Hold
10th %ile Green (s)	0.0	16.0	0.0	16.0	6.5	7.5
10th %ile Term Code	Skip	Gap	Skip	Hold	Hold	Hold

Intersection Summary
Cycle Length: 129
Actuated Cycle Length: 44.9
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 80.2
70th %ile Actuated Cycle: 39.7
50th %ile Actuated Cycle: 36.9
30th %ile Actuated Cycle: 35.1
10th %ile Actuated Cycle: 32.5

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

Timings

90: Highland Drive & Barnett Road 06/19/2020

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	95	495	125	570	415	115	430	1080	85	435
Future Volume (vph)	95	495	125	570	415	115	430	1080	85	435
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)	8.0	33.0	42.5	30.6	55.6	9.5	42.1	72.6	9.5	42.1
Actuated g/C Ratio	0.06	0.25	0.32	0.23	0.42	0.07	0.32	0.55	0.07	0.32
v/c Ratio	0.52	0.81	0.25	0.79	0.37	1.30	0.56	1.68	1.03	0.65
Control Delay	71.0	55.4	8.3	57.6	26.8	234.0	41.2	333.3	151.7	42.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.0	55.4	8.3	57.6	26.8	234.0	41.2	333.3	151.7	42.0
LOS	E	E	A	E	C	F	D	F	F	D
Approach Delay		50.2			43.2		244.6			58.9
Approach LOS		D			D		F			E

Intersection Summary	
Cycle Length: 144.5	
Actuated Cycle Length: 133.2	
Natural Cycle: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.68	
Intersection Signal Delay: 132.7	Intersection LOS: F
Intersection Capacity Utilization 105.7%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 90: Highland Drive & Barnett Road

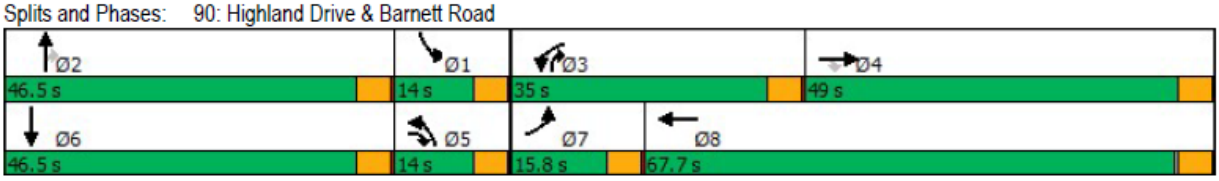


Figure G-50: AM Peak Barnett Road at Highland Drive Signal Phasing

Phasings

90: Highland Drive & Barnett Road 06/19/2020

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)	11.0	41.9	9.5	30.5	61.4	9.5	42.0	30.5	9.5	42.0
90th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Max	MaxR
70th %ile Green (s)	9.2	36.7	9.5	30.5	58.0	9.5	42.0	30.5	9.5	42.0
70th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Max	MaxR
50th %ile Green (s)	8.0	33.4	9.5	30.5	55.9	9.5	42.0	30.5	9.5	42.0
50th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Max	MaxR
30th %ile Green (s)	6.9	29.2	9.5	30.5	52.8	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)	5.3	24.9	9.5	30.5	50.1	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: 133.2
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 141.9
70th %ile Actuated Cycle: 136.7
50th %ile Actuated Cycle: 133.4
30th %ile Actuated Cycle: 129.2
10th %ile Actuated Cycle: 124.9

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

Timings

90: Highland Drive & Barnett Road 06/17/2020

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	175	440	295	830	705	200	495	585	55	615
Future Volume (vph)	175	440	295	830	705	200	495	585	55	615
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)	14.3	36.1	66.1	55.6	77.3	25.5	41.8	101.9	21.3	35.5
Actuated g/C Ratio	0.08	0.21	0.39	0.33	0.45	0.15	0.24	0.60	0.12	0.21
v/c Ratio	0.72	0.83	0.53	1.49	0.59	0.97	0.70	0.64	0.32	1.27
Control Delay	92.3	75.7	35.1	267.1	36.7	121.2	66.7	17.5	71.8	184.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	92.3	75.7	35.1	267.1	36.7	121.2	66.7	17.5	71.8	184.0
LOS	F	E	D	F	D	F	E	B	E	F
Approach Delay		66.5			164.4		53.8			176.2
Approach LOS		E			F		D			F

Intersection Summary	
Cycle Length: 180	
Actuated Cycle Length: 170.7	
Natural Cycle: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.49	
Intersection Signal Delay: 116.8	Intersection LOS: F
Intersection Capacity Utilization 92.1%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 90: Highland Drive & Barnett Road

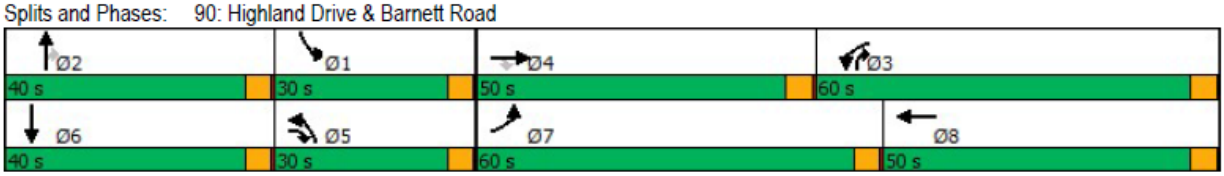


Figure G-52: PM Peak Barnett Road at Highland Drive Signal Phasing

Phasings

90: Highland Drive & Barnett Road 06/17/2020

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)	19.5	45.5	25.5	55.5	81.5	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)	16.3	39.5	25.5	55.5	78.7	25.5	35.5	55.5	25.5	35.5
70th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Hold	Max
50th %ile Green (s)	14.2	35.9	25.5	55.5	77.2	25.5	35.5	55.5	25.5	35.5
50th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Hold	Max
30th %ile Green (s)	12.3	32.5	25.5	55.5	75.7	25.5	35.5	55.5	25.5	35.5
30th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	MaxR	Max	Hold	Max
10th %ile Green (s)	9.6	27.8	25.5	55.5	73.7	25.5	65.5	55.5	0.0	35.5
10th %ile Term Code	Gap	Gap	Max	Max	Hold	Max	Hold	Max	Skip	Max

Intersection Summary
Cycle Length: 180
Actuated Cycle Length: 170.7
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 180
70th %ile Actuated Cycle: 174
50th %ile Actuated Cycle: 170.4
30th %ile Actuated Cycle: 167
10th %ile Actuated Cycle: 162.3

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

Timings

94: Ellendale Drive & Barnett Road 06/19/2020

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	15	1505	25	880	115	15	45	25
Future Volume (vph)	15	1505	25	880	115	15	45	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	37.6	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	0.95	0.38	0.51	0.40	0.11	0.14	0.22
Control Delay	72.7	40.2	80.8	17.7	44.3	26.0	38.1	20.4
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.7	40.3	80.8	17.7	44.3	26.0	38.1	20.4
LOS	E	D	F	B	D	C	D	C
Approach Delay		40.6		19.4		40.0		27.0
Approach LOS		D		B		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: 0.95	
Intersection Signal Delay: 33.1	Intersection LOS: C
Intersection Capacity Utilization 81.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 94: Ellendale Drive & Barnett Road

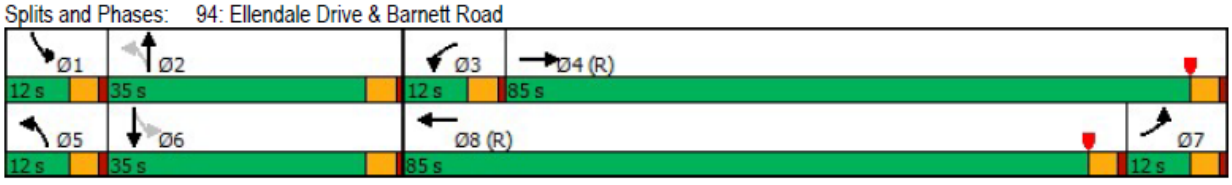


Figure G-54: AM Peak Barnett Road at Ellendale Drive Signal Phasing

Phasings

94: Ellendale Drive & Barnett Road 06/19/2020

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	30.7	7.3	30.5
30th %ile Term Code	Skip	Coord	Skip	Coord	Max	MaxR	Gap	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 G-55: PM Peak Barnett Road at Ellendale Drive Signal Timing

Timings

94: Ellendale Drive & Barnett Road 06/17/2020

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	30	955	20	1395	185	30	35	15
Future Volume (vph)	30	955	20	1395	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	77.9	6.8	75.5	49.9	40.5	40.1	33.2
Actuated g/C Ratio	0.05	0.54	0.05	0.52	0.35	0.28	0.28	0.23
v/c Ratio	0.67	0.62	0.27	0.84	0.45	0.14	0.10	0.13
Control Delay	123.3	24.8	74.7	35.0	39.9	23.0	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	24.8	74.7	35.0	39.9	23.0	34.3	20.7
LOS	F	C	E	D	D	C	C	C
Approach Delay		27.5		35.6		35.5		26.3
Approach LOS		C		D		D		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: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.84	
Intersection Signal Delay: 32.2	Intersection LOS: C
Intersection Capacity Utilization 79.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 94: Ellendale Drive & Barnett Road

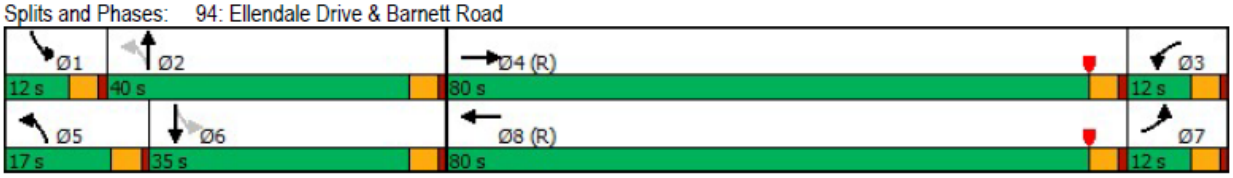


Figure G-56: PM Peak Barnett Road at Ellendale Drive Signal Phasing

Phasings

94: Ellendale Drive & Barnett Road 06/17/2020

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	Hold	Coord	Max	MaxR	Max	MaxR
30th %ile Green (s)	7.5	87.5	0.0	75.5	12.5	36.4	6.6	30.5
30th %ile Term Code	Max	Coord	Skip	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 G-57: AM Peak Garfield Street at I-5 Exit 27 Interchange Signal Timing

Timings

826: Garfield Street & SB off ramp/NB off ramp 06/19/2020

Lane Group	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	760	625	315	325	450	540	315	250	440	440
Future Volume (vph)	760	625	315	325	450	540	315	250	440	440
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)	60.6	136.8	60.6	136.8	26.4	33.7	136.8	17.5	24.8	60.6
Actuated g/C Ratio	0.44	1.00	0.44	1.00	0.19	0.25	1.00	0.13	0.18	0.44
v/c Ratio	0.93	0.52	0.25	0.25	0.84	0.74	0.25	0.69	0.83	0.53
Control Delay	54.7	1.5	24.9	0.4	68.9	55.3	0.4	68.9	68.3	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.7	1.5	24.9	0.4	68.9	55.3	0.4	68.9	68.3	4.3
LOS	D	A	C	A	E	E	A	E	E	A
Approach Delay						46.8			43.5	
Approach LOS						D			D	

Intersection Summary	
Cycle Length: 154.3	
Actuated Cycle Length: 136.8	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 36.0	Intersection LOS: D
Intersection Capacity Utilization 72.4%	ICU Level of Service C
Analysis Period (min) 15	

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

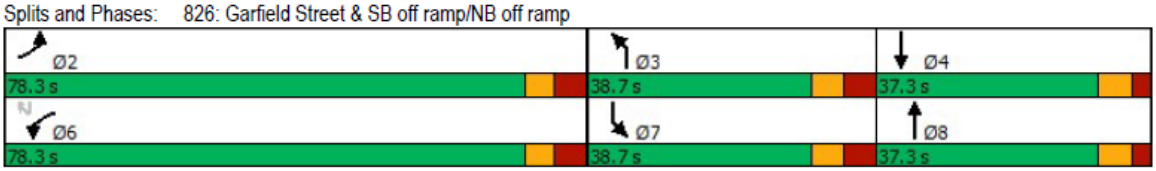


Figure G-58: AM Peak Garfield Street at I-5 Exit 27 Interchange Signal Phasing

Phasings

826: Garfield Street & SB off ramp/NB off ramp 06/19/2020

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	36.4		23.6	30.0	70.0
90th %ile Term Code	Max		Hold		Max	Hold		Gap	Max	Hold
70th %ile Green (s)	70.0		70.0		30.0	39.4		20.6	30.0	70.0
70th %ile Term Code	Max		Hold		Max	Hold		Gap	Max	Hold
50th %ile Green (s)	67.8		67.8		29.6	38.2		18.2	26.8	67.8
50th %ile Term Code	Gap		Hold		Gap	Hold		Gap	Gap	Hold
30th %ile Green (s)	55.6		55.6		24.4	31.4		15.0	22.0	55.6
30th %ile Term Code	Gap		Hold		Gap	Hold		Gap	Gap	Hold
10th %ile Green (s)	41.5		41.5		18.4	23.6		11.2	16.4	41.5
10th %ile Term Code	Gap		Hold		Gap	Hold		Gap	Gap	Hold

Intersection Summary
Cycle Length: 154.3
Actuated Cycle Length: 136.8
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 154.3
70th %ile Actuated Cycle: 154.3
50th %ile Actuated Cycle: 148.5
30th %ile Actuated Cycle: 126.3
10th %ile Actuated Cycle: 100.6

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

Timings
826: Garfield Street & SB off ramp/NB off ramp 06/17/2020

Lane Group	EBL	EBR2	WBL	WBR2	NBL	NBT	NBR2	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	395	685	370	385	630	500	465	350	590	800
Future Volume (vph)	395	685	370	385	630	500	465	350	590	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)	28.7	125.5	28.7	125.5	30.5	52.5	52.5	19.4	41.3	41.3
Actuated g/C Ratio	0.23	1.00	0.23	1.00	0.24	0.42	0.42	0.15	0.33	0.33
v/c Ratio	0.82	0.49	0.53	0.27	0.86	0.37	0.56	0.73	0.57	0.92
Control Delay	60.9	1.2	46.3	0.5	59.2	27.4	5.2	61.6	38.3	27.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.9	1.2	46.3	0.5	59.2	27.4	5.2	61.6	38.3	27.2
LOS	E	A	D	A	E	C	A	E	D	C
Approach Delay						33.5			37.9	
Approach LOS						C			D	

Intersection Summary	
Cycle Length: 149.3	
Actuated Cycle Length: 125.5	
Natural Cycle: 85	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 31.2	Intersection LOS: C
Intersection Capacity Utilization 85.5%	ICU Level of Service E
Analysis Period (min) 15	

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

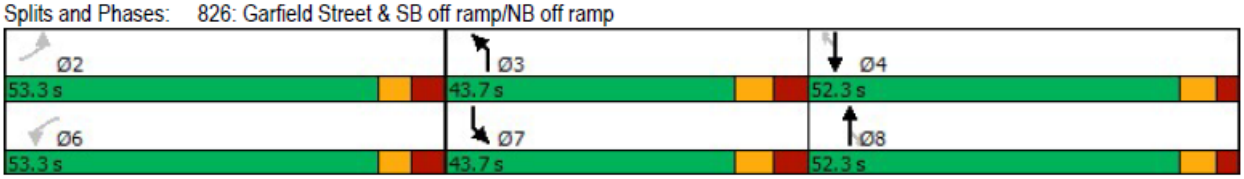


Figure G-60: PM Peak Garfield Street at I-5 Exit 27 Interchange Signal Phasing

Phasings

826: Garfield Street & SB off ramp/NB off ramp 06/17/2020

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)	39.5		39.5		35.0	53.7	53.7	26.3	45.0	45.0
90th %ile Term Code	Gap		Hold		Max	Hold	Hold	Gap	Max	Max
70th %ile Green (s)	33.4		33.4		35.0	57.7	57.7	22.3	45.0	45.0
70th %ile Term Code	Gap		Hold		Max	Hold	Hold	Gap	Max	Max
50th %ile Green (s)	29.4		29.4		33.2	58.4	58.4	19.8	45.0	45.0
50th %ile Term Code	Gap		Hold		Gap	Hold	Hold	Gap	Max	Max
30th %ile Green (s)	25.4		25.4		28.9	56.7	56.7	17.2	45.0	45.0
30th %ile Term Code	Gap		Hold		Gap	Hold	Hold	Gap	Max	Max
10th %ile Green (s)	17.7		17.7		21.1	35.8	35.8	12.5	27.2	27.2
10th %ile Term Code	Gap		Hold		Gap	Hold	Hold	Gap	Gap	Gap

Intersection Summary
Cycle Length: 149.3
Actuated Cycle Length: 125.5
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 143.8
70th %ile Actuated Cycle: 137.7
50th %ile Actuated Cycle: 131.9
30th %ile Actuated Cycle: 123.6
10th %ile Actuated Cycle: 90.3

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

Timings

827: Center Drive & Garfield Street 06/19/2020

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	75	1070	1	905	475	5	1	230	10
Future Volume (vph)	75	1070	1	905	475	5	1	230	10
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)	13.0	28.5	13.0	43.5	9.5	9.5	46.5	9.5	45.5
Total Split (s)	19.5	44.5	29.5	44.5	29.5	29.5	46.5	29.5	45.5
Total Split (%)	13.0%	29.7%	19.7%	29.7%	19.7%	19.7%	31.0%	19.7%	30.3%
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)	52.5	51.3	47.0	42.9	60.7	5.7	10.0	11.6	17.8
Actuated g/C Ratio	0.64	0.63	0.58	0.53	0.74	0.07	0.12	0.14	0.22
v/c Ratio	0.33	0.65	0.00	0.66	0.50	0.05	0.04	0.65	0.23
Control Delay	14.6	17.6	16.0	22.6	5.3	49.6	21.5	43.8	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.6	17.6	16.0	22.6	5.3	49.6	21.5	43.8	9.1
LOS	B	B	B	C	A	D	C	D	A
Approach Delay		17.4		16.7			34.5		35.8
Approach LOS		B		B			C		D

Intersection Summary	
Cycle Length: 150	
Actuated Cycle Length: 81.5	
Natural Cycle: 115	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 19.1	Intersection LOS: B
Intersection Capacity Utilization 61.5%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 827: Center Drive & Garfield Street

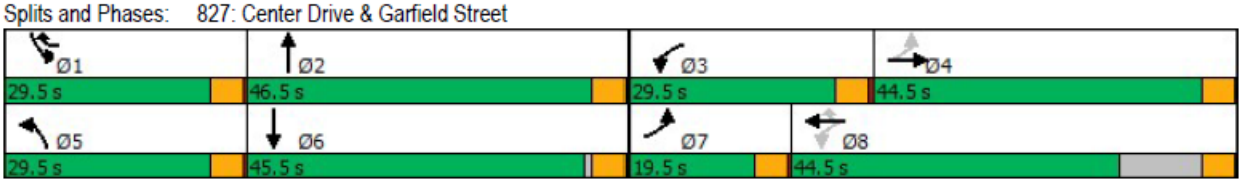


Figure G-62: AM Peak Garfield Street at Center Drive Signal Phasing

Phasings

827: Center Drive & Garfield Street 06/19/2020

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)	13.0	28.5	13.0	43.5	9.5	9.5	46.5	9.5	45.5
Total Split (s)	19.5	44.5	29.5	44.5	29.5	29.5	46.5	29.5	45.5
Total Split (%)	13.0%	29.7%	19.7%	29.7%	19.7%	19.7%	31.0%	19.7%	30.3%
Maximum Green (s)	15.0	40.0	25.0	40.0	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)	13.1	47.9	5.2	40.0	21.3	6.5	42.0	21.3	56.8
90th %ile Term Code	Gap	Hold	Gap	Max	Gap	Gap	Ped	Gap	Hold
70th %ile Green (s)	8.0	52.5	0.0	40.0	12.4	0.0	5.3	12.4	22.2
70th %ile Term Code	Gap	Hold	Skip	Max	Gap	Skip	Gap	Gap	Hold
50th %ile Green (s)	6.2	48.4	0.0	37.7	9.9	0.0	0.0	9.9	9.9
50th %ile Term Code	Gap	Hold	Skip	Gap	Gap	Skip	Skip	Gap	Hold
30th %ile Green (s)	5.3	48.4	0.0	38.6	8.6	0.0	0.0	8.6	8.6
30th %ile Term Code	Gap	Hold	Skip	Gap	Gap	Skip	Skip	Gap	Hold
10th %ile Green (s)	0.0	40.0	0.0	40.0	7.1	0.0	0.0	7.1	7.1
10th %ile Term Code	Skip	Max	Skip	Max	Gap	Skip	Skip	Gap	Hold

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 81.5
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 134.4
70th %ile Actuated Cycle: 83.7
50th %ile Actuated Cycle: 67.3
30th %ile Actuated Cycle: 66
10th %ile Actuated Cycle: 56.1

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

Timings

827: Center Drive & Garfield Street 06/17/2020

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	160	950	45	960	640	25	15	605	30
Future Volume (vph)	160	950	45	960	640	25	15	605	30
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)	59.6	50.7	47.2	40.2	73.2	7.4	16.5	28.0	39.7
Actuated g/C Ratio	0.51	0.44	0.41	0.35	0.63	0.06	0.14	0.24	0.34
v/c Ratio	0.62	0.70	0.22	0.87	0.61	0.25	0.23	0.82	0.53
Control Delay	35.5	32.5	21.2	46.9	8.7	71.3	21.1	55.4	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.5	32.5	21.2	46.9	8.7	71.3	21.1	55.4	9.3
LOS	D	C	C	D	A	E	C	E	A
Approach Delay		33.0		31.3			37.0		38.1
Approach LOS		C		C			D		D

Intersection Summary	
Cycle Length: 165	
Actuated Cycle Length: 116	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.87	
Intersection Signal Delay: 33.6	Intersection LOS: C
Intersection Capacity Utilization 75.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 827: Center Drive & Garfield Street

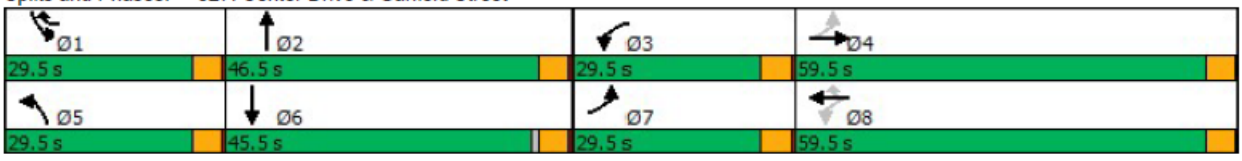


Figure G-64: PM Peak Garfield Street at Center Drive Signal Phasing

Phasings

827: Center Drive & Garfield Street 06/17/2020

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)	24.1	69.8	9.3	55.0	25.0	10.5	42.0	25.0	56.5
90th %ile Term Code	Gap	Hold	Gap	Max	Max	Gap	Ped	Max	Hold
70th %ile Green (s)	18.6	65.5	8.1	55.0	25.0	8.5	42.0	25.0	58.5
70th %ile Term Code	Gap	Hold	Gap	Max	Max	Gap	Ped	Max	Hold
50th %ile Green (s)	12.9	43.3	6.1	36.5	25.0	6.6	6.1	25.0	24.5
50th %ile Term Code	Gap	Hold	Gap	Gap	Max	Gap	Gap	Max	Hold
30th %ile Green (s)	10.2	36.4	5.6	31.8	25.0	0.0	5.0	25.0	34.5
30th %ile Term Code	Gap	Hold	Gap	Gap	Max	Skip	Min	Max	Hold
10th %ile Green (s)	7.8	34.6	0.0	22.3	25.0	0.0	0.0	25.0	25.0
10th %ile Term Code	Gap	Hold	Skip	Gap	Max	Skip	Skip	Max	Hold

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 116
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 164.1
70th %ile Actuated Cycle: 158.6
50th %ile Actuated Cycle: 98.5
30th %ile Actuated Cycle: 90
10th %ile Actuated Cycle: 68.6

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

Timings
87: Riverside/OR99 & Garfield Street 06/19/2020

Lane Group	EBL	EBT	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations											
Traffic Volume (vph)	65	480	370	280	320	225	270	25	50	520	445
Future Volume (vph)	65	480	370	280	320	225	270	25	50	520	445
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)	8.8	26.3	19.9	37.4	56.5	14.6	38.2	52.4	9.1	30.4	55.8
Actuated g/C Ratio	0.08	0.24	0.18	0.34	0.52	0.13	0.35	0.48	0.08	0.28	0.51
v/c Ratio	0.58	0.83	0.77	0.57	0.45	0.64	0.28	0.04	0.46	0.68	0.65
Control Delay	68.2	49.6	52.9	34.4	8.4	53.4	29.6	0.9	62.0	41.6	20.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.2	49.6	52.9	34.4	8.4	53.4	29.6	0.9	62.0	41.6	20.1
LOS	E	D	D	C	A	D	C	A	E	D	C
Approach Delay		51.6		32.9			38.5			33.2	
Approach LOS		D		C			D			C	

Intersection Summary	
Cycle Length: 169.3	
Actuated Cycle Length: 109.3	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 37.6	Intersection LOS: D
Intersection Capacity Utilization 64.6%	ICU Level of Service C
Analysis Period (min) 15	

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

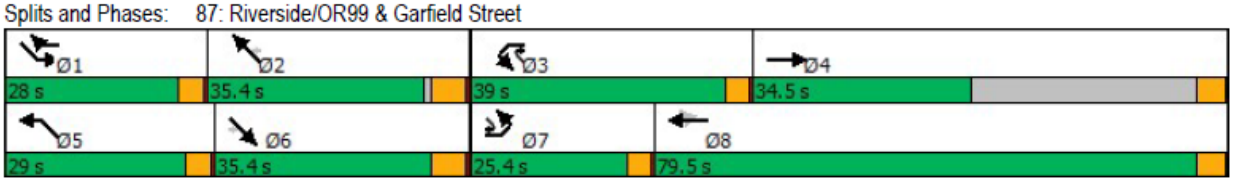


Figure G-66: AM and PM Peak Garfield Street at Riverside/OR 99 Signal Phasing

Phasings

87: Riverside/OR99 & Garfield Street 06/19/2020

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)	13.6	30.0	27.8	44.2	20.6	20.6	37.1	13.6	13.5	30.0	27.8
90th %ile Term Code	Gap	Max	Gap	Hold	Gap	Gap	Hold	Gap	Gap	Max	Gap
70th %ile Green (s)	10.6	30.0	22.6	42.0	16.3	16.3	35.6	10.6	10.7	30.0	22.6
70th %ile Term Code	Gap	Max	Gap	Hold	Gap	Gap	Hold	Gap	Gap	Max	Gap
50th %ile Green (s)	8.8	28.3	20.0	39.5	14.3	14.3	35.2	8.8	9.1	30.0	20.0
50th %ile Term Code	Gap	Gap	Gap	Hold	Gap	Gap	Hold	Gap	Gap	Max	Gap
30th %ile Green (s)	7.1	24.4	17.5	34.8	12.5	12.5	35.0	7.1	7.5	30.0	17.5
30th %ile Term Code	Gap	Gap	Gap	Hold	Gap	Gap	Hold	Gap	Gap	Max	Gap
10th %ile Green (s)	5.0	19.4	13.3	27.7	10.1	10.1	44.1	5.0	0.0	30.0	13.3
10th %ile Term Code	Min	Gap	Gap	Hold	Gap	Gap	Hold	Min	Skip	Max	Gap

Intersection Summary
Cycle Length: 169.3
Actuated Cycle Length: 109.3
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 126.3
70th %ile Actuated Cycle: 116.8
50th %ile Actuated Cycle: 110.5
30th %ile Actuated Cycle: 102.3
10th %ile Actuated Cycle: 90.7

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

Timings
84: Riverside/OR99 & Stewart 06/19/2020

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	130	500	10	170	55	285	315	575	15
Future Volume (vph)	130	500	10	170	55	285	315	575	15
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	36.5	9.0	42.4	9.0	41.4	
Total Split (s)	25.0	41.5	26.0	36.5	24.0	42.4	24.0	41.4	
Total Split (%)	18.7%	31.0%	19.4%	27.3%	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)	14.2	37.0	4.1	22.8	8.3	37.5	16.6	48.0	57.1
Actuated g/C Ratio	0.13	0.33	0.04	0.21	0.07	0.34	0.15	0.43	0.51
v/c Ratio	0.77	0.81	0.20	0.37	0.64	0.47	0.83	0.51	0.02
Control Delay	72.8	39.0	65.6	37.3	80.2	30.1	63.8	28.2	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.8	39.0	65.6	37.3	80.2	30.1	63.8	28.2	0.5
LOS	E	D	E	D	F	C	E	C	A
Approach Delay		44.1		38.6		36.3		40.1	
Approach LOS		D		D		D		D	

Intersection Summary	
Cycle Length: 133.9	
Actuated Cycle Length: 111.2	
Natural Cycle: 105	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 40.7	Intersection LOS: D
Intersection Capacity Utilization 66.2%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 84: Riverside/OR99 & Stewart

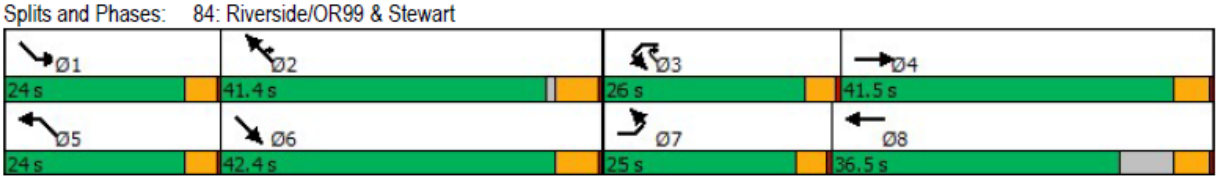


Figure G-68: AM and PM Peak Riverside/OR 99 at Stewart Avenue Signal Phasing

Phasings

84: Riverside/OR99 & Stewart 06/19/2020

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	36.5	9.0	42.4	9.0	41.4	
Total Split (s)	25.0	41.5	26.0	36.5	24.0	42.4	24.0	41.4	
Total Split (%)	18.7%	31.0%	19.4%	27.3%	17.9%	31.7%	17.9%	30.9%	
Maximum Green (s)	21.0	37.0	22.0	32.0	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	5.0	0.0	10.0	0.0	10.0	0.0	10.0	
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	47.9	5.1	32.0	14.9	37.0	20.0	42.1	
90th %ile Term Code	Max	Hold	Gap	Ped	Gap	MaxR	Max	Hold	
70th %ile Green (s)	18.3	37.0	5.0	23.7	11.2	37.0	20.0	45.8	
70th %ile Term Code	Gap	Max	Min	Hold	Gap	MaxR	Max	Hold	
50th %ile Green (s)	15.9	37.0	5.0	26.1	9.3	37.0	19.4	47.1	
50th %ile Term Code	Gap	Max	Min	Hold	Gap	MaxR	Gap	Hold	
30th %ile Green (s)	12.7	34.8	0.0	18.1	7.2	37.0	16.0	45.8	
30th %ile Term Code	Gap	Gap	Skip	Hold	Gap	MaxR	Gap	Hold	
10th %ile Green (s)	9.4	29.1	0.0	15.7	0.0	37.0	13.2	54.2	
10th %ile Term Code	Gap	Gap	Skip	Hold	Skip	MaxR	Gap	Hold	

Intersection Summary
Cycle Length: 133.9
Actuated Cycle Length: 111.2
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 127.9
70th %ile Actuated Cycle: 116.9
50th %ile Actuated Cycle: 116.3
30th %ile Actuated Cycle: 101.7
10th %ile Actuated Cycle: 93.2

Freeway Analysis

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

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)		2210	640
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		2698	898
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.61	0.45
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)	0.379
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	53.2
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	2698	Ramp Junction Speed (S), mi/h	53.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	25.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.0

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

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)		3175	1385
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		3877	1626
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.87	0.82
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)	0.444
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	52.0
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	3877	Ramp Junction Speed (S), mi/h	52.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	37.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.8

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

HCS7 Freeway Merge Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)		1570	890
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		1917	1010
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.66	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 (MS)	0.366
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	53.4
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	1917	Ramp Junction Speed (S), mi/h	53.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	2927	Average Density (D), pc/mi/ln	27.4
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.0

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

HCS7 Freeway Merge Report

Project Information

Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)	1790	565
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	2186	683
Capacity (c), pc/h	4453	1995
Volume-to-Capacity Ratio (v/c)	0.64	0.34

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)	0.362
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	53.5
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	2186	Ramp Junction Speed (S), mi/h	53.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2869	Average Density (D), pc/mi/ln	26.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	25.7

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

HCS7 Basic Freeway Report					
Project Information					
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020		
Agency	ODOT TPAU	Analysis Year	2019		
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV AM peak		
Project Description	Exit 27 AMT, NB 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	2210	Heavy Vehicle Adjustment Factor (f_{HV})	0.900		
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1349		
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)	0.61		
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7		
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.0		
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C		
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	15	25	36	45	-
Bi-Directional DSV, 1000 veh/day	31	50	73	93	-

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

HCS7 Basic Freeway Report					
Project Information					
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020		
Agency	ODOT TPAU	Analysis Year	2019		
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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	1570	Heavy Vehicle Adjustment Factor (f_{HV})	0.900		
Peak Hour Factor	0.91	Flow Rate (v_p), pc/h/ln	958		
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)	0.43		
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7		
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.3		
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	B		
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	15	25	36	45	-
Bi-Directional DSV, 1000 veh/day	31	50	73	93	-

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

HCS7 Basic Freeway Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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	2460	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1502
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)	0.68
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.6
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
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	15	25	36	45	-
Bi-Directional DSV, 1000 veh/day	31	50	73	93	-

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

HCS7 Basic Freeway Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV AM 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	3175	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1938
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)	0.88
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	55.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.0
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 G-77: AM Peak SB Mainline Past Exit 27

HCS7 Basic Freeway Report					
Project Information					
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020		
Agency	ODOT TPAU	Analysis Year	2019		
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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	1790	Heavy Vehicle Adjustment Factor (f_{HV})	0.900		
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1093		
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)	0.49		
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7		
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6		
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C		
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 G-78: AM Peak SB Mainline Downstream of Exit 27

HCS7 Basic Freeway Report					
Project Information					
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020		
Agency	ODOT TPAU	Analysis Year	2019		
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV AM 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	2355	Heavy Vehicle Adjustment Factor (f_{HV})	0.900		
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1438		
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)	0.65		
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7		
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.5		
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C		
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 G-79: PM Peak NB Off-ramp Diverge

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)		2515	755
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		2881	778
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.65	0.39
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)	0.368
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	53.4
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	2881	Ramp Junction Speed (S), mi/h	53.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	27.0
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.6

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

HCS7 Freeway Diverge Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)		2715	1080
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		3110	1163
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.70	0.58
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)	0.403
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	3110	Ramp Junction Speed (S), mi/h	52.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	29.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.2

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

HCS7 Freeway Merge Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)		1760	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		2016	1540
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.80	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)	0.430
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	52.3
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	2016	Ramp Junction Speed (S), mi/h	52.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3556	Average Density (D), pc/mi/ln	34.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.7

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

HCS7 Freeway Merge Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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)		1635	815
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		1873	906
Capacity (c), pc/h		4453	1995
Volume-to-Capacity Ratio (v/c)		0.62	0.45
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)	0.356
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	53.6
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	1873	Ramp Junction Speed (S), mi/h	53.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	2779	Average Density (D), pc/mi/ln	25.9
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.9

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

HCS7 Basic Freeway Report

Project Information

Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV PM peak
Project Description	Exit 27 AMT, NB 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	2515	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.97	Flow Rate (V_p), pc/h/ln	1440
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)	0.65
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.5
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
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	13	20	30	38	-
Bi-Directional DSV, 1000 veh/day	26	42	60	77	-

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

HCS7 Basic Freeway Report					
Project Information					
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020		
Agency	ODOT TPAU	Analysis Year	2019		
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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	1760	Heavy Vehicle Adjustment Factor (f_{HV})	0.900		
Peak Hour Factor	0.97	Flow Rate (V_p), pc/h/ln	1008		
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)	0.46		
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7		
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.2		
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	B		
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	13	20	30	38	-
Bi-Directional DSV, 1000 veh/day	26	42	60	77	-

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

HCS7 Basic Freeway Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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	3190	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.97	Flow Rate (V_p), pc/h/ln	1827
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)	0.83
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	57.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.1
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	13	20	30	38	-
Bi-Directional DSV, 1000 veh/day	26	42	60	77	-

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

HCS7 Basic Freeway Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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	2715	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.97	Flow Rate (V_p), pc/h/ln	1555
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)	0.70
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.5
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	-

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

HCS7 Basic Freeway Report					
Project Information					
Analyst	Tricia Tanner EIT and Kristie Gladhill PE		Date	5/30/2020	
Agency	ODOT TPAU		Analysis Year	2019	
Jurisdiction	ODOT		Time Period Analyzed	2019 30HV 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	1635		Heavy Vehicle Adjustment Factor (f_{HV})	0.900	
Peak Hour Factor	0.97		Flow Rate (V_p), pc/h/ln	936	
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)	0.42	
Passenger Car Equivalent (ET)	2.000				
Speed and Density					
Lane Width Adjustment (f_{LW})	0.0		Average Speed (S), mi/h	58.7	
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0		Density (D), pc/mi/ln	15.9	
Total Ramp Density Adjustment	1.3		Level of Service (LOS)	B	
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	-

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

HCS7 Basic Freeway Report			
Project Information			
Analyst	Tricia Tanner EIT and Kristie Gladhill PE	Date	5/30/2020
Agency	ODOT TPAU	Analysis Year	2019
Jurisdiction	ODOT	Time Period Analyzed	2019 30HV 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	2450	Heavy Vehicle Adjustment Factor (f_{HV})	0.900
Peak Hour Factor	0.97	Flow Rate (V_p), pc/h/ln	1403
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)	0.63
Passenger Car Equivalent (ET)	2.000		
Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.9
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
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 G-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)	153	119	58	193	185	202	136	80	54
Average Queue (ft)	77	49	25	87	78	98	58	33	17
95th Queue (ft)	125	93	53	163	146	165	112	65	40
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	0	
Queuing Penalty (veh)				0	0		1	0	

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

Intersection: 91: Alba Drive & Barnett Road

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	T	T	L	T	TR	L	R
Maximum Queue (ft)	31	104	121	26	162	171	28	37
Average Queue (ft)	2	30	31	1	53	53	5	11
95th Queue (ft)	18	74	84	15	115	121	20	34
Link Distance (ft)		1406	1406		711	711	654	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	85			83				32
Storage Blk Time (%)		0			2		1	1
Queuing Penalty (veh)		0			0		0	0

Figure G-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)	77	98	305	324	115	345	360	276	278	258	1304	1373
Average Queue (ft)	28	55	168	179	45	181	222	114	120	129	930	1325
95th Queue (ft)	63	90	260	276	86	318	351	266	247	246	1747	1448
Link Distance (ft)			711	711				905	905		1263	1263
Upstream Blk Time (%)											2	58
Queuing Penalty (veh)											14	475
Storage Bay Dist (ft)	300	300			300	360	360			465		
Storage Blk Time (%)			0	1		0	1					1
Queuing Penalty (veh)			0	1		1	3					6

Intersection: 90: Highland Drive & Barnett Road

Movement	NB	SB	SB	SB
Directions Served	R	L	T	TR
Maximum Queue (ft)	690	215	277	351
Average Queue (ft)	690	80	116	181
95th Queue (ft)	690	165	218	309
Link Distance (ft)			852	852
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	600	250		
Storage Blk Time (%)	59	1	0	
Queuing Penalty (veh)	129	2	0	

Figure G-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)	138	489	506	150	406	352	169	159	90	107
Average Queue (ft)	25	333	354	34	225	134	78	31	31	40
95th Queue (ft)	93	471	487	102	355	273	141	92	72	85
Link Distance (ft)		905	905		1213	1213		614		735
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	82			80			105		95	
Storage Blk Time (%)	0	29		1	26		7	0	1	1
Queuing Penalty (veh)	0	4		6	6		2	0	1	1

Figure G-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)	458	537	1469	179	445	1462	341	445	1269	1261	445	178
Average Queue (ft)	285	351	467	70	403	1217	177	292	798	860	302	83
95th Queue (ft)	482	554	1324	149	597	1843	310	530	1517	1545	644	153
Link Distance (ft)			1648			1407			1237	1237		
Upstream Blk Time (%)			6			56			6	11		
Queuing Penalty (veh)			0			0			39	70		
Storage Bay Dist (ft)	375	375		270	270		270	270			270	200
Storage Blk Time (%)	3	17	3		0	88	3	5	32	70		0
Queuing Penalty (veh)	17	109	21		0	275	8	13	142	220		0

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

Movement	SB	SB	SB	SB
Directions Served	L	T	T	>
Maximum Queue (ft)	239	306	394	310
Average Queue (ft)	109	149	196	49
95th Queue (ft)	188	253	322	213
Link Distance (ft)		1263	1263	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	200			200
Storage Blk Time (%)	0	4	11	1
Queuing Penalty (veh)	1	10	48	1

Figure G-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	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	L	TR
Maximum Queue (ft)	234	820	833	61	719	908	210	30	26	196	247	74
Average Queue (ft)	76	366	379	2	232	345	132	4	5	71	93	26
95th Queue (ft)	212	875	879	44	607	807	272	18	20	160	199	59
Link Distance (ft)		940	940		1237	1237			342		950	950
Upstream Blk Time (%)		3	4			0						
Queuing Penalty (veh)		17	25			0						
Storage Bay Dist (ft)	186			400			175	51		190		
Storage Blk Time (%)	0	23			1	18	0	0	0	2	3	
Queuing Penalty (veh)	0	18			0	89	0	0	0	2	3	

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

Figure G-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)	184	292	470	205	239	302	248	179	173	167	133	94
Average Queue (ft)	59	166	240	96	116	128	73	80	82	58	66	37
95th Queue (ft)	146	314	529	180	202	244	171	159	166	157	117	81
Link Distance (ft)			664		940	940				2428	2428	
Upstream Blk Time (%)			7									
Queuing Penalty (veh)			0									
Storage Bay Dist (ft)	220	220		300			300	250	250			220
Storage Blk Time (%)		11	15		0	0	0	1	1			
Queuing Penalty (veh)		32	45		0	1	0	2	2			

Intersection: 87: Riverside/OR99 & Garfield Street

Movement	NW	NW	NW
Directions Served	T	T	R
Maximum Queue (ft)	433	475	350
Average Queue (ft)	189	177	155
95th Queue (ft)	418	495	353
Link Distance (ft)	1227	1227	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			330
Storage Blk Time (%)	3	0	7
Queuing Penalty (veh)	2	1	17

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

Intersection: 84: Riverside/OR99 & Stewart

Movement	EB	EB	EB	WB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	L	T
Maximum Queue (ft)	196	259	293	34	133	114	138	171	179	162	184	211
Average Queue (ft)	69	113	126	7	66	27	33	86	69	74	102	93
95th Queue (ft)	141	207	233	24	120	78	91	156	141	137	162	178
Link Distance (ft)		1212	1212		745	745		1052	1052			2428
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	247			218			128			298	298	
Storage Blk Time (%)	0	0					1	3				
Queuing Penalty (veh)	0	1					1	2				

Intersection: 84: Riverside/OR99 & Stewart

Movement	NW
Directions Served	T
Maximum Queue (ft)	230
Average Queue (ft)	114
95th Queue (ft)	196
Link Distance (ft)	2428
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Figure G-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)	213	201	95	322	354	317	225	319	256
Average Queue (ft)	115	105	46	173	150	162	121	59	29
95th Queue (ft)	180	173	81	295	282	272	207	193	110
Link Distance (ft)	1165	1165			1406	1406		631	631
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			200	237			151		
Storage Blk Time (%)		0	0	5	1		13	0	
Queuing Penalty (veh)		1	0	16	5		21	0	

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

Intersection: 91: Alba Drive & Barnett Road

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	T	T	L	T	TR	L	R
Maximum Queue (ft)	29	160	177	8	232	226	48	44
Average Queue (ft)	6	35	47	1	68	67	14	16
95th Queue (ft)	24	97	125	6	168	164	38	43
Link Distance (ft)		1406	1406		712	712	650	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	85			83				32
Storage Blk Time (%)	0	1			3		3	2
Queuing Penalty (veh)	0	0			0		1	1

Figure G-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)	175	206	325	353	308	405	450	917	794	359	351	331
Average Queue (ft)	72	95	167	181	156	301	355	381	264	188	153	169
95th Queue (ft)	137	162	279	298	266	480	515	835	564	339	274	291
Link Distance (ft)			712	712				905	905		1263	1263
Upstream Blk Time (%)								1	0			
Queuing Penalty (veh)								7	1			
Storage Bay Dist (ft)	300	300			300	360	360			465		
Storage Blk Time (%)	0	0	1	1	0	4	17	1		1	0	
Queuing Penalty (veh)	0	0	1	4	1	14	62	6		2	0	

Intersection: 90: Highland Drive & Barnett Road

Movement	NB	SB	SB	SB
Directions Served	R	L	T	TR
Maximum Queue (ft)	397	340	884	905
Average Queue (ft)	134	98	849	865
95th Queue (ft)	306	300	969	936
Link Distance (ft)			857	857
Upstream Blk Time (%)			42	83
Queuing Penalty (veh)			0	0
Storage Bay Dist (ft)	600	250		
Storage Blk Time (%)	0		44	
Queuing Penalty (veh)	0		25	

Figure G-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)	162	437	454	159	1196	1182	190	249	67	85
Average Queue (ft)	40	227	249	27	887	828	111	61	23	28
95th Queue (ft)	112	401	416	101	1389	1364	182	167	56	65
Link Distance (ft)		905	905		1214	1214		620		738
Upstream Blk Time (%)					19	6				
Queuing Penalty (veh)					0	0				
Storage Bay Dist (ft)	82			80			105		95	
Storage Blk Time (%)	1	24		0	48		14	1	0	0
Queuing Penalty (veh)	7	7		0	10		9	2	0	0

Figure G-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)	218	550	910	221	254	255	320	347	385	404	197	184
Average Queue (ft)	114	244	418	108	150	65	178	204	177	209	12	87
95th Queue (ft)	195	531	829	195	238	216	279	317	330	349	99	167
Link Distance (ft)			1648			1407			1237	1237		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	375	375		270	270		270	270			270	200
Storage Blk Time (%)			22	0	0	0	1	2	3	7		0
Queuing Penalty (veh)			86	0	2	1	2	5	18	32		0

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

Movement	SB	SB	SB	SB
Directions Served	L	T	T	>
Maximum Queue (ft)	202	237	356	320
Average Queue (ft)	104	117	165	115
95th Queue (ft)	183	208	288	325
Link Distance (ft)		1263	1263	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	200			200
Storage Blk Time (%)	1	1	5	5
Queuing Penalty (veh)	2	3	36	15

Figure G-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)	234	468	466	218	909	1044	210	61	111	226	784	603
Average Queue (ft)	111	207	214	33	341	459	174	23	38	201	392	224
95th Queue (ft)	227	386	392	118	760	966	281	55	81	265	797	587
Link Distance (ft)		960	960		1237	1237			345		910	910
Upstream Blk Time (%)					0	0					5	2
Queuing Penalty (veh)					0	4					0	0
Storage Bay Dist (ft)	186			400			175	51		190		
Storage Blk Time (%)	1	11			2	24	0	8	9	23	30	
Queuing Penalty (veh)	4	18			1	153	2	5	2	70	90	

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

Figure G-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)	146	236	277	281	310	484	325	190	204	255	276	229
Average Queue (ft)	66	109	138	159	173	219	100	109	101	133	151	67
95th Queue (ft)	124	194	231	261	278	396	267	174	172	237	255	155
Link Distance (ft)			666		960	960				2422	2422	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	220	220		300			300	250	250			220
Storage Blk Time (%)		0	1	0	1	4	0		0	0		
Queuing Penalty (veh)		0	3	0	2	10	0		0	1		

Intersection: 87: Riverside/OR99 & Garfield Street

Movement	NW	NW	NW
Directions Served	T	T	R
Maximum Queue (ft)	399	364	298
Average Queue (ft)	250	221	120
95th Queue (ft)	373	340	232
Link Distance (ft)	1234	1234	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			330
Storage Blk Time (%)	18	1	0
Queuing Penalty (veh)	14	7	0

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

Intersection: 84: Riverside/OR99 & Stewart

Movement	EB	EB	EB	WB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	L	T
Maximum Queue (ft)	268	210	253	152	276	257	175	672	654	198	223	252
Average Queue (ft)	131	79	102	50	162	135	99	348	327	101	124	129
95th Queue (ft)	233	165	200	111	245	224	205	665	637	175	198	236
Link Distance (ft)		1212	1212		743	743		1050	1050			2422
Upstream Blk Time (%)								0	0			
Queuing Penalty (veh)								0	0			
Storage Bay Dist (ft)	247			218			128			298	298	
Storage Blk Time (%)	1	0			2		3	43				0
Queuing Penalty (veh)	2	0			1		11	44				0

Intersection: 84: Riverside/OR99 & Stewart

Movement	NW
Directions Served	T
Maximum Queue (ft)	265
Average Queue (ft)	148
95th Queue (ft)	247
Link Distance (ft)	2422
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Contact Information

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