Tillamook: US 101/OR 6 Alternatives Study
2030 Future No-Build Transportation Analysis - Final

PREPARED FOR: Tony Snyder/ODOT
PREPARED BY: Andra Henriques/CH2M HILL
CC: Kristin Hull/CH2M HILL
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This memorandum provides an overview of the Future No-Build (Year 2030) transportation conditions within the Tillamook US 101/OR 6 Alternatives Study traffic analysis study area. The 2030 Future No-Build analysis provides an overview of expected future traffic conditions with minimal improvements made to the transportation infrastructure.

I. Future Study Area and Analysis Year

Project Study Area

The project study area for the 2030 Future No-Build traffic analysis is based on the existing traffic analysis study area outlined *Technical Memorandum 2b Tillamook: US 101/OR 6 Alternatives Study Existing Conditions Memorandum*. The analysis study area includes nine study intersections focused around the group of US 101/OR 6 intersections.

Analysis Year and Time Period

The year 2030 was chosen as the horizon analysis year for the Future No-Build traffic analysis. This year was chosen to provide a 20 year forecast horizon from existing conditions. The 30th highest hour was selected as the future No-Build analysis time period because it is consistent with the existing conditions traffic analysis.

II. Future No-Build Forecasting

Because a transportation model for the study area is unavailable, the use of historical trend forecasts to evaluate future deficiencies and to analyze system alternatives are used for this analysis. This forecasting process was approved by ODOT as part of the methods and assumptions memorandum in Technical Memorandum 2a, *Tillamook: US 101/OR 6 Alternatives Study Methods and Assumptions*. **Table 1** shows the forecasted growth rate calculated for the project area.

TABLE 1
State Highway Annual Growth Rates

Milepost	2006 ADT	2027 ADT	R-Squared	Overall Factor	1-year growth
US 101 – Pacific Coast Highway No. 9					
65.65	12,700	16,600	0.3576	--	--
65.69	6,800	9,300	0.5851	1.37	1.75%
65.76	6,000	8,300	0.3138	--	--
65.78	6,000	8,800	0.2017	--	--
				US 101 Annual Rate	1.75%
				US 101 22-Year Factor	1.39
OR 6 Wilson River Highway No. 37					
0.01	6,300	7,500	0.5841	1.19	0.91%
0.04	6,100	6,300	0.0352	--	--
0.15	5,600	5,800	0.1761	--	--
0.02	2,400	2,500	0.1133	--	--
0.01	5100	6200	0.2074	--	--
0.12	4700	5600	0.5816	1.19	0.91%
0.19	4100	4400	0.4326	--	--
				OR 6 Average Annual Rate	0.91%
				OR 6 22-Year Factor	1.20

Notes:
Source: ODOT 2027 Highway Future Volume Table http://www.oregon.gov/ODOT/TD/TP/docs/TADR/2027FVT.pdf
The available growth rates are only projected to year 2027; this study assumed the AAGR to continue at the same rate through year 2030.

The volumes used to calculate the annual growth rate are chosen based on the R-squared value. The R-squared value measures the correlation between the historical data points and the generated trend. An R-squared value above 0.75 holds the highest confidence level, but if that is not available than values of 0.50 are acceptable. The annual rate for US 101 was calculated using the overall factor at mile point 65.69 because this mile point's R-squared value (0.5851) held the highest confidence level within the study area along US 101. The annual rate for OR 6 was calculated using an average of two locations within the study area. These two locations held the highest confidence levels within the study area along OR 6.

The annual growth rate on US 101 suggests a growth of 1.75 percent per year or about a 39 percent increase in traffic over the 22-year roadway design life (2008 to 2030). This 39 percent factor was applied uniformly to each of the existing 2008 30th highest hour intersection turn movements on US 101 to obtain future 2030 No-Build 30th highest hour intersection volumes.

The annual growth rate on OR 6 suggests a growth of 0.91% percent per year or about a 20 percent increase in traffic over the 22-year roadway design life (2008 to 2030). This 20 percent factor was applied uniformly to each of the existing 2008 30th highest hour intersection turn movements on OR 6 to obtain future 2030 No-Build 30th highest hour intersection volumes.

Figure A.1 in **Appendix A** shows a schematic of the study area that provides 2030 No-Build 30th highest hour intersection turn movements.

III. Future No-Build Traffic Analysis

This section describes the methodology employed and results for the 2030 Future No-Build traffic operational analysis.

Methodology

Performance and Mobility Standards

For the 2030 Future No-Build conditions, the mobility standards for intersections within ODOT's jurisdiction vary based on roadway classification. **Table 2** shows the mobility standards for the intersection operational analysis.

Traffic Analysis Software Tools

A Synchro 7 computer traffic operations model was constructed for the 2030 Future No-Build analysis. The future model uses existing peak hour factors and truck percentages as that is the most accurate available data and future geometrics and post-processed turning movement volumes.

SimTraffic, a traffic microsimulation software program, was used to collect queuing information for all signalized intersections. Queue results are reported as a 95th percentile expected queue length, which means that 95 percent of the time during the peak hour analyzed, the queue length should be less than or equal to the value reported. An average of at least five runs of SimTraffic was used for signalized intersections.

Future Intersection Operations

The volume to capacity ratios and 95th percentile queue lengths were collected from the future no-build Synchro and SimTraffic simulation models for the nine study area intersections. The post processed 2030 balanced volumes for each intersection were utilized in the analysis.

Operational Analysis Results

Results from the operational analysis results show that two of the nine study intersections do not meet ODOT mobility standards for the 2030 Future No-Build scenario. Those intersections are Main Avenue and 1st Street and Main Avenue and 3rd Street.

Congestion is expected to worsen in 2030 as compared to the 2008 existing conditions. The intersections of Main Avenue and 1st Street and Main Avenue and 3rd Street are forecast as not meeting mobility standards. Congestion at these intersections could lead to delay for vehicles traveling within and through Tillamook. Meeting mobility standards at these intersections along US 101 and OR 6 is important for maintaining mobility for goods and people along both state highways.

TABLE 2

Tillamook: US 101/OR 6 Alternatives Study – 2030 Future No-Build Operational Results

ID	Intersecting Roadway (OHP Highway Classification)		Control Type	Future No-Build OHP V/C Standard		Forecast V/C Ratio	
1	Main Avenue (Statewide NHS, TR, SB, STA)	1st Street (Regional FR, TR)	Signal	0.90		**0.92**	
2	Main Avenue (Statewide NHS, TR, SB, STA)	3rd Street (Regional FR, TR)	Signal	0.90		**1.17**	
3	Main Avenue (Statewide NHS, SB, STA)	4th Street (N/A – Local Road)	Signal	0.90		0.81	
4	Pacific Avenue (Statewide NHS, TR, SB, STA)	1st Street (Regional FR, TR)	Signal	0.90		0.72	
5	Pacific Avenue (Statewide NHS, TR, SB, STA)	3rd Street (Regional FR, TR)	Signal	0.90		0.79	
6	Pacific Avenue (Statewide NHS, SB, STA)	4th Street (N/A – Local Road)	Signal	0.90		0.69	
7	1st Street (Regional FR, TR)	Madrona Avenue (N/A – Local Road)	TWSC	0.85[1]	0.90[2]	0.23	0.42
8	3rd Street (Regional FR, TR)	Madrona Avenue (N/A – Local Road)	TWSC	0.85[1]	0.90[2]	0.29	0.28
9	OR 6 (Regional FR, TR)	Miller Avenue (N/A – Local Road)	TWSC	0.85[1]	0.90[2]	0.15	0.05

Notes:
[1] Indicates OHP Mobility Standard V/C ratio for uncontrolled roadway approach
[2] Indicates OHP Mobility Standard V/C ratio for stop controlled roadway approach
Signal: Signalized Intersection
TWSC: Two-Way Stop controlled
Black highlighting indicates intersection does not meet mobility standards
NHS – National Highway System
TR – Federally Designated Truck Route
SB – State and/or Federal Scenic Byway
STA – Special Transportation Area
FR – State Freight Route
Due to new information, the V/C standards have been updated since the Methods and Assumptions Memorandum.

Table 2 shows the results of the 2030 Future No-Build intersection operational analysis. **Figure A.1** of **Appendix A** shows the volumes, channelization, and analysis results for all of the study area intersections. **Appendix B** shows the Synchro HCM reports for each study intersection.

Queuing Analysis Results

The vehicle queue analysis identifies deficient vehicle storage locations and provides key information as this project advances into the alternative development stage. **Table 3** shows the forecast 2030 95th percentile vehicle queues for each movement in the study area. The movements that are not forecast have adequate storage are shown in the table with black highlight. Seven intersections (a total of 22 movements) have queue lengths that exceed available storage capacity. Seven of the movements are either exclusive left or right turn lanes. The other 15 movements are either through, combined left/through, combined through/right or combined left/through/right lanes.

TABLE 3

2030 Future No-Build 95th Percentile Queues

ID	Intersection	Approach	Lane Group	Existing Storage (feet)	Queue Length (feet)
1	Main Avenue and 1st Street	Eastbound	Left	35	80
			Right	220	540
		Westbound	Left	160	190
			Thru	170	250
			Right	80	120
		Southbound	Thru/Right	220	230
2	Main Avenue and 3rd Street	Eastbound	Thru/Right	210	530
		Southbound	Left/Thru/Right	210	600
3	Main Avenue and 4th Street	Eastbound	Thru/Right	490	600
		Westbound	Left	50	110
			Thru	150	220
		Southbound	Left/Thru/Right	210	230
4	Pacific Avenue and 1st Street	Westbound	Thru/Right	220	590
		Northbound	Left	140	650
			Left/Thru	140	550
		Southbound	Right	Driveway	50
5	Pacific Avenue and 3rd Street	Eastbound	Left/Thru	150	200
		Northbound	Thru/Right	210	250
6	Pacific Avenue and 4th Street	Eastbound	Left	40	100
			Thru	140	230
		Westbound	Thru/Right	220	320
		Northbound	Left/Thru/Right	210	1010
7	1st Street and Madrona Avenue	Westbound	Left/Thru/Right	--	--
		Northbound	Left/Thru	290	350
		Southbound	Thru/Right	Driveway	90
8	3rd Street and Madrona Avenue	Eastbound	Left/Thru/Right	--	--
		Northbound	Thru/Right	220	210
		Southbound	Left/Thru	290	60
9	OR 6 and Miller Avenue	Eastbound	Thru/Right	--	--
		Westbound	Thru	--	--
		Northbound	Right	210	60

Notes:

95th Percentile queues calculated using an average of five, one hour SimTraffic runs

Queue lengths not reported for free-flowing and uncontrolled movements

Queue lengths rounded up to the nearest ten feet

Numbers in black highlight indicate a vehicle queue length that exceeds the available storage length

As shown in **Table 3**, some of the estimated vehicle queue lengths extend a considerable distance from the intersection and could block numerous upstream intersections/driveways creating gridlock throughout the corridor.

Many of the long vehicle queues are expected to occur on side streets because traffic signals are coordinated along Main and Pacific avenues to provide efficient north-south movement through Tillamook along US 101. Almost all east-west movements at the study intersections along Main and Pacific avenues are forecast to have significantly longer vehicles queues than the provided storage. Most movements at the study intersections along Madrona are forecast to be satisfied with the available storage.

Although traffic signals are coordinated along Main and Pacific avenues, the high volume of traffic on these routes still creates queuing. The southbound through movements along Main Avenue and northbound through movements along Pacific Avenue have queues that exceed storage at every intersection included in the study area. In the southbound direction, the worst queuing occurs at Main Avenue and 3rd Street. In the northbound direction, the worst queuing occurs at Pacific Avenue and 4th Street. Queues at these intersections extend well past the nearest upstream intersections, potentially blocking upstream intersections which would further degrade intersection performance along Main Avenue and Pacific Avenue.

For the Future No-Build 2030 analysis, of the seven intersections identified in **Table 3** as having queue length deficiencies, two are also forecast to have reported V/C ratios higher than ODOT mobility standards: Main Avenue and 1st Street and Main Avenue and 3rd Street.

Next Steps

The next step in the analysis process will be to review these findings with the Project Management Team (PMT), the Stakeholder Advisory Committee (SAC), and the public, and identify potential improvement projects that could address needs along the corridor.

IV. Summary of Results

The following intersections located in the study area fail to meet mobility standards in the 2030 Future No-Build scenario:

- Main Avenue and 1st Street
- Main Avenue and 3rd Street

The queuing analysis results show that seven of the nine intersections analyzed have one or more movements where queues exceed existing storage.

The major traffic concerns identified thus far include:

Existing Conditions

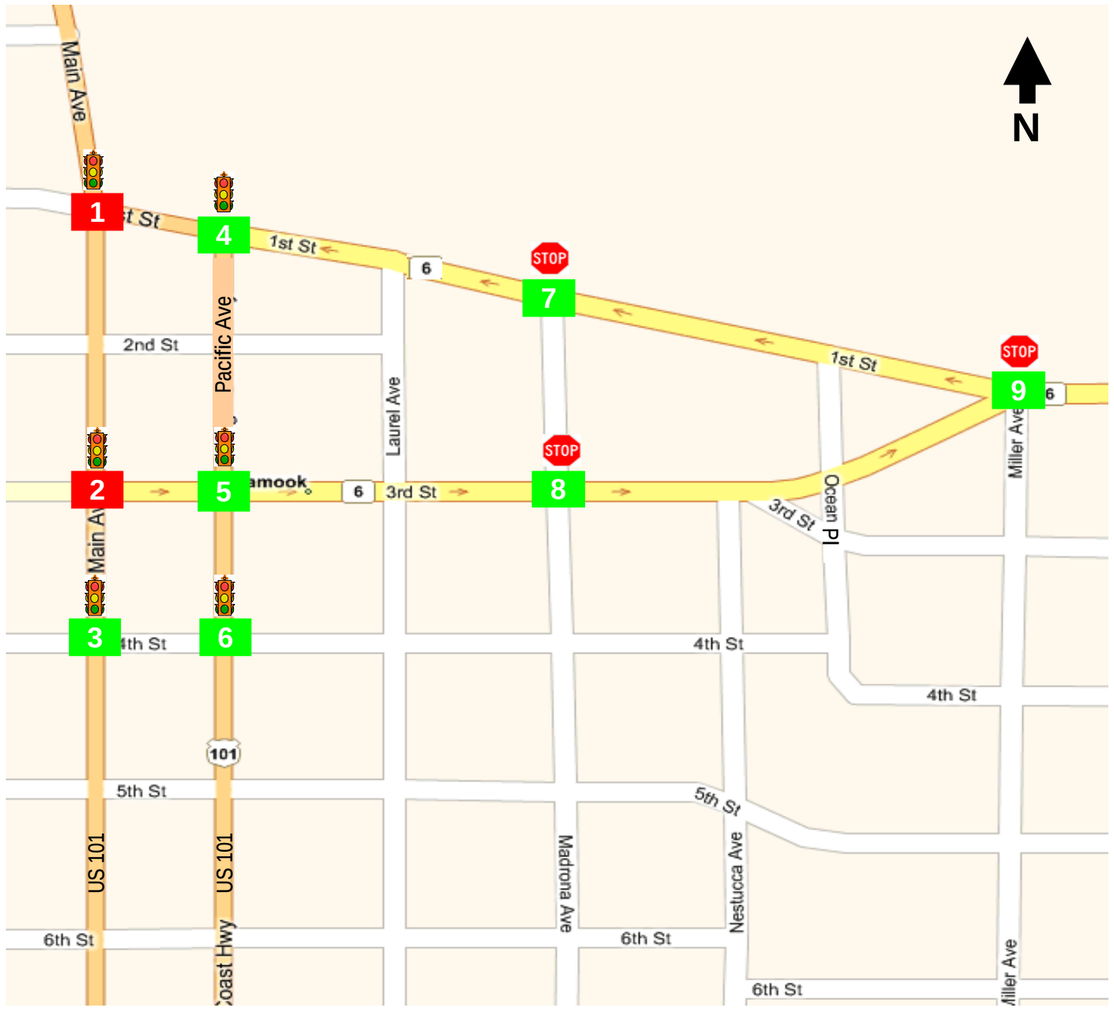
- All study intersections meet mobility standards.
- Vehicle queuing at the study intersections along US 101 causes delay for the side street and possible gridlock along US 101.
- The high 2007 average crash rate in the City of Tillamook as identified in the ODOT 2007 State Highway Crash Rate Tables and the high intersection crash rate at Main Avenue and 4th Street bring attention to a safety concern within the study area.
- Sub-standard access management as indicated by the 22 driveways within the study area not meeting access standards decreases mobility and safety along US 101 and OR 6.

Future Conditions

- The intersections of Main Avenue and 1st Street and Main Avenue and 3rd Street perform poorly.
- Vehicle queuing on Main and Pacific avenues blocks upstream intersections and creates gridlock along US 101.
- Vehicle queuing on 1st and 3rd streets creates delay and inhibits mobility along OR 6.

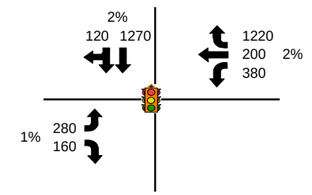
Appendix A

Figure A.1 Future No-Build: Volumes, Channelization, & V/C Ratios



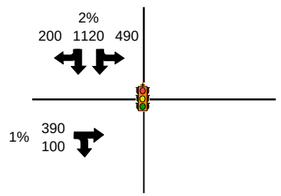
1	Main Ave. & 1st St.

V/C Ratio Std: 0.90 PHF: 0.93
V/C Ratio: 0.92



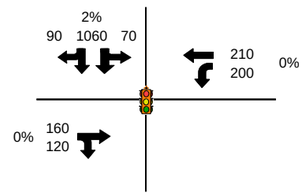
2	Main Ave. & 3rd St.

V/C Ratio Std: 0.90 PHF: 0.95
V/C Ratio: 1.17



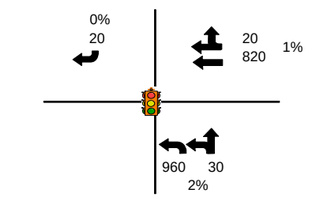
3	Main Ave. & 4th St.

V/C Ratio Std: 0.90 PHF: 0.94
V/C Ratio: 0.81



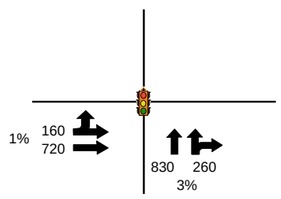
4	Pacific Ave. & 1st St.

V/C Ratio Std: 0.90 PHF: 0.97
V/C Ratio: 0.72



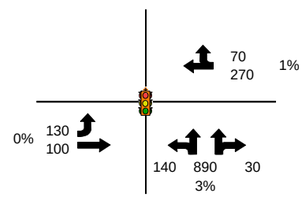
5	Pacific Ave. & 3rd St.

V/C Ratio Std: 0.90 PHF: 0.97
V/C Ratio: 0.79



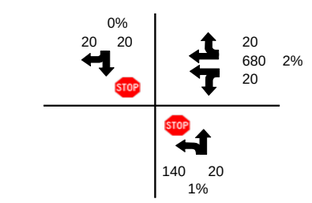
6	Pacific Ave. & 4th St.

V/C Ratio Std: 0.90 PHF: 0.94
V/C Ratio: 0.69



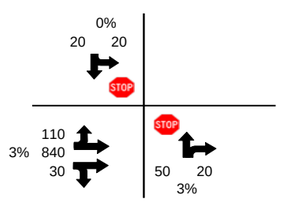
7	1st St. & Madrona Ave.

V/C Ratio Std: 0.85 PHF: 0.93
V/C Ratio: 0.42



8	3rd St. & Madrona Ave.

V/C Ratio Std: 0.85 PHF: 0.90
V/C Ratio: 0.29



9	OR 6 & Miller Ave.

V/C Ratio Std: 0.85 PHF: 0.95
V/C Ratio: 0.15

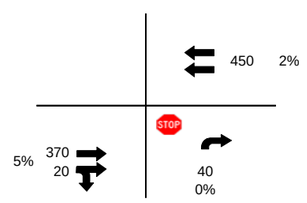


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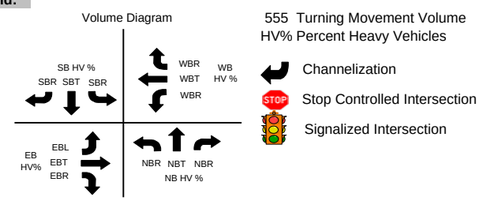
FIGURE A.1 Tillamook: US 101/OR 6 Alternatives Study

2030 No-Build: Volumes, Channelization, & V/C Ratio

Notes:

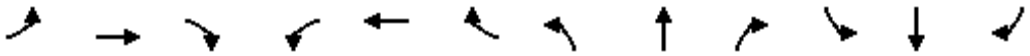
1. "V/C Ratio Std" corresponds to the intersection's mobility standard
2. Mobility Standards are based on Oregon Highway Plan
3. A green box on the map represents an acceptable measured mobility
4. A red box on the map represents a failing measured mobility
5. The reported Peak Hour Factor (PHF) is for the overall intersection
6. Truck Percentages calculated from raw counts
7. System Peak hour is 3:45-4:45 PM
8. All 30th Highest Hour volumes were seasonally adjusted
9. Intersection map source: Microsoft Live Maps

Legend:



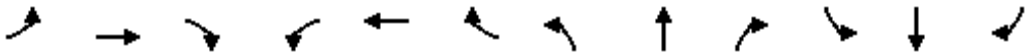
Appendix B

HCM Synchro Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	280	0	160	380	200	1220	0	0	0	0	1270	120
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	10	12	14	16	11	12	12	12	12	12	12	13
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0					4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00					0.95	
Frpb, ped/bikes	1.00		0.97	1.00	1.00	0.98					1.00	
Flpb, ped/bikes	0.99		1.00	0.99	1.00	1.00					1.00	
Frt	1.00		0.85	1.00	1.00	0.85					0.99	
Flt Protected	0.95		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (prot)	1526		1528	1829	1658	1433					3206	
Flt Permitted	0.56		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (perm)	903		1528	1829	1658	1433					3206	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.95	0.95	0.95
Adj. Flow (vph)	301	0	172	409	215	1312	0	0	0	0	1337	126
RTOR Reduction (vph)	0	0	4	4	0	0	0	0	0	0	6	0
Lane Group Flow (vph)	301	0	168	405	215	1312	0	0	0	0	1457	0
Confl. Peds. (#/hr)	10		10	10		10						10
Confl. Bikes (#/hr)			10			10						10
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	0%	0%	0%	2%	2%	2%
Turn Type	custom		custom	Perm		Free						
Protected Phases					4						2	
Permitted Phases	8		8	4		Free						
Actuated Green, G (s)	35.1		35.1	35.1	35.1	90.0					46.9	
Effective Green, g (s)	35.1		35.1	35.1	35.1	90.0					46.9	
Actuated g/C Ratio	0.39		0.39	0.39	0.39	1.00					0.52	
Clearance Time (s)	4.0		4.0	4.0	4.0						4.0	
Vehicle Extension (s)	0.2		0.2	0.2	0.2						0.2	
Lane Grp Cap (vph)	352		596	713	647	1433					1671	
v/s Ratio Prot					0.13						0.45	
v/s Ratio Perm	0.33		0.11	0.22		c0.92						
v/c Ratio	0.86		0.28	0.57	0.33	0.92					0.87	
Uniform Delay, d1	25.1		18.8	21.5	19.2	0.0					18.9	
Progression Factor	1.00		1.00	1.02	1.00	1.00					1.00	
Incremental Delay, d2	17.4		0.1	0.5	0.1	8.4					6.6	
Delay (s)	42.5		18.9	22.4	19.4	8.4					25.5	
Level of Service	D		B	C	B	A					C	
Approach Delay (s)		33.9			12.6			0.0			25.5	
Approach LOS		C			B			A			C	

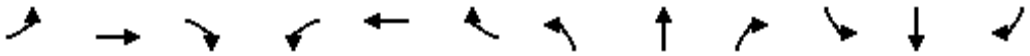
Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	390	100	0	0	0	0	0	0	490	1120	200
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	10	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		4.0									4.0	
Lane Util. Factor		1.00									0.95	
Frpb, ped/bikes		0.99									1.00	
Flpb, ped/bikes		1.00									1.00	
Frt		0.97									0.98	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		1328									2713	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		1328									2713	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	411	105	0	0	0	0	0	0	516	1179	211
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	53	0
Lane Group Flow (vph)	0	506	0	0	0	0	0	0	0	0	1853	0
Confl. Peds. (#/hr)			10							10		10
Confl. Bikes (#/hr)			10									10
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Parking (#/hr)		10	10							10	10	10
Turn Type										Perm		
Protected Phases		8									2	
Permitted Phases		8								2	2	
Actuated Green, G (s)		29.0									53.0	
Effective Green, g (s)		29.0									53.0	
Actuated g/C Ratio		0.32									0.59	
Clearance Time (s)		4.0									4.0	
Vehicle Extension (s)		0.2									0.2	
Lane Grp Cap (vph)		428									1598	
v/s Ratio Prot		c0.38										
v/s Ratio Perm											0.68	
v/c Ratio		1.18									1.16	
Uniform Delay, d1		30.5									18.5	
Progression Factor		1.00									0.85	
Incremental Delay, d2		103.5									77.0	
Delay (s)		134.0									92.7	
Level of Service		F									F	
Approach Delay (s)		134.0			0.0			0.0			92.7	
Approach LOS		F			A			A			F	

Intersection Summary			
HCM Average Control Delay	101.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		

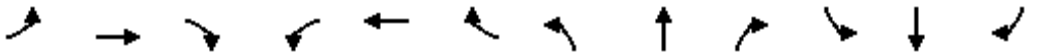
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	160	120	200	210	0	0	0	0	70	1060	90
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0						4.0	
Lane Util. Factor		1.00		1.00	1.00						0.95	
Frpb, ped/bikes		0.99		1.00	1.00						1.00	
Flpb, ped/bikes		1.00		0.99	1.00						1.00	
Frt		0.94		1.00	1.00						0.99	
Flt Protected		1.00		0.95	1.00						1.00	
Satd. Flow (prot)		1386		1651	1983						2963	
Flt Permitted		1.00		0.40	1.00						1.00	
Satd. Flow (perm)		1386		701	1983						2963	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95
Adj. Flow (vph)	0	170	128	213	223	0	0	0	0	74	1116	95
RTOR Reduction (vph)	0	33	0	0	0	0	0	0	0	0	6	0
Lane Group Flow (vph)	0	265	0	213	223	0	0	0	0	0	1279	0
Confl. Peds. (#/hr)			10	10						10		10
Confl. Bikes (#/hr)						10						10
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Parking (#/hr)		10	10							10	10	10
Turn Type				Perm						Perm		
Protected Phases		8			4						2	
Permitted Phases		8		4						2		
Actuated Green, G (s)		27.7		27.7	27.7						54.3	
Effective Green, g (s)		27.7		27.7	27.7						54.3	
Actuated g/C Ratio		0.31		0.31	0.31						0.60	
Clearance Time (s)		4.0		4.0	4.0						4.0	
Vehicle Extension (s)		0.2		0.2	0.2						0.2	
Lane Grp Cap (vph)		427		216	610						1788	
v/s Ratio Prot		0.19			0.11							
v/s Ratio Perm				c0.30							0.43	
v/c Ratio		0.62		0.99	0.37						0.72	
Uniform Delay, d1		26.6		31.0	24.3						12.5	
Progression Factor		1.00		0.71	0.64						0.93	
Incremental Delay, d2		2.0		53.1	0.1						0.2	
Delay (s)		28.7		75.0	15.6						11.8	
Level of Service		C		E	B						B	
Approach Delay (s)		28.7			44.6			0.0			11.8	
Approach LOS		C			D			A			B	

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	114.6%	ICU Level of Service	H
Analysis Period (min)	15		

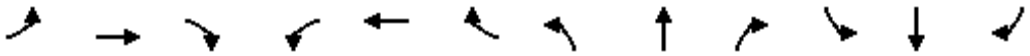
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	820	20	960	30	0	0	0	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	12	12	10	10	12	12	12	12
Total Lost time (s)					4.0		4.0	4.0				4.0
Lane Util. Factor					0.95		0.95	0.95				1.00
Frpb, ped/bikes					1.00		1.00	1.00				0.98
Flpb, ped/bikes					1.00		1.00	1.00				1.00
Frt					1.00		1.00	1.00				0.86
Flt Protected					1.00		0.95	0.96				1.00
Satd. Flow (prot)					3031		1228	1235				1480
Flt Permitted					1.00		0.95	0.96				1.00
Satd. Flow (perm)					3031		1228	1235				1480
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)	0	0	0	0	845	21	990	31	0	0	0	21
RTOR Reduction (vph)	0	0	0	0	2	0	56	56	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	864	0	449	460	0	0	0	21
Confl. Peds. (#/hr)						10	10					10
Confl. Bikes (#/hr)						10			10			
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	2%	2%	2%	0%	0%	0%
Parking (#/hr)					10	10	10	10				
Turn Type							Split					custom
Protected Phases					4		2	2				
Permitted Phases												4 2
Actuated Green, G (s)					38.1		43.9	43.9				90.0
Effective Green, g (s)					38.1		43.9	43.9				90.0
Actuated g/C Ratio					0.42		0.49	0.49				1.00
Clearance Time (s)					4.0		4.0	4.0				
Vehicle Extension (s)					5.2		5.2	5.2				
Lane Grp Cap (vph)					1283		599	602				1480
v/s Ratio Prot					c0.28		0.37	c0.37				
v/s Ratio Perm												0.01
v/c Ratio					0.67		0.75	0.76				0.01
Uniform Delay, d1					20.9		18.6	18.8				0.0
Progression Factor					1.00		0.47	0.47				1.00
Incremental Delay, d2					1.9		5.5	5.9				0.0
Delay (s)					22.8		14.2	14.7				0.0
Level of Service					C		B	B				A
Approach Delay (s)		0.0			22.8			14.4			0.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

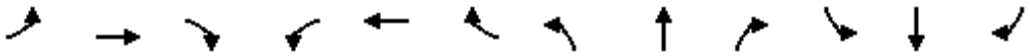
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	720	0	0	0	0	0	830	260	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Total Lost time (s)		4.0						4.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						0.99				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.96				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		2812						2671				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		2812						2671				
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	742	0	0	0	0	0	856	268	0	0	0
RTOR Reduction (vph)	0	23	0	0	0	0	0	30	0	0	0	0
Lane Group Flow (vph)	0	884	0	0	0	0	0	1094	0	0	0	0
Confl. Peds. (#/hr)	10								10			
Confl. Bikes (#/hr)			10						10			
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	3%	3%	3%	0%	0%	0%
Parking (#/hr)	10	10						10	10			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4	4						2				
Actuated Green, G (s)		31.7						50.3				
Effective Green, g (s)		31.7						50.3				
Actuated g/C Ratio		0.35						0.56				
Clearance Time (s)		4.0						4.0				
Vehicle Extension (s)		0.2						0.2				
Lane Grp Cap (vph)		990						1493				
v/s Ratio Prot								c0.41				
v/s Ratio Perm		0.31										
v/c Ratio		0.89						0.73				
Uniform Delay, d1		27.6						14.8				
Progression Factor		0.82						0.98				
Incremental Delay, d2		1.1						2.6				
Delay (s)		23.6						17.1				
Level of Service		C						B				
Approach Delay (s)		23.6			0.0			17.1			0.0	
Approach LOS		C			A			B			A	

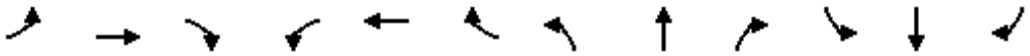
Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	100	0	0	270	70	140	890	30	0	0	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0			4.0			4.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.97			1.00				
Flt Protected	0.95	1.00			1.00			0.99				
Satd. Flow (prot)	1655	1750			1424			2944				
Flt Permitted	0.35	1.00			1.00			0.99				
Satd. Flow (perm)	606	1750			1424			2944				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95	0.94	0.94	0.94
Adj. Flow (vph)	138	106	0	0	287	74	147	937	32	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	1	0	0	0	0
Lane Group Flow (vph)	138	106	0	0	352	0	0	1115	0	0	0	0
Confl. Peds. (#/hr)	10					10	10		10			
Confl. Bikes (#/hr)			10			10			10			
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	3%	3%	3%	0%	0%	0%
Parking (#/hr)					10	10	10	10	10			
Turn Type	Perm						Perm					
Protected Phases		4			4			2				
Permitted Phases	4				4		2	2				
Actuated Green, G (s)	30.3	30.3			30.3			51.7				
Effective Green, g (s)	30.3	30.3			30.3			51.7				
Actuated g/C Ratio	0.34	0.34			0.34			0.57				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Vehicle Extension (s)	0.2	0.2			0.2			0.2				
Lane Grp Cap (vph)	204	589			479			1691				
v/s Ratio Prot		0.06			c0.25							
v/s Ratio Perm	0.23							0.38				
v/c Ratio	0.68	0.18			0.73			0.66				
Uniform Delay, d1	25.6	21.1			26.3			13.1				
Progression Factor	0.56	0.63			1.00			1.00				
Incremental Delay, d2	5.5	0.0			5.0			2.0				
Delay (s)	19.9	13.2			31.3			15.1				
Level of Service	B	B			C			B				
Approach Delay (s)		17.0			31.3			15.1			0.0	
Approach LOS		B			C			B			A	

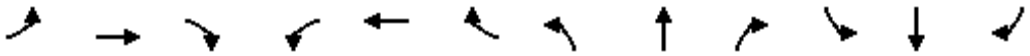
Intersection Summary			
HCM Average Control Delay	18.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	114.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	20	680	20	140	20	0	0	20	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	0	0	0	22	731	22	151	22	0	0	22	22
Pedestrians		10						10			10	
Lane Width (ft)		0.0						12.0			12.0	
Walking Speed (ft/s)		4.0						4.0			4.0	
Percent Blockage		0						1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		554										
pX, platoon unblocked												
vC, conflicting volume	763			10			461	816	10	806	805	396
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	763			10			461	816	10	806	805	396
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			65	93	100	100	93	96
cM capacity (veh/h)	852			1595			430	303	1066	254	309	604

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	387	387	172	43
Volume Left	22	0	151	0
Volume Right	0	22	0	22
cSH	1595	1700	409	409
Volume to Capacity	0.01	0.23	0.42	0.11
Queue Length 95th (ft)	1	0	51	9
Control Delay (s)	0.5	0.0	20.1	14.8
Lane LOS	A		C	B
Approach Delay (s)	0.3		20.1	14.8
Approach LOS			C	B

Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	44.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	110	840	30	0	0	0	0	50	20	20	20	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	122	933	33	0	0	0	0	56	22	22	22	0
Pedestrians		10			10			10			10	
Lane Width (ft)		11.0			0.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			0			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		550										
pX, platoon unblocked				0.83			0.83	0.83	0.83	0.83	0.83	
vC, conflicting volume	10			977			1226	1214	503	781	1231	20
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	10			562			862	848	0	326	868	20
tC, single (s)	4.2			4.1			7.6	6.6	7.0	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			100			100	75	98	94	90	100
cM capacity (veh/h)	1587			839			173	222	890	367	220	1043

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	589	500	78	44
Volume Left	122	0	0	22
Volume Right	0	33	22	0
cSH	1587	1700	283	275
Volume to Capacity	0.08	0.29	0.28	0.16
Queue Length 95th (ft)	6	0	27	14
Control Delay (s)	2.2	0.0	22.5	20.6
Lane LOS	A		C	C
Approach Delay (s)	1.2		22.5	20.6
Approach LOS			C	C

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	370	20	0	450	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.92	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	389	22	0	474	0	42
Pedestrians				10	10	
Lane Width (ft)				12.0	10.0	
Walking Speed (ft/s)				4.0	4.0	
Percent Blockage				1	1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			421		647	226
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			421		647	226
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	95
cM capacity (veh/h)			1127		405	772

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	260	152	237	237	42
Volume Left	0	0	0	0	0
Volume Right	0	22	0	0	42
cSH	1700	1700	1700	1700	772
Volume to Capacity	0.15	0.09	0.14	0.14	0.05
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	9.9
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.9
Approach LOS					A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	26.3%	ICU Level of Service	A
Analysis Period (min)	15		