Tillamook: US 101/OR 6 Alternatives Study Existing Conditions Memorandum - Final

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This memorandum provides an overview of the existing (2008) transportation conditions within the Tillamook US 101/OR 6 Alternatives Study traffic analysis study area. A description of the study area, an inventory of the transportation facilities within the project study area, an overview of the existing operational and crash analysis results for the intersection facilities, and a discussion of access management are provided within this memorandum.

I. Study Area Description

The traffic study area of the Tillamook: US 101/OR 6 Alternatives Study includes roadways that are the jurisdiction of two different agencies: the City of Tillamook and the Oregon Department of Transportation (ODOT). The study area is bordered on the west by US 101 (Main Avenue) and extends from 1st Street to 4th Street on both Main and Pacific avenues. The study area then extends east along OR 6 (both 1st Street and 3rd Street) to Miller Avenue.

Figure A.1 in **Appendix A** shows the extents of the traffic study area and the location of all study intersections. A total of nine intersections are analyzed as part of this study.

II. Inventory of Transportation Facilities

Roadways

The Tillamook US 101/OR 6 Alternatives Study includes primary roadways that are within the jurisdictions of the City of Tillamook and ODOT. A brief description of each primary roadway and a discussion on the secondary roadways in the study area are included in the following sections.

Primary Roadways

US 101

US 101 is a major north-south highway on the west coast of the United States and is also known as Oregon Coast Highway No. 9 within Oregon. US 101 is state-classified as a Statewide roadway and is part of the National Highway System. Within the study area, US

101 is designated as a scenic byway and a special transportation area. The study area north of 3rd Street on US 101 is also a federally-designated truck route. Within the study area, US 101 is a couplet formed by Main (southbound) and Pacific (northbound) avenues. Through downtown Tillamook (south of 1st Street) two lanes are provided in each direction on these streets. Within the study area, US 101 has a posted speed of 20 mph and parallel parking on both sides of the roadway.

OR 6

OR 6 is a facility that intersects US 101 in downtown Tillamook. The ODOT designation within the study area is Wilson River Highway No. 37. OR 6 (Highway No. 37) is classified as a Regional roadway in the Oregon Highway Plan. This section of OR 6 is also a state freight route and federally designated truck route. West of US 101 and outside of the study area, OR 6 is designated as Netarts Highway No. 131.

Within the study area, OR 6 is designated as a minor arterial. OR 6 is two lanes in each direction within the study area. OR 6 between Main and Miller avenues is a couplet where the eastbound lanes are located on 3rd Street and the westbound lanes are located on 1st Street. The four lanes join together east of Miller Avenue. The posted speed on 1st Street between Miller and Main avenues is 25 mph. The posted speed on 3rd Street is 20 mph between Main and Miller avenues. Just east of Miller Avenue the posted speed is 30 mph.

Table 1 provides a description of each of the primary roadways.

TABLE 1

Primary Roadway Classifications & Characteristics

Roadway	Jurisdiction	Classification	Posted Speed	Bike Lanes	Parking Lanes	Sidewalks
US 101 (Main Avenue)	ODOT	Principal Arterial	20 mph	No	Yes	Yes
US 101 (Pacific Avenue)	ODOT	Principal Arterial	20 mph	No	Yes	Yes
OR 6 (1st Street)	ODOT	Minor Arterial	25 mph	No	Intermittent[1]	Yes
OR 6 (3rd Street)	ODOT	Minor Arterial	20 mph	No	Yes	Intermittent[2]

Notes:
[1] Parking every block except between Main and Pacific Avenues
[2] Continuous sidewalks except between Miller and Ocean Avenues

Secondary Roadways

There are several roadways traveling east-west from US 101. West of the study area, OR 6 continues along 3rd Street, but changes to Netarts Highway No 131 and is classified as an urban collector. Front Street, 1st Street and 4th Street are all classified as minor collectors. In the eastward direction, 3rd Street splits from OR 6 at Ocean Place. From this point, OR 6 continues in the northeast direction and 3rd Street continues east as an urban collector.

The roadways traveling north-south from OR 6 include Ocean Place which is classified as a minor collector, and Laurel Avenue, Madrona Avenue, Nestucca Avenue and Miller Avenue which are all local roads.

Table 2 shows the roadways classifications and characteristics for the secondary roadways within the study area.

TABLE 2

Secondary Roadway Classifications & Characteristics

Roadway	Jurisdiction	Classification	Posted Speed	Bike Lanes	Parking Lanes	Sidewalks
2nd Street (between Main and Laurel)	City of Tillamook	Local Road	20 mph	No	Intermittent[1]	Yes
4th Street (between US 101 couplet)	City of Tillamook	Minor Collector	20 mph	No	Intermittent[2]	Yes
Laurel Avenue (between OR 6 couplet)	City of Tillamook	Local Road	20 mph	No	Yes	Yes
Madrona Avenue (between OR 6 couplet)	City of Tillamook	Local Road	20 mph	No	Yes	Yes
Ocean Place (between OR 6 couplet)	City of Tillamook	Local Road	20 mph	No	Yes	Yes

Notes:
[1] Parking everywhere except south side of street between Pacific and Laurel Avenues
[2] No parking on south side of street

Transit Routes

The project study area is serviced by many routes operated by the Tillamook County Transportation District. The Tillamook County Transportation District provides fixed route and dial-a-ride transit service within the City of Tillamook, as well as to other neighboring cities. **Table 3** outlines these routes.

TABLE 3

Tillamook County Transit Service

Route #	Route	Days Operated	Operation Times	Headway*
1	Tillamook Town Loop	Mon-Sat	7:15 AM to 7:00 PM	1 hour
2	Tillamook-Oceanside/Netarts	Mon-Sat	6:30 AM to 6:00 PM	3 hours
3	Tillamook-Manzanita/Cannon Beach	Mon-Sat	6:00 AM to 7:23 PM	2 hours
4	Tillamook-Pacific City/Neskowin	Mon-Sat	5:55 AM to 8:00 PM	4 hours
5	Tillamook-Portland	Mon-Sun	8:15 AM to 5:00 PM (Monday-Saturday) 4:00 PM to 8:15 PM (Sunday)	4 hours (Monday-Saturday) 24 hours (Sunday)

Note:
* Headway is defined at the time between successive busses as they pass a common point on the roadway.

The Tillamook County bus routes run mostly Monday through Saturday, with the exception of Route 5, which makes one trip on Sundays. These routes have designated stops, but can also be flagged down at any location along their route.

Route 1, Tillamook Town Loop, provides service within the City limits. Its route runs east on 9th and 12th streets; north on Marolf and McCormick streets; west on 3rd Street and Hwy 6; and south on Stillwell Avenue and Birch Street. The route passes grocery stores, residential communities, parks, fair grounds, and the Tillamook Cheese Factory. This route has runs within the study area along Wilson River Highway, with designated stops at North Costal Plaza and the Tillamook Cheese Factory.

Routes 2, 3, and 4 have a one dollar fare each way. Route 1 (Tillamook Town Loop) has a one dollar fare for all day unlimited use. Route 5 (Tillamook-Portland) is ten dollars one way, or fifteen dollars round trip.

Tillamook County also provides paratransit services, known and Dial-A-Ride.

In October of 2008 a Town Square Transit and Visitor Center was opened in downtown Tillamook located at Second Street and Laurel Avenue next to the City Hall. This building serves as the central point for all Transportation District bus routes in Tillamook County.

Heavy Rail Facilities

The Port of Tillamook Bay Railroad runs service near Tillamook, but does not go within city limits. The rail line runes parallel to US 101, between Delmonte Avenue and Evergreen Drive, and crosses Wilson River Highway, 3rd Street, and 12th Street within the City of Tillamook. These crossings take place outside of the project study area. This rail only facilitates the movement of freight and does not include passenger service.

Non-Motorized Facilities

There are no designated bike lanes on any of the roadways within the study area. US 101 is a designated State Bike Route (Oregon Coast Bikeway) and all local roads in Tillamook are considered shared roadways where cyclists and motorists share the same lane. **Table 1** above provides a description of the non-motorized facilities on all the primary roadways within the study area.

III. Existing Conditions Transportation Analysis

Methodology

This section describes the data collected for the traffic analysis task and the methodology employed for the traffic operational and crash analysis.

Study Intersections and Analysis Time Period

A total of nine study intersections, all under ODOT jurisdiction, were analyzed as part of the Tillamook: US 101/OR 6 Alternatives Study existing conditions analysis. Sixteen-hour turning movement counts were collected at each of the study intersections on September 30, 2008. A light/medium/heavy vehicle split was collected for seven of the intersection turning movement counts. Full vehicle classification counts, dividing truck traffic by axle, were collected at two locations; Main Avenue at 1st Street and Pacific Avenue at 3rd Street.

Based on the volume counts for all intersections within the study area, an overall peak hour of 3:45-4:45 p.m. was determined and used in the traffic analysis.

Table 4 outlines the control type, jurisdiction, and count information for each intersection within the study area.

TABLE 4
Tillamook: US 101/OR 6 Alternatives Study – Traffic Study Intersections

ID	Intersection	Control Type	Jurisdiction	Date	Count Hours	Count Type
1	Main Avenue at 1st Street	Signal	ODOT	9/30/2008	6AM-10PM	Full Classification
2	Main Avenue at 3rd Street	Signal	ODOT	9/30/2008	6AM-10PM	Light/Med/Hev Classification
3	Main Avenue at 4th Street	Signal	ODOT	9/30/2008	6AM-10PM	Light/Med/Hev Classification
4	Pacific Avenue at 1st Street	Signal	ODOT	9/30/2008	6AM-10PM	Light/Med/Hev Classification
5	Pacific Avenue at 3rd Street	Signal	ODOT	9/30/2008	6AM-10PM	Full Classification
6	Pacific Avenue at 4th Street	Signal	ODOT	9/30/2008	6AM-10PM	Light/Med/Hev Classification
7	1st Street at Madrona Avenue	2-way Stop Controlled	ODOT	9/30/2008	6AM-10PM	Light/Med/Hev Classification
8	3rd Street at Madrona Avenue	2-way Stop Controlled	ODOT	9/30/2008	6AM-10PM	Light/Med/Hev Classification
9	OR 6 at Miller Avenue	1-way Stop Controlled	ODOT	9/30/2008	6AM-10PM	Light/Med/Hev Classification

Seasonal Adjustments

ODOT traffic analysis procedures require the 30th highest hour traffic volumes be used for planning, project design, and to calculate volume to capacity (v/c) ratios for intersections and street segments. The 30th highest hour represents the 30th highest recorded traffic volumes during a one-year period.

ODOT guidelines require that raw volumes be processed through four steps:

1. Collect raw traffic volumes and determine individual intersection peak hour.
2. Consolidate traffic counts and determine a system peak hour for all intersections within the study area.
3. Apply the seasonal adjustment factor of 1.26 to obtain the 30th highest peak hour volumes. The method used to calculate the factor is explained in Technical Memorandum 2a, *Tillamook: US 101/OR 6 Alternatives Study Methods and Assumptions.*
4. Balance the 30th highest peak hour volumes for use in the traffic analysis.

Figures B.1-B.3 in **Appendix B** show the raw counts, raw counts with system peak hour and 30th highest volumes for all the study intersections. **Appendix C** is Technical Memorandum

2a, *Tillamook: US 101/OR 6 Alternatives Study Methods and Assumptions,* which describes the process used to obtain the 30th highest volumes.

There are six intersections included the Tillamook: US 101/OR 6 Alternatives Study that were also included in the Tillamook Transportation Refinement Plan, adopted in 2006. These intersections are:

- Main Avenue at 1st Street
- Main Avenue at 3rd Street
- Main Avenue at 4th Street
- Pacific Avenue at 1st Street
- Pacific Avenue at 3rd Street
- Pacific Avenue at 4th Street

At these six intersections, the 30th highest hour volumes derived as a part of the Tillamook: US 101/OR 6 Alternatives study are 12-27% less than the 30 Highest Hour volumes reported as a part of the Tillamook Transportation Refinement Plan. There are several possible contributing factors to this decrease in volumes.

- Lower 30th Highest Hour adjustment factor: The ODOT methodology for arriving at the 30th Highest Hour has changed since previous refinement plan and the current method produced a factor of 1.26 as opposed to the 2004 factors of 1.68 and 1.80 depending on the intersection.
- Higher gas prices: The price of gas was at an all-time high during the 2008 count period, and may have caused a decrease in overall traffic volumes.
- Alternative Routes: As a part of the recommendations in the Tillamook Transportation Refinement Plan, an informal alternative route to bypass downtown Tillamook may have resulted in a decrease in the overall amount of truck traffic in downtown Tillamook.

Performance and Mobility Standards

For ODOT facilities, ODOT specifies mobility standards that shall be maintained on state facility roadway segments and intersections that vary according to functional classification, location, and role within the state highway system. The mobility standards are quantified in terms of the relative vehicle demand versus the capacity of a facility/intersection, termed volume-to-capacity ratios (v/c). Intersection and roadway segments operations, measured by v/c ratios, are compared to the applicable mobility standards to determine if they maintain appropriate mobility based on roadway functional classification, location, and role within the state facility system. Volume-to-capacity ratios are deemed acceptable when they are less than the applicable mobility standard that is outlined in the Oregon Highway Plan (OHP) and the Oregon Highway Design Manual (HDM).

The mobility standards vary and are shown in **Table 5** of this memorandum for each of the study intersections. These standards are based on roadway classification, speed and area type as shown in **Table 5** of Technical Memorandum 2a, *Tillamook: US 101/OR 6 Alternatives Study Methods and Assumptions* located in **Appendix C**.

Traffic Analysis Software Tools

A Synchro 7 computer traffic operations model was constructed for the study area based on the collected traffic turning movement counts, peak hour factors, truck percentages and field observations which were balanced for the 30th highest hour design volumes. This model was used to assess existing traffic operations within the study area.

The Synchro model uses methodologies in the 2000 Highway Capacity Manual (HCM) to analyze both signalized and stop-controlled intersections. The model also computes the v/c ratio to determine whether the intersection meets the applicable mobility standards from the OHP.

SimTraffic, a traffic microsimulation software program, was used to collect vehicle queuing information for all signalized intersections. As a microscopic traffic model, SimTraffic models each vehicle as a separate entity with its own individual parameters and car-following logic.

Vehicle queue results are reported for the expected 95th percentile 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 will be used to calculate the 95th percentile queue lengths.

Intersection Operational & Vehicle Queuing Analysis

The average intersection vehicle delay and level-of-service, 95th percentile queue length, and volume to capacity ratio were collected from the existing conditions Synchro and SimTraffic simulation models for the nine study area intersections.

Operational Analysis Results

Results from the operational analysis results indicate that one of the nine study intersections does not currently meet jurisdictional mobility standards. The intersection of Main Avenue and 3rd Street fails to meet mobility standards as the eastbound vehicles on 3rd Street incur delays because the main traffic flow is in the southbound direction. Also, the vehicles making an eastbound left turn could be blocked from the turn pocket by the vehicles waiting to make an eastbound right turn.

Table 5 shows the results of the existing conditions intersection operational analysis. **Figure D.1** of **Appendix D** provides the volumes, channelization, and analysis results for all of the study area intersections. **Appendix E** provides the Synchro HCM reports for each study intersection.

TABLE 5

Tillamook: US 101/OR 6 Alternatives Study – Intersection Mobility Standards

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	0.85		0.70	
2	Main Avenue (Statewide NHS, TR, SB, STA)	3rd Street (Regional FR, TR)	Signal	0.85		**0.89**	
3	Main Avenue (Statewide NHS, SB, STA)	4th Street (N/A – Local Road)	Signal	0.90		0.52	
4	Pacific Avenue (Statewide NHS, TR, SB, STA)	1st Street (Regional FR, TR)	Signal	0.85		0.55	
5	Pacific Avenue (Statewide NHS, TR, SB, STA)	3rd Street (Regional FR, TR)	Signal	0.85		0.60	
6	Pacific Avenue (Statewide NHS, SB, STA)	4th Street (N/A – Local Road)	Signal	0.90		0.50	
7	1st Street (Regional FR, TR)	Madrona Avenue (N/A – Local Road)	TWSC	0.85[1]	0.90[2]	0.85[1]	0.90[2]
8	3rd Street (Regional FR, TR)	Madrona Avenue (N/A – Local Road)	TWSC	0.85[1]	0.90[2]	0.85[1]	0.90[2]
9	OR 6 (Regional FR, TR)	Miller Avenue (N/A – Local Road)	TWSC	0.85[1]	0.90[2]	0.85[1]	0.90[2]

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

Vehicle Queuing Analysis Results

The analysis shows that eight intersections within the study area are experiencing vehicle queue lengths that extend to the previous intersection. Vehicle queues that exceed their storage are shown in **Table 6**.

Queue lengths can impact overall intersection corridor operations by delaying and restricting upstream vehicle movements. Long queues can result in spillback into the main roadway section, thereby blocking side-street private driveways and hindering through traffic from proceeding. Traffic turning left onto a roadway at an unsignalized intersection can also delay right-turning vehicles while they wait for a safe gap in traffic.

At the four locations listed below, existing queues exceed the turn pocket storage.

- Main Avenue and 1st Street eastbound left
- Main Avenue and 1st Street westbound right
- Main Avenue and 4th Street westbound left
- Pacific Avenue and 4th Street eastbound left

At the 11 intersection movements listed below, existing queues extend into the next intersection.

- Main Avenue and 1st Street eastbound
- Main Avenue and 1st Street westbound
- Main Avenue and 1st Street southbound
- Main Avenue and 3rd Street eastbound
- Main Avenue and 3rd Street southbound
- Main Avenue and 4th Street westbound
- Pacific Avenue and 1st Street westbound
- Pacific Avenue and 1st Street northbound
- Pacific Avenue and 3rd Street eastbound
- Pacific Avenue and 3rd Street northbound
- Pacific Avenue and 4th Street eastbound

At all other locations noted in **Table 6**, the queues extend to the next intersection. This means that the vehicles could cause gridlock by blocking traffic at downstream intersection. Some of the most critical queues include the southbound movement at Main Avenue and 3rd Street. This queue extends to Main Avenue and 1st Street, blocking a major intersection of US 101 and OR 6. Also, along Pacific Avenue, the northbound movement queue exceeds storage at all three of the study intersections. The queues at 1st Street, 3rd Street and 4th Street along Pacific Avenue are all extending to the previous intersection causing delay and possible gridlock all along Pacific Avenue.

Table F.1 in **Appendix F** shows a detailed description of the 95th percentile queue lengths for all movements at the study area intersections.

TABLE 6
2008 Existing Conditions 95th Percentile Queues

ID	Intersection	Method	Approach	Lane Group	Existing Storage (feet)	Queue Length (feet)
1	**Main Avenue and 1st Street**	95% Queue SimTraffic	Eastbound	Left	35	**80**
				Right	220	**230**
			Westbound	Left	160	**180**
				Thru	170	**250**
				Right	80	**120**
			Southbound	Thru/Right	220	**230**
2	**Main Avenue and 3rd Street**	95% Queue SimTraffic	Eastbound	Thru/Right	210	**420**
			Southbound	Left/Thru/Right	210	**230**
3	**Main Avenue and 4th Street**	95% Queue SimTraffic	Eastbound	Thru/Right	490	300
			Westbound	Left	50	**100**
				Thru	150	**190**
			Southbound	Left/Thru/Right	210	130
4	**Pacific Avenue and 1st Street**	95% Queue SimTraffic	Westbound	Thru/Right	220	**600**
			Northbound	Left	140	**400**
				Left/Thru	140	**550**
			Southbound	Right	Driveway	40
5	**Pacific Avenue and 3rd Street**	95% Queue SimTraffic	Eastbound	Left/Thru	150	**170**
			Northbound	Thru/Right	210	**280**
6	**Pacific Avenue and 4th Street**	95% Queue SimTraffic	Eastbound	Left	40	**100**
				Thru	140	**170**
			Westbound	Thru/Right	220	**300**
			Northbound	Left/Thru/Right	210	**550**
7	**1st Street and Madrona Avenue**	95% Queue SimTraffic	Westbound	Left/Thru/Right	--	--
			Northbound	Left/Thru	290	210
			Southbound	Thru/Right	Driveway	60
8	**3rd Street and Madrona Avenue**	95% Queue SimTraffic	Eastbound	Left/Thru/Right	--	--
			Northbound	Thru/Right	220	70
			Southbound	Left/Thru	290	50
9	**OR 6 and Miller Avenue**	95% Queue SimTraffic	Eastbound	Thru/Right	--	--
			Westbound	Thru	--	--
			Northbound	Right	210	50

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

Crash Analysis

Vehicle crash data for study area intersections and major corridors were analyzed for the years 2003 through 2007. The crash data were analyzed to identify crash patterns that may describe safety deficiencies within the study area.

Corridor Crash Rates

Crash rates, expressed in "crashes per million vehicle-miles (MVM) traveled," are used to compare the crash experience of one roadway segment to another. This rate expresses how many crashes might be expected of vehicles traveling through a particular section of roadway for a cumulative total of one million miles.

The four corridors studied as a part of the Tillamook US 101/OR 6 Alternatives Study are smaller than the recommended segment length for crash analysis, due to the size and characteristics of the study area. These segments are covered in the memorandum, but it should be noted that the 2007 average crash rate on US 101 for the City of Tillamook is 4.26 crashes per million vehicle miles, as reported in the ODOT 2007 State Highway Crash Rate Tables. This rate is higher than the five-year statewide average of 1.22 crashes per million vehicle miles.

The four corridors listed below were analyzed as part of the Tillamook US 101/OR 6 Alternative Study. The corridors were separated into segments based on the study area boundaries.

- Wilson River Highway Westbound – 1st Street (Highway No. 37)
  - MP 0.00, Main Street, to MP 0.25, Miller Avenue
- Wilson River Highway Eastbound - 3rd Street (Highway No. 37)
  - MP 0.00, Main Street, to MP 0.28, Miller Avenue
- Oregon Coast Highway Northbound (Highway No. 9)
  – MP 65.68, 1st Street, to MP 65.82, 4th Street
- Oregon Coast Highway Southbound (Highway No. 9)
  - MP 65.64, 1st Street, to MP 65.79, 4th Street

Table 7 provides a summary of the segment crash analysis results.

TABLE 7
Historical Crash Data January 1, 2002 to December 31, 2006

Roadway	Segment	Milepost From	Milepost To	Length (miles)	2008 AADT[1]	Number of Crashes[2]	Crash Rate[3] 5-year State Average	Crash Rate[3] 5-year Segment Average
Wilson River Highway (Highway No 37)	Westbound	0.00	0.25	0.25	4800	4	1.60*	1.83
	Eastbound	0.00	0.28	0.28	5300	23	1.60*	8.57
Oregon Coast Highway (Highway No 9)	Northbound	65.68	65.82	0.14	8500	29	1.22**	18.16
	Southbound	65.64	65.79	0.15	8500	39	1.22**	15.49

Notes:
[1] AADT = Average Annual Daily Traffic
[2] Total number of crashes over 5-year period
[3] Crashes per million vehicle miles
*Statewide average crash rate for minor arterials in rural cities on the rural highway system
**Statewide average crash rate for other non-freeway principal arterials in rural cities on the rural highway system

The crash rates for all four segments exceed their corresponding average state rate; however, this is not unexpected. To provide the most meaningful results, it is generally recommended that segments studied exceed one mile in length. These segments, however, are closer to a quarter mile in length. When segments are this small, the formula inflates crash rate results. Also, these segments all have at least three intersections included in them. The combination of short segments lengths and high density of intersections most likely resulted in these above average crash rates. A qualitative review of the data shows a high number of rear-end crashes along these corridors. These rear-ends are likely due to a combination of high levels of congestion along the segments, as well as intersection spacing problems. In some cases, the intersections are less than 500 feet apart, increasing the likelihood of queue related rear-end crashes, particularly at signalized intersections.

Intersection Crash Rates

Intersection crash rates were calculated for all of the Tillamook: US 101/OR 6 Alternative study area intersections. Intersection crash rates are measured in "number of crashes per million annual vehicles entering into an intersection within 250 feet of an intersection."

The number of entering vehicles into each study intersection was approximated from the 2008 raw turning movement counts. The raw 2008 intersection turning movement volumes are added together to achieve a total 16 hour vehicle count, and then a factor of 1.10 is applied to get a 24-hour vehicle approximation. A seasonal adjustment factor was then applied to obtain the Average Annual Daily Traffic (AADT).

Table 8 provides a summary of the intersection crash analysis.

TABLE 8
Intersection Crash Data (2003-2007)

	Intersection	Severity of Crash				
		Fatal	Injury	Property Damage	Total Crashes	Crash Rate^
1	Main Avenue at 1st Street	0	2	26	28	0.69
2	Main Avenue at 3rd Street	1	2	14	17	0.63
3	Main Avenue at 4th Street	0	3	20	23	1.22
4	Pacific Avenue at 1st Street	0	2	12	14	0.64
5	Pacific Avenue at 3rd Street	0	5	14	19	0.85
6	Pacific Avenue at 4th Street	0	2	12	14	0.85
7	1st Street at Madrona Avenue	0	0	2	2	0.19
8	3rd Street at Madrona Avenue	0	2	8	10	0.76
9	OR 6 at Miller Avenue	0	1	10	11	0.97

Notes:
-Crash rate is based on number of accidents and AADT at the intersection
^Crash rates are measured in total crashes per million vehicles entering into the intersection

The range of intersection crash rates for the study area is 0.19 to 1.22. While none of these crash rates are exceedingly large, intersections Main Avenue at 4th Street and OR 6 at Miller Avenue intersections are on the upper end of this range. As result, these intersections will be kept in mind when developing alternatives.

Safety Priority Index System (SPIS)

In addition to crash rates, ODOT also assesses roadway safety via the Safety Priority Index System (SPIS). The SPIS takes into account crash frequency, crash rate, and crash severity. SPIS scores are computed for sections that are one tenth of a mile. The scores for different roadway segments can be compared to determine where safety improvement funds might best be spent. Typically, ODOT places the highest priority locations where SPIS scores fall within the top 10 percent in the entire state or region. The 2008 top 10% SPIS data for Region 2 was analyzed for this report.

One site within the study area, US 101 - Hoquarten Slough to Main between 1st and 2nd, appears in the top 10 percent of the Region 2, 2008 SPIS scoring. The 2008 SPIS data is the most recent data available and includes crash information from January 1, 2005 through December 31, 2007. **Table 9** lists the locations of the SPIS sites.

TABLE 9
Top 10 Percent Region 2 SPIS Locations within the Study Area

Location	Milepost (location)	
	Start	End
US 101	65.55 (Hoquarten Slough)	65.67 (Main Avenue between 1st and 2nd Street)

Source: ODOT, 2008

This site on US 101 runs southbound along Main Avenue (Main Avenue changes from a two-way to a one-way, southbound facility at MP 65.64). This site has not experienced any fatalities, but has experienced six injury crashes and 12 property damage only crashes. It is likely on a member of the SPIS list because of its total crash frequency.

IV. Access Management

A prime strategy for promoting increased safety and improved mobility is to manage access to the highway. Access management involves planning the location, design, and operation of driveways, medians, and intersections to provide access while, at the same time, preserving safety and roadway efficiency. Access management involves:

- Restricting the number of direct accesses to major surface streets,
- Providing reasonable indirect access,
- Effectively designing driveways, and
- Enforcing safe and efficient spacing of driveways to limit the number and location of conflict points.

An access inventory of all public and private driveway approaches throughout the study area was conducted. The results are summarized in **Appendix F, Table F.1** and **Figure F.1**. Documented in the table are approach width and use, business name (if applicable), lot number, and milepost location.

Existing Accesses

Existing approaches to roadways within the study area are depicted on **Figure F.1** and described below.

Within the study area, there are 26 approaches to westbound OR 6 (1st Street), as follows:

- 6 commercial driveways
- 10 residential driveways
- 4 institutional driveways
- 6 public streets

Within the study area, there are 19 approaches to eastbound OR 6 (3rd Street), as follows:

- 7 commercial driveways
- 2 residential driveways
- 3 institutional driveways
- 7 public streets

Within the study area, there are 6 approaches to southbound US 101 (Main Avenue), as follows:

- 2 commercial driveways
- 4 public streets

Within the study area, there are 10 approaches to northbound US 101 (Pacific Avenue), as follows:

- 5 commercial driveways
- 4 public streets
- 1 vacant property driveway

Within the study area, there are 4 approaches to Madrona Avenue, as follows:

- 2 residential driveways
- 1 institutional driveway
- 1 public alley

Within the study area, there are two approaches to 4th Street. Both approaches are commercial driveways.

State Spacing Standards

The State of Oregon has codified access management and spacing standards. The purpose of these standards is to provide a safe and efficient transportation system by protecting highway traffic from the hazards of unrestricted and unregulated entry from adjacent properties. Oregon Administrative Rule (OAR) 734-051-0115 specifies access management standards for ODOT facilities. The standards are based on the functional classification of the highway, the general type of land use (i.e., rural, urban), and the posted speed. In the Tillamook study area, both US 101 and OR 6 are subject to state access spacing standards. Relevant state access management spacing standards for US 101 and OR 6 are found in Table 1 and Table 2, respectively, of the OAR Division 51 Tables. These Division 51 tables are provided here as **Table 10** and **11**, with applicable spacing standard values bolded in each table.

TABLE 10
Division 51 Tables, Table 1:ODOT Access Management Spacing Standards for Private and Public Approaches on Statewide Highways (1)(2)(3)(4)
Measurement is in Feet; these standards are relevant to US 101 in the Tillamook study area..*

Posted Speed(5) **(miles per hour)**	**Rural Expressway ****	**Rural**	**Urban Expressway ** *****	**Urban *****	**STA******
≥55	5,280	1,320	2,640	1,320	
50	5,280	1,100	2,640	1,100	
40 & 45	5,280	990	2,640	990	
30 & 35		770		720	(6)
≤25		550		520	**(6)**

Notes:

**Measurement of the approach road spacing is from center to center on the same side of the roadway*

*** Spacing for Expressway at-grade intersections only. See the OHP for interchange spacing guidelines.*

****These standards also apply to Commercial Centers.*

*****Special Transportation Area*

(1) These access management spacing standards are for unsignalized approaches only. Signal spacing standards supersede access management spacing standards for approaches.

(2) These access management spacing standards do not apply to approaches in existence prior to April 1, 2000 except as provided in OAR 734-051-0115(1)(c) and 734-051-0125(1)(c).

(3) For infill and redevelopment, see OAR 734-051-0135(4).

(4) For deviations to the designated access management spacing standards see OAR 734-051-0135.

(5) Posted (or Desirable) Speed: Posted speed can only be adjusted (up or down) after a speed study is conducted and that study determines the correct posted speed to be different than the current posted speed. In cases where actual speeds are suspected to be much higher than posted speeds, the Department reserves the right to adjust the access management spacing accordingly. A determination can be made to go to longer access management spacing standards as appropriate for a higher speed. A speed study will need to be conducted to determine the correct speed.

(6) Minimum access management spacing for public road approaches is the existing city block spacing or the city block spacing as identified in the local comprehensive plan. Public road connections are preferred over private driveways and in STAs driveways are discouraged. However, where driveways are allowed and where land use patterns permit, the minimum access management spacing for driveways is 175 feet (55 meters) or mid-block if the current city block spacing is less than 350 feet (110 meters).

According to **Table 10**, private driveways onto statewide highways inside STAs are discouraged; where conditions do permit them, the access spacing standard is 175 feet, or mid-block if the current city block spacing is less than 350 feet. Based on this standard, the spacing standard for private approaches to US 101 in the Tillamook study area is mid-block, given that the average city block spacing along the US 101 corridor in the study area is approximately 200 feet. Public road spacing is the existing city block spacing.

Of the eight private approaches onto US 101 (Main and Pacific avenues) in the Tillamook study area, only approach #26 appears to meet the "mid-block" spacing standard.

TABLE 11
Division 51 Tables, Table 2:ODOT Access Management Spacing Standards for Private and Public Approaches on Regional Highways (1)(2)(3)(4)
Measurement is in Feet; these standards are relevant to OR 6 in the Tillamook study area).*

Posted Speed(5) **(miles per hour)**	**Rural Expressway** **	**Rural**	**Urban Expressway** ** ***	**Urban** ***	**STA**
≥55	5,280	990	2,640	990	
50	5,280	830	2,640	830	
40 & 45	5,280	750	2,640	750	
30 & 35		600		425	(6)
≤25		450		**350**	(6)

Notes:

**Measurement of the approach road spacing is from center to center on the same side of the roadway*

*** Spacing for Expressway at-grade intersections only. See the OHP for interchange spacing guidelines.*

****These standards also apply to Commercial Centers.*
(1) These access management spacing standards are for unsignalized approaches only. Signal spacing standards supersede access management spacing standards for approaches.
(2) These access management spacing standards do not apply to approaches in existence prior to April 1, 2000 except as provided in OAR 734-051-0115(1)(c) and 734-051-0125(1)(c).

(3) For infill and redevelopment, see OAR 734-051-0135(4).
(4) For deviations to the designated access management spacing standards see OAR 734-051-0135.
(5) Posted (or Desirable) Speed: Posted speed can only be adjusted (up or down) after a speed study is conducted and that study determines the correct posted speed to be different than the current posted speed. In cases where actual speeds are suspected to be much higher than posted speeds, the Department reserves the right to adjust the access management spacing accordingly. A determination can be made to go to longer access management spacing standards as appropriate for a higher speed. A speed study will need to be conducted to determine the correct speed.
(6) Minimum access management spacing for public road approaches is the existing city block spacing or the city block spacing as identified in the local comprehensive plan. Public road connections are preferred over private driveways and in STAs driveways are discouraged. However, where driveways are allowed and where land use patterns permit, the minimum access management spacing for driveways is 175 feet (55 meters) or mid-block if the current city block spacing is less than 350 feet (110 meters).

According to **Table 11**, the spacing standard for public and private approaches to OR 6 (1st Street and 3rd Street) in the Tillamook study area is 350 feet. None of the public or private approaches to OR 6 meet this standard.

Local Spacing Standards

City of Tillamook access spacing standards are provided in 22.1.17(E) of the city's zoning code. The city's spacing standard is 10 feet on local streets and 50 feet on all other roads. Madrona Avenue and 4th Street are the only city-owned roadways in the study area that contain existing street approaches.

As Madrona Avenue is classified as a local street, the access spacing standard is 10 feet. All four of the private approaches on Madrona Avenue appear to meet the city's access spacing standard.

4th Street (between Main and Pacific avenues) is classified as a Minor Collector. Both of the private approaches on 4th Street are located between Main and Pacific avenues therefore the access spacing standard is 50 feet. Of these two approaches, approach #23 does not meet the city spacing standard, while approach #24 does.

V. Summary of Existing Conditions

Operational Conditions

The intersection of Main Avenue and 3rd Street fails to meet mobility standards.

The following intersections currently have 95th percentile queue lengths that exceed storage capacity.

- Main Avenue and 1st Street
- Main Avenue and 3rd Street
- Main Avenue and 4th Street
- Pacific Avenue and 1st Street
- Pacific Avenue and 3rd Street
- Pacific Avenue and 4th Street

Crash Analysis Results

Based on the crash analysis, all roadway segments analyzed are all currently higher than the state average for a similar roadway type; however, the segments are short and do not offer a good comparison with the state averages. While none of the study intersection crash rates appear unusually high, there are two intersections whose crash rates are slightly higher than the rest. These intersections, Main Avenue/4th Street and OR 6/Miller Avenue, might benefit from a more in depth analysis. In addition, one segment within the study area appears in the top 10 percent SPIS scoring within ODOT Region 2. This is likely the result of high crash frequency; no fatalities are recorded at this SPIS location.

Access Conditions

Of the eight private approaches on US 101 in the study area, only one meets the applicable state access spacing standard. Of the 32 private approaches on OR 6 in the study area, none meet the applicable state access spacing standard. Of the six private approaches on local city streets in the study area, only one does not meet the applicable city access spacing standard.

Appendix A

Figure A.1 Traffic Study Intersections

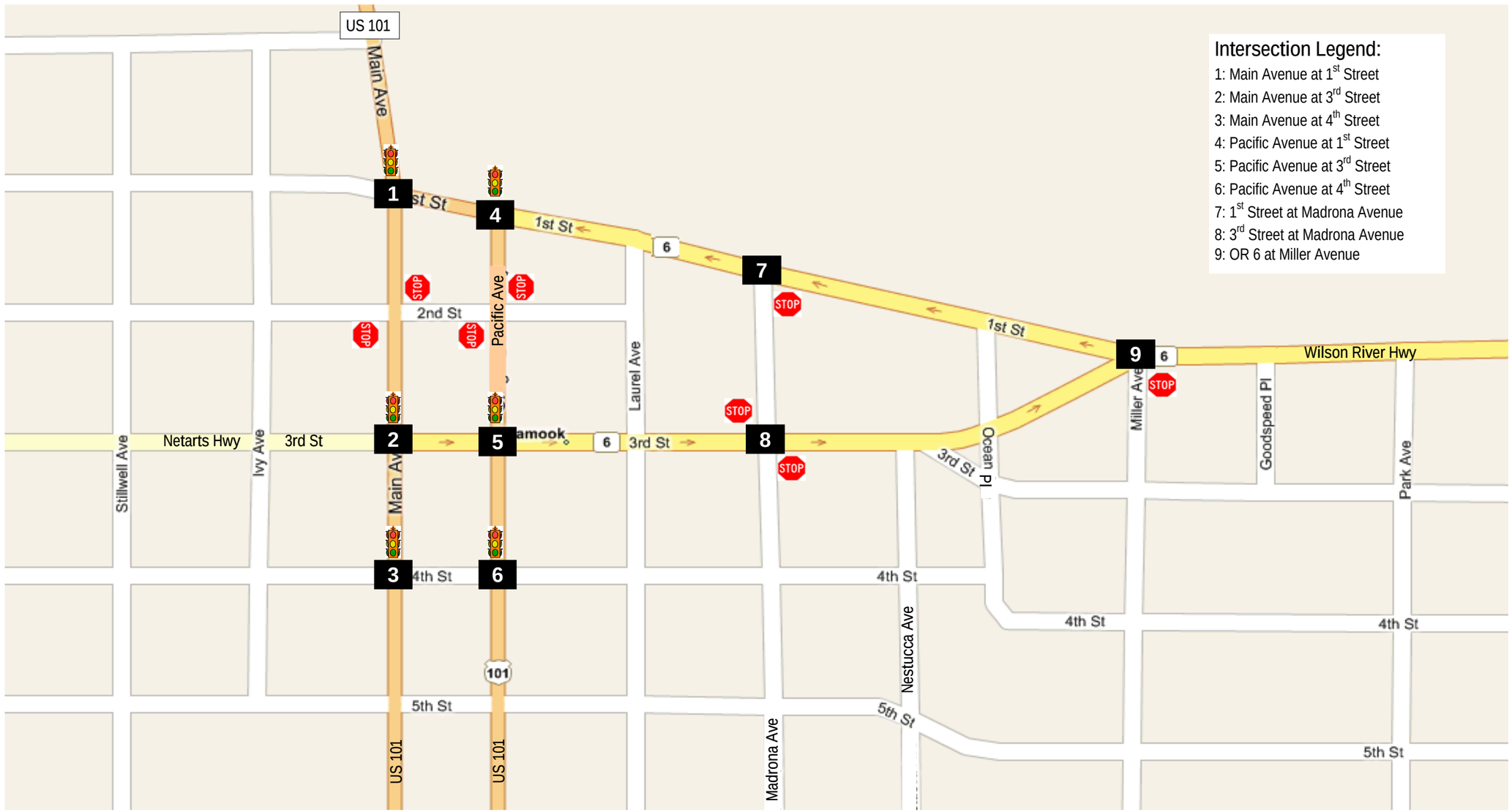

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FIGURE A.1 Tillamook: US 101/OR 6 Alternatives Study

Traffic Study Intersections

Legend/Notes:

* Maps source: Microsoft Live Maps

Signalized Intersection

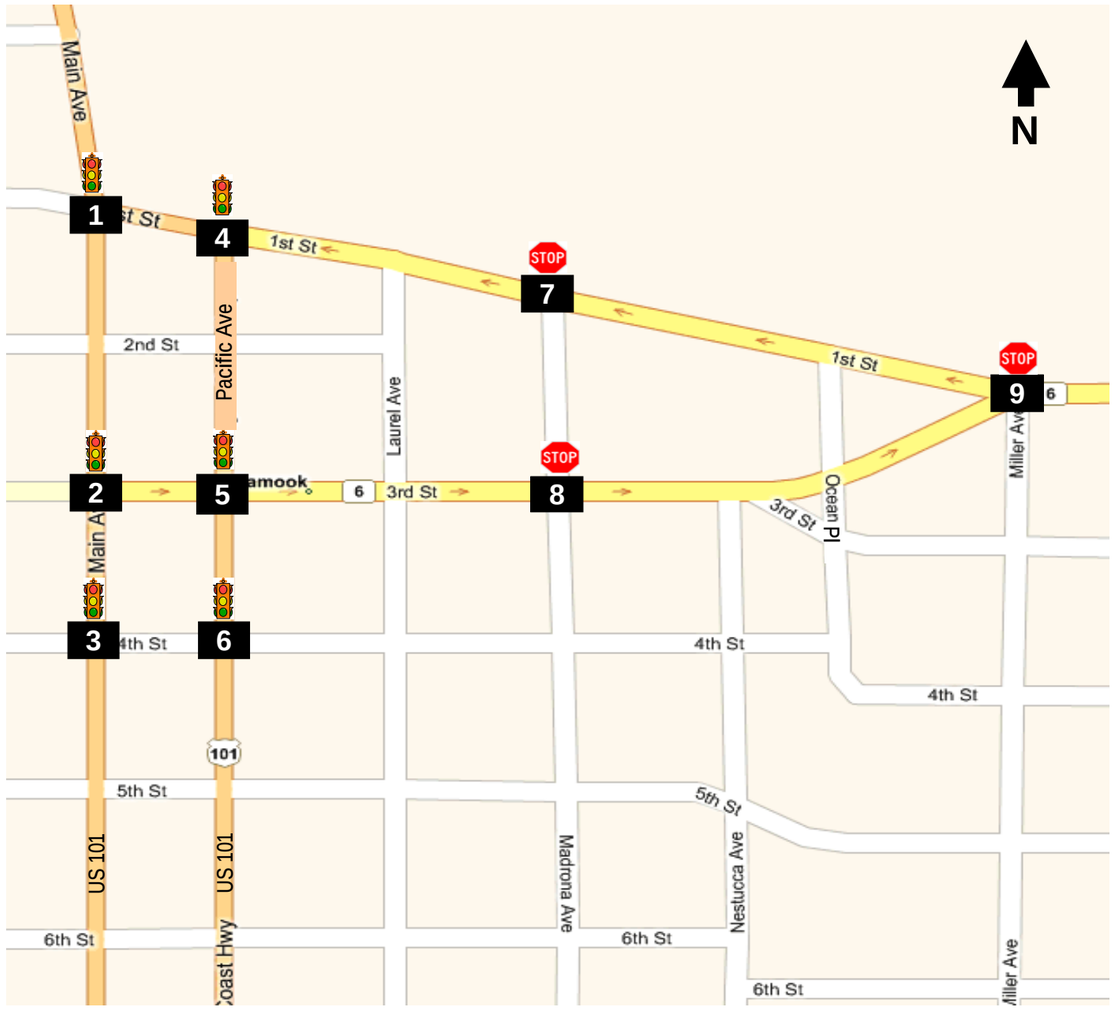
Stop-Controlled Intersection

Study Intersections

N

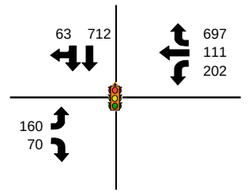
Appendix B

Figures B.1 – B.3 Traffic Volumes



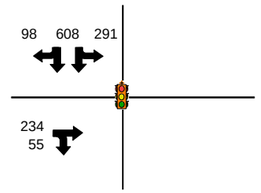
1	Main Ave. & 1st St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



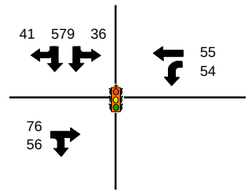
2	Main Ave. & 3rd St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



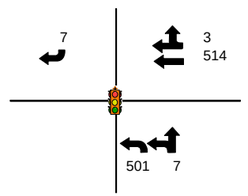
3	Main Ave. & 4th St.

Peak Hour: 3:15-4:15 PM
Date: September 30, 2008
Type: 16 Hour Video Count



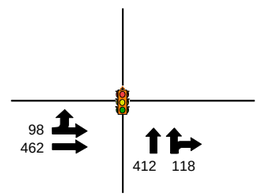
4	Pacific Ave. & 1st St.

Peak Hour: 11:30 AM - 12:30 PM
Date: September 30, 2008
Type: 16 Hour Video Count



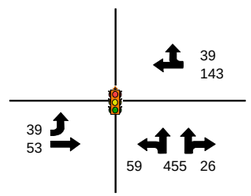
5	Pacific Ave. & 3rd St.

Peak Hour: 4:30-5:30 PM
Date: September 30, 2008
Type: 16 Hour Video Count



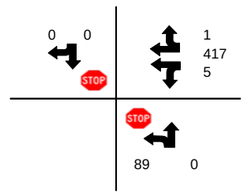
6	Pacific Ave. & 4th St.

Peak Hour: 4:45-5:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



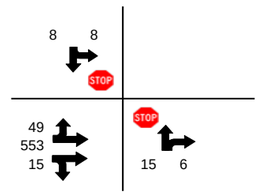
7	1st St. & Madrona Ave.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



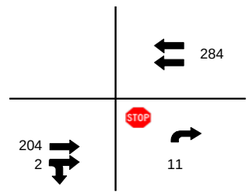
8	3rd St. & Madrona Ave.

Peak Hour: 4:30-5:30 PM
Date: September 30, 2008
Type: 16 Hour Video Count



9	OR 6 & Miller Ave.

Peak Hour: 4:15-5:15 PM
Date: September 30, 2008
Type: 16 Hour Video Count



Note:
Intersection map source: Microsoft Live Maps

Legend:

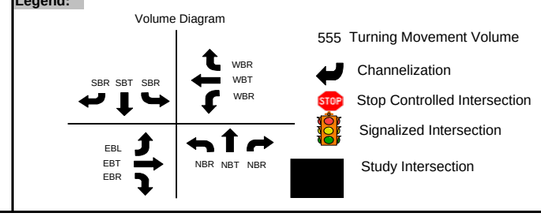


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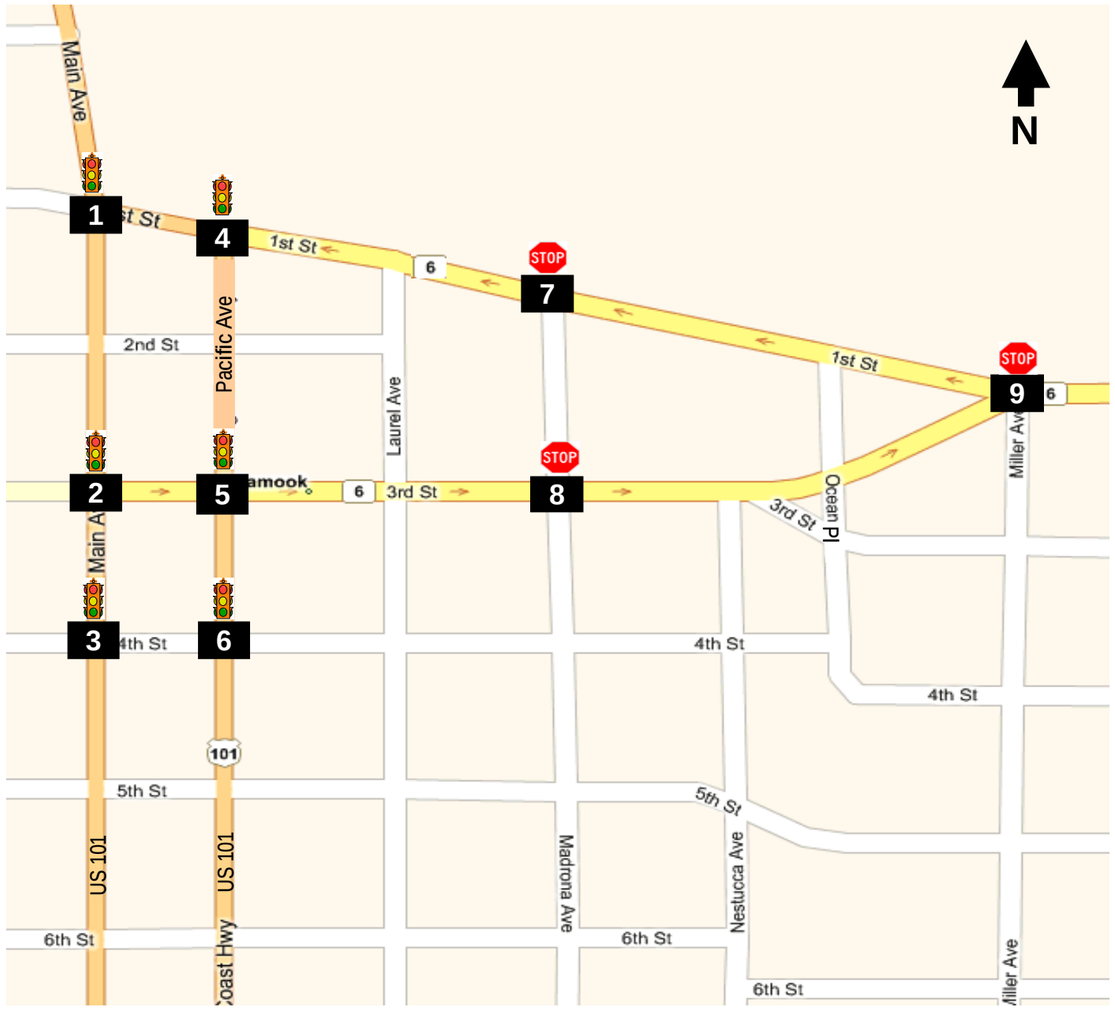
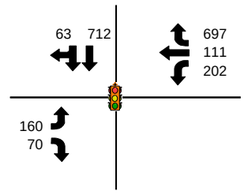
FIGURE B.1 Tillamook: US 101/OR 6 Alternatives Study

Raw Count: 2008 Individual Intersection Peak Hour Volumes & Channelization



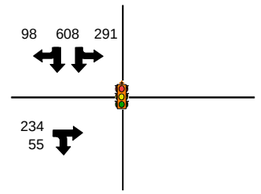
1	Main Ave. & 1st St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



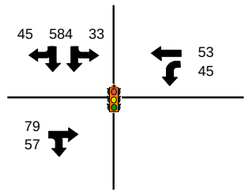
2	Main Ave. & 3rd St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



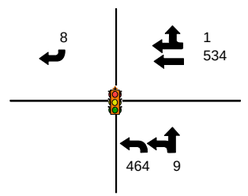
3	Main Ave. & 4th St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



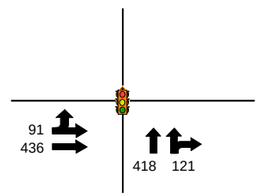
4	Pacific Ave. & 1st St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



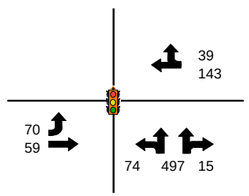
5	Pacific Ave. & 3rd St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



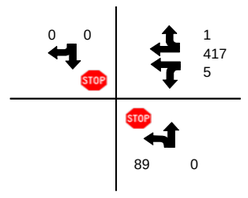
6	Pacific Ave. & 4th St.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



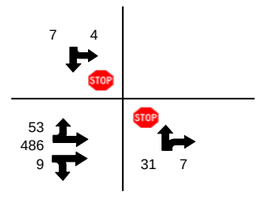
7	1st St. & Madrona Ave.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



8	3rd St. & Madrona Ave.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count



9	OR 6 & Miller Ave.

Peak Hour: 3:45-4:45 PM
Date: September 30, 2008
Type: 16 Hour Video Count

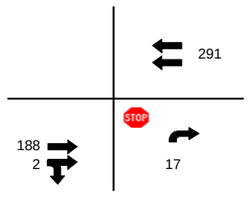


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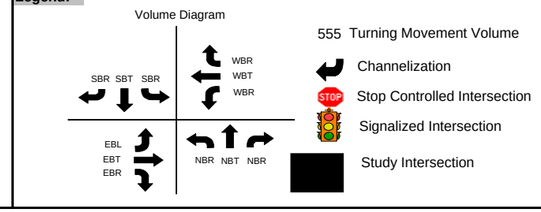
FIGURE B.2 Tillamook: US 101/OR 6 Alternatives Study

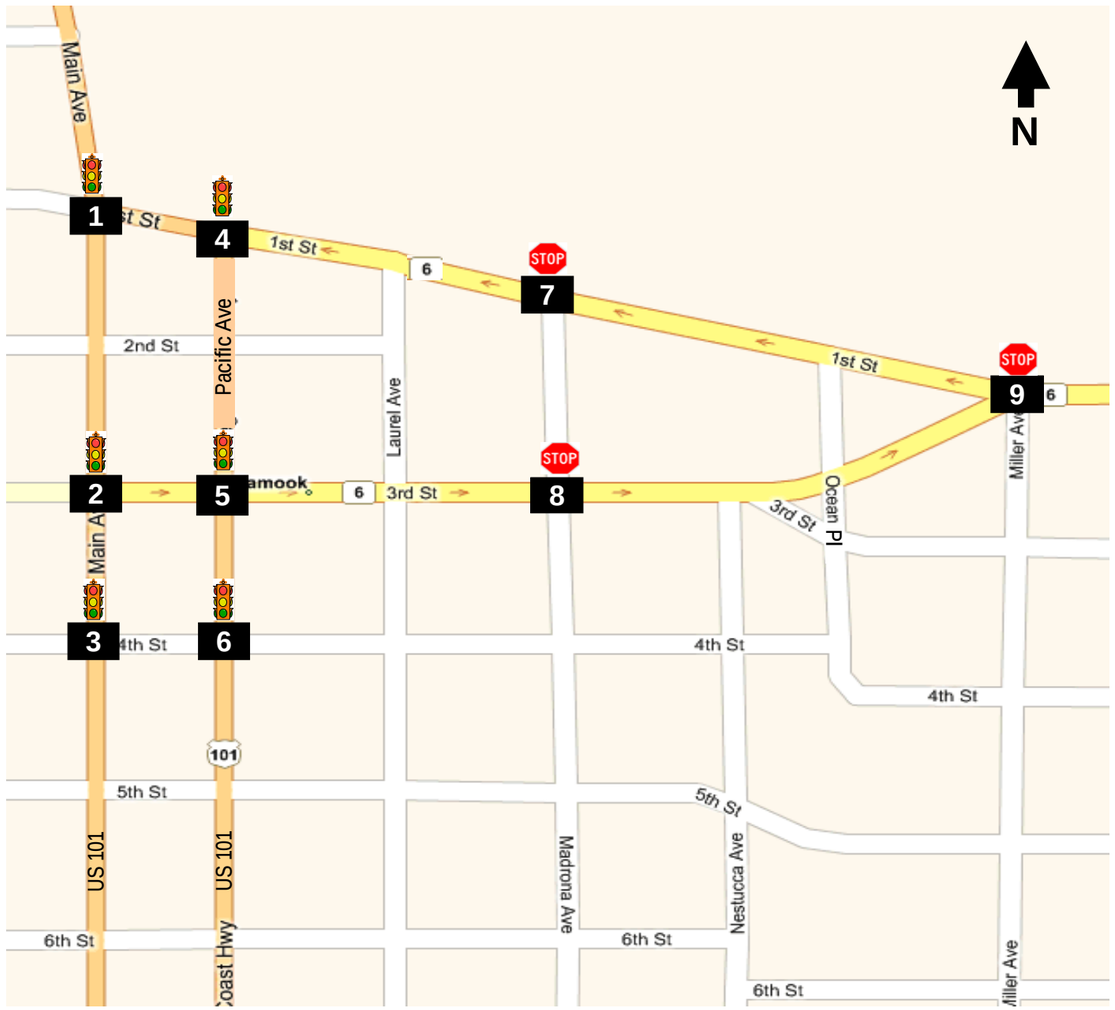
Raw Count: 2008 System Wide Peak Hour Volumes & Channelization

Notes:

1. System Peak hour is 3:45-4:45 PM
2. Intersection map source: Microsoft Live Maps

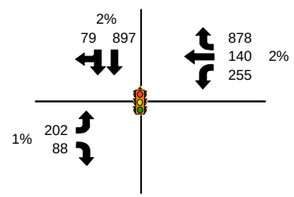
Legend:





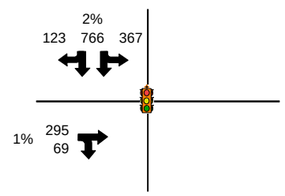
1	Main Ave. & 1st St.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.93
Type: 16 Hour Video Count



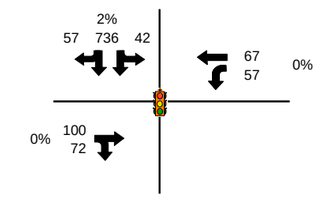
2	Main Ave. & 3rd St.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.95
Type: 16 Hour Video Count



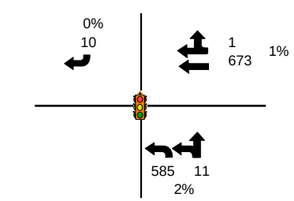
3	Main Ave. & 4th St.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.94
Type: 16 Hour Video Count



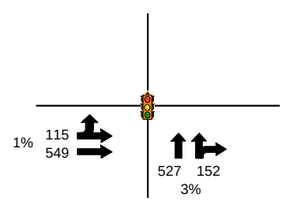
4	Pacific Ave. & 1st St.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.97
Type: 16 Hour Video Count



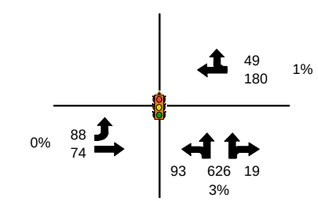
5	Pacific Ave. & 3rd St.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.97
Type: 16 Hour Video Count



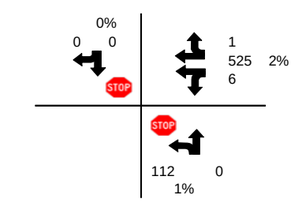
6	Pacific Ave. & 4th St.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.94
Type: 16 Hour Video Count



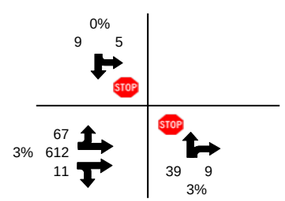
7	1st St. & Madrona Ave.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.93
Type: 16 Hour Video Count



8	3rd St. & Madrona Ave.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.90
Type: 16 Hour Video Count



9	OR 6 & Miller Ave.

Peak Hour: 3:45-4:45 PM 30th HV Factor: 1.26
Date: September 30, 2008 PHF: 0.95
Type: 16 Hour Video Count

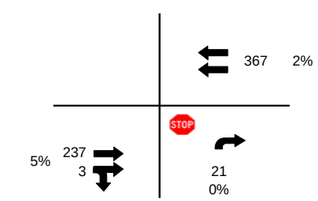


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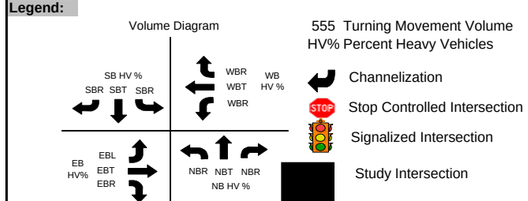
FIGURE B.3 Tillamook: US 101/OR 6 Alternatives Study

2008 Existing 30th Highest Hour Volumes: Unbalanced Volumes & Channelization

Notes:

1. The reported Peak Hour Factor (PHF) is for the overall intersection
2. Truck Percentages calculated from raw counts
3. System Peak hour is 3:45-4:45 PM
4. All 30th Highest Hour volumes were seasonally adjusted
5. Intersection map source: Microsoft Live Maps

Legend:



Appendix C

Tillamook: US 101/OR 6 Alternatives Study Methods and Assumptions TM#2a

Tillamook: US 101/OR 6 Alternatives Study Methods and Assumptions Memorandum

PREPARED FOR: Tony Snyder/ODOT

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DATE: October 17, 2008

This memorandum outlines the traffic analysis and evaluation framework that will be used in the Tillamook: US 101/OR 6 Alternatives study. Its intent is to state the key assumptions and methodologies that will be used as part of the study's traffic analysis. The analysis years, study area limits, travel demand forecasting and modeling methodologies, safety analysis methods, and operational parameters will all be discussed in this memo.

To meet project schedule, please submit comments to Norm Rauscher by October 24, 2008.

I. Analysis Years & Time Periods

Transportation analysis will be conducted for the following years:

- Existing Year (2008)
- Design Year (2030)

The traffic analysis will be conducted for the 30th highest hour volume. An overall study area peak hour will be determined by 16-hour intersection turning movement counts that will be collected as part of the study.

II. Traffic Study Area Limits

The traffic study area of the Tillamook: US 101/OR 6 Alternatives study includes roadways that are the jurisdiction of two different agencies: the City of Tillamook and the Oregon Department of Transportation (ODOT). The study area includes US 101 and OR 6 as shown in Table 1.

TABLE 1

Tillamook: US 101/OR 6 Alternatives Study - Traffic Study Area Mile Posts

State Highway Number/Street Name	Route Number	Begin MP/Cross Street	End MP/Cross Street
Wilson River Highway No. 37	OR 6 Westbound (1st St)	0.00 Main Street	0.28 Miller Avenue
Wilson River Highway No. 37	OR 6 Eastbound (3rd St)	0.00 Main Street	0.28 Miller Avenue
Oregon Coast Highway No. 9	US 101 Southbound (Main Ave)	65.64 1st Street	65.79 4th Street
Oregon Coast Highway No. 9	US 101 Northbound (Pacific Ave)	65.64 1st Street	65.82 4th Street

Table 2 shows the key study area roadways and ODOT classifications. The intersection names, jurisdictions, and count information are listed in Table 3. Figure A.1 in Appendix A of the *Tillamook: US 101/OR 6 Alternatives Study Existing Conditions TM#2b* shows the location of each study intersection.

TABLE 2

Tillamook: US 101/OR 6 Alternatives Study – Traffic Study Area Roadways

Roadway	State Highway Name	State Highway Number	ODOT Functional Classification
City of Tillamook			
1st Street (west of Main Avenue)	N/A	N/A	Minor Collector
4th Avenue	N/A	N/A	Minor Collector
Madrona Avenue	N/A	N/A	Local Road
Miller Avenue (north of 3rd Street)	N/A	N/A	Local Road
Miller Avenue (south of 3rd Street)	N/A	N/A	Minor Collector
Oregon Department of Transportation			
US 101 southbound (Main Avenue)	Oregon Coast Highway	9	Principal Arterial
US 101 northbound (Pacific Avenue)	Oregon Coast Highway	9	Principal Arterial
OR 6 westbound (1st Street – Pacific to Main Avenue)	Wilson River Highway	37	Principal Arterial
OR 6 westbound (1st Street east of Pacific Avenue)	Wilson River Highway	37	Minor Arterial
OR 6 eastbound (3rd Street east of Main Avenue)	Wilson River Highway	37	Minor Arterial
OR 6 (3rd Street west of Main Avenue)	Netarts Highway	131	Major Collector

TABLE 3

Tillamook: US 101/OR 6 Alternatives Study – Traffic Study Intersections

ID #	Intersection	Jurisdiction	Date	Count Hours
1	Main Avenue at 1st Street	ODOT	9/30/2008	6AM-10PM
2	Main Avenue at 3rd Street	ODOT	9/30/2008	6AM-10PM
3	Main Avenue at 4th Street	ODOT	9/30/2008	6AM-10PM
4	Pacific Avenue at 1st Street	ODOT	9/30/2008	6AM-10PM
5	Pacific Avenue at 3rd Street	ODOT	9/30/2008	6AM-10PM
6	Pacific Avenue at 4th Street	ODOT	9/30/2008	6AM-10PM
7	1st Street at Madrona Avenue	ODOT	9/30/2008	6AM-10PM
8	3rd Street at Madrona Avenue	ODOT	9/30/2008	6AM-10PM
9	OR 6 at Miller Avenue	ODOT	9/30/2008	6AM-10PM

III. Existing and Future Traffic Volumes

Turning movements over a 16-hour period were collected for each of the study area intersections. The peak hour turning movement counts will be adjusted to account for seasonal effects according to ODOT Transportation Planning Analysis Unit (TPAU) *Analysis Procedures Manual*. The Coastal Destination and Coastal Destination Routes were searched in the ATR (Automatic Traffic Recorder) Characteristic Table and none of the resulting ATR sites had the same characteristics as the study area. Therefore, the 2008 Seasonal Trend Table will be used to develop the 30th highest peak hour traffic volumes. An average of the Coastal Destination and Coastal Destination Route trends will be used as shown in Table 4. The resulting seasonal adjustment is 1.26.

TABLE 4

Tillamook: US 101/OR 6 Alternatives Study – 2008 Seasonal Trend Adjustment

Trend	15-Sep	1-Oct	Peak Period Seasonal Factor	Trend for Count Date 30-Sept	Seasonal Adjustment
Coastal Destination	0.9220	0.9877	0.8362	0.9836	1.1763
Coastal Destination Route	0.9302	1.0488	0.7797	1.0414	1.3356
Average Seasonal Adjustment					1.26

The derived 30th highest hour design volumes will be balanced between adjacent study intersections as outlined by ODOT standards. The existing conditions analysis will be conducted using the 30th highest hour volumes. If possible, the study will assign one peak hour for use in the traffic analysis. If the characteristics of the traffic count data show that different peak hours occur at different locations within the study area, multiple peak hours will be utilized in the analysis.

IV. Forecasting/Modeling Methodology

Travel demand forecasts for study intersections in the Tillamook: US 101/OR 6 Alternatives study will be determined by analyzing the ODOT Future Volume Tables. The latest tables provide 2006 traffic volumes, forecast traffic volumes for the year 2027, and a statistical descriptor (R-squared value) that provides the reliability of the forecast for all state highways. Consistent with ODOT guidelines, growth rates for future forecasts will be developed using Future Volume Table estimates with R-squared values above 0.75 for the 21-year planning period. When the adjustment factor is calculated, it will be applied to the balanced 2008 30th highest hour volumes which will then be balanced again to get the 2030 future volumes.

Based on the scope of work, up to five design alternatives will be tested as part of this project.

V. State, Regional, and Local Mobility Standards

State highway mobility standards were developed for the 1999 Oregon Highway Plan (OHP) as a method to gauge reasonable and consistent standards for traffic flow along state

highways. These mobility standards consider the classification (e.g., freeway, district) and location (rural, urban) of each state highway. Mobility standards are based on V/C ratios. The 1999 OHP, with amendments adopted by the Oregon Transportation Commission from November 1999 through January 2006, was released on August 23, 2006. This version of the 1999 OHP will be used in this study.

Table 5 shows the OHP and HDM mobility standards for each roadway in the traffic study area. These standards will be applied to all study intersections since they are all within ODOT jurisdiction. Table 6 shows the mobility standards for each intersection in the study area. Table 6 is developed from Table 5. The most conservative mobility standard for each intersecting roadway is chosen for the intersection mobility standard. Table 6 will be used to identify mobility standards in the existing and future conditions analysis.

TABLE 5

Tillamook: US 101/OR 6 Alternatives Study – Highway Mobility Standards

Highway/ Roadway	Segment	OHP Highway Classification	Highway Category	Area	Posted Speed	Applicable V/C Ratio	
						Existing or Future No-Build Operational Analysis	Future Build Operational Analysis
US 101	1st to 3rd Street	Statewide NHS, TR, SB, STA	Statewide (not a freight route)	STA	N/A[1]	0.90	0.90
US 101	3rd to 4th Street	Statewide NHS, SB, STA	Statewide (not a freight route)	STA	N/A[1]	0.90	0.90
OR 6	east of US 101	Regional FR, TR	Freight Route on a Regional Hwy	Non-MPO	<=35 mph	0.85	0.75
OR 6	west of US 101	District	District / Local Interest Road	Non-MPO	<=35 mph	0.90	0.80
Madrona Avenue	1st to 3rd Street	N/A	District / Local Interest Road	Non-MPO	<=35 mph	0.90	0.80
Miller Avenue	South of OR 6	N/A	District / Local Interest Road	Non-MPO	<=35 mph	0.90	0.80

1 – posted speed for this roadway segment does not affect which V/C standard is applicable

NHS – National Highway System

TR – Federally Designated Truck Route

SB – State and/or Federal Scenic Byway

STA – Special Transportation Area

FR – State Freight Route

Existing and No-Build Mobility Source: Adopted Oregon Highway Plan as Amended in July 2006 (Table 6)

Future Mobility Source: ODOT Highway Design Manual (Table 10-1)

TABLE 6

Tillamook: US 101/OR 6 Alternatives Study – Intersection Mobility Standards

Intersection		Control Type	Overriding Highway Category		Existing or Future No-Build Mobility Standard		Future Build Mobility Standard	
Main Avenue (US 101, MP 65.64)	1st Street (OR 6, MP 0.00)	Signal	Freight Route on a Regional Hwy		0.85		0.75	
Main Avenue (US 101, MP 65.74)	3rd Street (OR 6, MP 0.00)	Signal	Freight Route on a Regional Hwy		0.85		0.75	
Main Avenue (US 101, MP 65.79)	4th Street	Signal	Statewide (not a freight route)		0.90		0.90	
Pacific Avenue (US 101 MP, 65.68)	1st Street (OR 6 MP 0.00)	Signal	Freight Route on a Regional Hwy		0.85		0.75	
Pacific Avenue (US 101, PM 65.77)	3rd Street (OR 6, MP 0.03)	Signal	Freight Route on a Regional Hwy		0.85		0.75	
Pacific Avenue (US 101, MP 65.82)	4th Street	Signal	Statewide (not a freight route)		0.90		0.90	
1st Street (OR 6, MP 0.11)	Madrona Avenue	TWSC	Freight Route on a Regional Hwy[1]	District / Local Interest Road[2]	0.85[1]	0.90[2]	0.75[1]	0.80[2]
3rd Street (OR 6, MP 0.14)	Madrona Avenue	TWSC	Freight Route on a Regional Hwy[1]	District / Local Interest Road[2]	0.85[1]	0.90[2]	0.75[1]	0.80[2]
OR 6 (EB MP 0.28, WB MP 0.25)	Miller Avenue	TWSC	Freight Route on a Regional Hwy[1]	District / Local Interest Road[2]	0.85[1]	0.90[2]	0.75[1]	0.80[2]

[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

Notes:
- Signal: Signalized Intersection
- TWSC: Two-Way Stop controlled

VI. Traffic Analysis Software and Input Assumptions

Synchro software, version 7, will be used for the intersection analysis. The reported results will be the V/C ratios from the HCM report. The assumptions are listed in Table 7. Consultant will worked with TPAU for inputs for timing, detectors and simulation inputs.

TABLE 7

Tillamook: US 101/OR 6 Alternatives Study – Synchro Operations Parameters/Assumptions

Arterial Intersection Parameters	Condition	
	Existing (2008)	**No-Build and Build Alternatives**
PHF (Peak Hour Factor)	From traffic count.	- 0.85 for side street approaches - 0.90 for State Highway Minor Arterials - 0.95 for State Highway Major Arterials If traffic count has higher PHFs than default PHFs, then continue using the existing PHFs
Conflicting Bikes and Pedestrian per Hour	From traffic count, if not provided, assume 10 peds/bikes per approach	From Existing
Area Type	Default	From Existing
Ideal Saturation Flow Rate per Lane (for all movements)	1750	From Existing
Lane Width	From As-builts, field visit or ODOT website, otherwise 12 feet	From Existing
Percent Heavy Vehicles	From traffic count, otherwise 5%	From Existing
Percent Grade	From As-builts, otherwise 0%	From Existing
Parking Maneuvers per Hour	If on-street parking allowed, assume some maneuvers (approx. 1 maneuver per stall)	From Existing
Bus Blockages	From field visit, otherwise assume 0	From Existing
Intersection signal phasing and coordination	From field visit and signal timing plans	Optimize phase and cycle length, phase sequence and offset (if signals are coordinated)
Intersection signal timing optimization limits	N/A, only performed in future year analysis	60 to 120 seconds depending on the number of phases[1]
Minimum Green time	From signal timing plans	For existing signals, same as existing. If additional signal warranted, 10 seconds if no pedestrian time is required
Yellow and all-red time	From signal timing plans	For existing signals, same as existing. If additional signal warranted, (Y) = 4 seconds and (R) = 1 second
Right Turn on Red	From field visit	From existing conditions, if additional signal, then “allow”
Vehicle Queues	95th Percentile, calculated based on an average of 25 feet per vehicle. SimTraffic will be used for both signalized and unsignalized intersections (the average of at least 5 runs of 1 hour length with 15-min peak divided out)[2]	Same as Existing

[1]Assumptions consistent with White Paper on Application of Oregon Highway Plan Mobility Standards.

[2]The simulation will be for one hour with the peak 15-minutes in the first 15 minutes. The results from this simulation will be applied to signalized and unsignalized intersections. Instructions provided by TPAU.

VII. Crash Analysis

A crash analysis will be conducted in the study area. Data will be collected from ODOT for the five most recent years available at time of project start date.

Analysis will include crash rates for each study intersection and major roadway segments; as well as calculations of crash rates with comparisons to published rates of similar facilities and identification of crash patterns and causes. Any sites in the study area within the top ten (10) percent of Safety Priority Index System (SPIS) will also be identified.

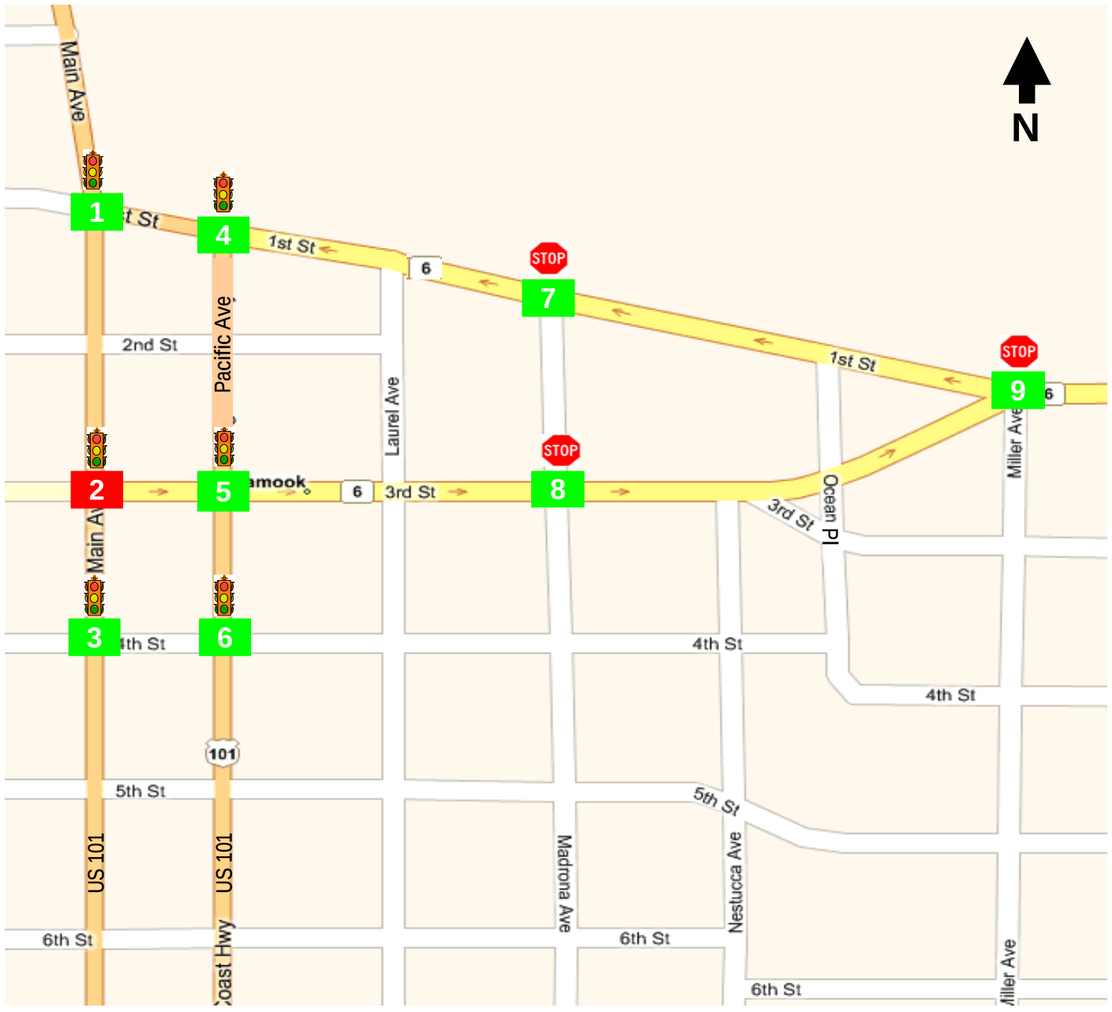
The roadway segments that will be analyzed as part of the crash analysis include:

- US 101 couplet from 1st Street to 4th Street
- OR 6 couplet from Main Street to Miller Avenue

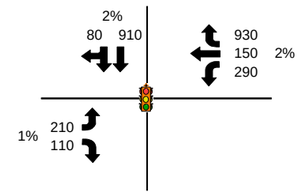
The future crash analysis will be qualitative in nature and will not include a quantitative future predictive analysis.

Appendix D

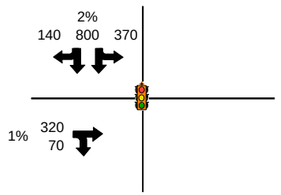
Figure D.1 Existing Conditions: Volumes, Channelization, & V/C Ratios



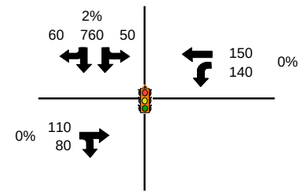
1	Main Ave. & 1st St.		
V/C Ratio Std: 0.85		30th HV Factor: 1.26	
V/C Ratio: 0.70		PHF: 0.93	



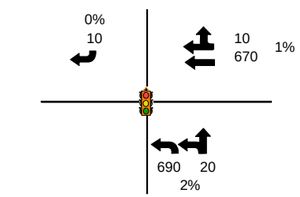
2	Main Ave. & 3rd St.		
V/C Ratio Std: 0.85		30th HV Factor: 1.26	
V/C Ratio: 0.89		PHF: 0.95	



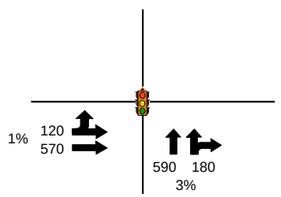
3	Main Ave. & 4th St.		
V/C Ratio Std: 0.90		30th HV Factor: 1.26	
V/C Ratio: 0.52		PHF: 0.94	



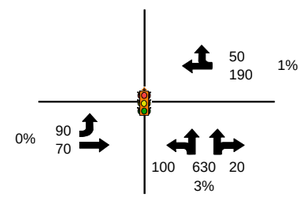
4	Pacific Ave. & 1st St.		
V/C Ratio Std: 0.85		30th HV Factor: 1.26	
V/C Ratio: 0.55		PHF: 0.97	



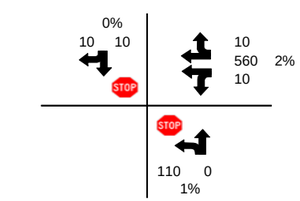
5	Pacific Ave. & 3rd St.		
V/C Ratio Std: 0.85		30th HV Factor: 1.26	
V/C Ratio: 0.60		PHF: 0.97	



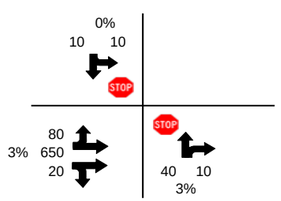
6	Pacific Ave. & 4th St.		
V/C Ratio Std: 0.90		30th HV Factor: 1.26	
V/C Ratio: 0.50		PHF: 0.94	



7	1st St. & Madrona Ave.		
V/C Ratio Std: 0.85		30th HV Factor: 1.26	
V/C Ratio: 0.25		PHF: 0.93	



8	3rd St. & Madrona Ave.		
V/C Ratio Std: 0.85		30th HV Factor: 1.26	
V/C Ratio: 0.23		PHF: 0.90	



9	OR 6 & Miller Ave.		
V/C Ratio Std: 0.85		30th HV Factor: 1.26	
V/C Ratio: 0.11		PHF: 0.95	

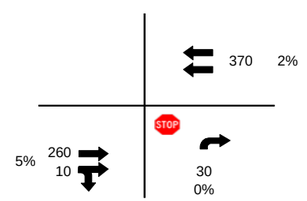


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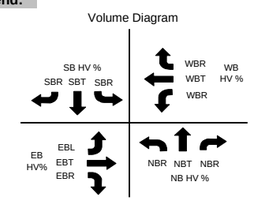
FIGURE D.1 Tillamook: US 101/OR 6 Alternatives Study

2008 Existing Conditions: 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. Balanced 30th Highest Volumes were used in the existing condition analysis
6. The reported Peak Hour Factor (PHF) is for the overall intersection
7. Truck Percentages calculated from raw counts
8. System Peak hour is 3:45-4:45 PM
9. All 30th Highest Hour volumes were seasonally adjusted
10. Intersection map source: Microsoft Live Maps

Legend:



555 Turning Movement Volume
HV% Percent Heavy Vehicles

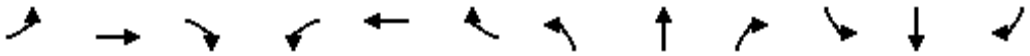
Channelization

Stop Controlled Intersection

Signalized Intersection

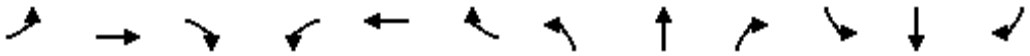
Appendix E

HCM Synchro Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	0	110	290	150	930	0	0	0	0	910	80
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		0.98	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)	1528		1533	1834	1658	1433					3210	
Flt Permitted	0.66		1.00	0.95	1.00	1.00					1.00	
Satd. Flow (perm)	1053		1533	1834	1658	1433					3210	
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)	215	0	118	312	161	1000	0	0	0	0	978	86
RTOR Reduction (vph)	0	0	28	30	0	0	0	0	0	0	10	0
Lane Group Flow (vph)	215	0	90	282	161	1000	0	0	0	0	1054	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)	28.0		28.0	28.0	28.0	65.0					29.0	
Effective Green, g (s)	28.0		28.0	28.0	28.0	65.0					29.0	
Actuated g/C Ratio	0.43		0.43	0.43	0.43	1.00					0.45	
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)	454		660	790	714	1433					1432	
v/s Ratio Prot					0.10						0.33	
v/s Ratio Perm	0.20		0.06	0.15		c0.70						
v/c Ratio	0.47		0.14	0.36	0.23	0.70					0.74	
Uniform Delay, d1	13.2		11.2	12.4	11.7	0.0					14.8	
Progression Factor	1.00		1.00	1.00	0.99	1.00					1.00	
Incremental Delay, d2	0.3		0.0	0.1	0.1	2.5					3.4	
Delay (s)	13.5		11.2	12.5	11.6	2.5					18.3	
Level of Service	B		B	B	B	A					B	
Approach Delay (s)		12.7			5.6			0.0			18.3	
Approach LOS		B			A			A			B	

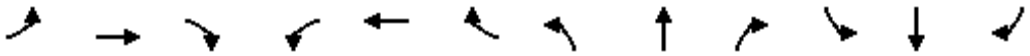
Intersection Summary			
HCM Average Control Delay	11.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	320	70	0	0	0	0	0	0	370	800	140
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		0.98									0.98	
Flt Protected		1.00									0.99	
Satd. Flow (prot)		1334									2716	
Flt Permitted		1.00									0.99	
Satd. Flow (perm)		1334									2716	
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	337	74	0	0	0	0	0	0	389	842	147
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	0	0	78	0
Lane Group Flow (vph)	0	399	0	0	0	0	0	0	0	0	1300	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)		20.8									36.2	
Effective Green, g (s)		20.8									36.2	
Actuated g/C Ratio		0.32									0.56	
Clearance Time (s)		4.0									4.0	
Vehicle Extension (s)		0.2									0.2	
Lane Grp Cap (vph)		427									1513	
v/s Ratio Prot		c0.30										
v/s Ratio Perm											0.48	
v/c Ratio		0.93									0.86	
Uniform Delay, d1		21.4									12.2	
Progression Factor		1.00									0.69	
Incremental Delay, d2		27.2									5.3	
Delay (s)		48.6									13.7	
Level of Service		D									B	
Approach Delay (s)		48.6			0.0			0.0			13.7	
Approach LOS		D			A			A			B	

Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

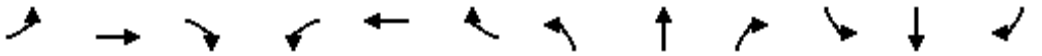
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	110	80	140	150	0	0	0	0	50	760	60
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)		1390		1651	1983						2967	
Flt Permitted		1.00		0.58	1.00						1.00	
Satd. Flow (perm)		1390		1004	1983						2967	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	117	85	149	160	0	0	0	0	53	809	64
RTOR Reduction (vph)	0	41	0	0	0	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	161	0	149	160	0	0	0	0	0	918	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)		20.0		20.0	20.0						37.0	
Effective Green, g (s)		20.0		20.0	20.0						37.0	
Actuated g/C Ratio		0.31		0.31	0.31						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)		428		309	610						1689	
v/s Ratio Prot		0.12			0.08							
v/s Ratio Perm				c0.15							0.31	
v/c Ratio		0.38		0.48	0.26						0.54	
Uniform Delay, d1		17.6		18.3	16.9						8.7	
Progression Factor		1.00		1.00	1.00						0.36	
Incremental Delay, d2		0.2		0.4	0.1						0.6	
Delay (s)		17.8		18.7	17.0						3.8	
Level of Service		B		B	B						A	
Approach Delay (s)		17.8			17.8			0.0			3.8	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

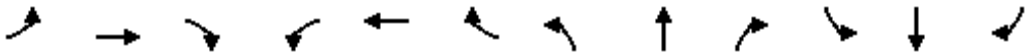
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	670	10	690	20	0	0	0	10
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	0.95				1.00
Satd. Flow (prot)					3037		1228	1235				1484
Flt Permitted					1.00		0.95	0.95				1.00
Satd. Flow (perm)					3037		1228	1235				1484
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	691	10	711	21	0	0	0	10
RTOR Reduction (vph)	0	0	0	0	2	0	61	61	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	699	0	302	308	0	0	0	10
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)					23.3		33.7	33.7				65.0
Effective Green, g (s)					23.3		33.7	33.7				65.0
Actuated g/C Ratio					0.36		0.52	0.52				1.00
Clearance Time (s)					4.0		4.0	4.0				
Vehicle Extension (s)					5.2		5.2	5.2				
Lane Grp Cap (vph)					1089		637	640				1484
v/s Ratio Prot					c0.23		0.25	c0.25				
v/s Ratio Perm												0.01
v/c Ratio					0.64		0.47	0.48				0.01
Uniform Delay, d1					17.4		10.0	10.0				0.0
Progression Factor					1.00		0.19	0.19				1.00
Incremental Delay, d2					1.9		2.0	2.0				0.0
Delay (s)					19.2		3.8	3.9				0.0
Level of Service					B		A	A				A
Approach Delay (s)		0.0			19.2			3.9			0.0	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

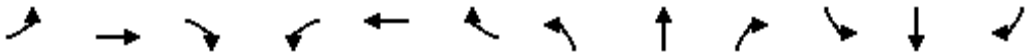
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	570	0	0	0	0	0	590	180	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)		2814						2674				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		2814						2674				
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)	124	588	0	0	0	0	0	608	186	0	0	0
RTOR Reduction (vph)	0	28	0	0	0	0	0	43	0	0	0	0
Lane Group Flow (vph)	0	684	0	0	0	0	0	751	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)		28.0						29.0				
Effective Green, g (s)		28.0						29.0				
Actuated g/C Ratio		0.43						0.45				
Clearance Time (s)		4.0						4.0				
Vehicle Extension (s)		0.2						0.2				
Lane Grp Cap (vph)		1212						1193				
v/s Ratio Prot								c0.28				
v/s Ratio Perm		0.24										
v/c Ratio		0.56						0.63				
Uniform Delay, d1		13.9						13.9				
Progression Factor		0.83						1.00				
Incremental Delay, d2		0.2						2.5				
Delay (s)		11.8						16.4				
Level of Service		B						B				
Approach Delay (s)		11.8			0.0			16.4			0.0	
Approach LOS		B			A			B			A	

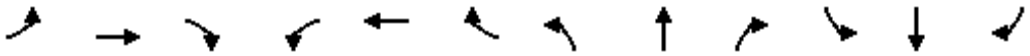
Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	70	0	0	190	50	100	630	20	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			1.00			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			2947				
Flt Permitted	0.56	1.00			1.00			0.99				
Satd. Flow (perm)	981	1750			1424			2947				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	96	74	0	0	202	53	106	670	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	12	0	0	3	0	0	0	0
Lane Group Flow (vph)	96	74	0	0	243	0	0	794	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)	28.0	28.0			28.0			27.0				
Effective Green, g (s)	28.0	28.0			28.0			27.0				
Actuated g/C Ratio	0.44	0.44			0.44			0.43				
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)	436	778			633			1263				
v/s Ratio Prot		0.04			c0.17							
v/s Ratio Perm	0.10							0.27				
v/c Ratio	0.22	0.10			0.38			0.63				
Uniform Delay, d1	10.8	10.2			11.7			14.1				
Progression Factor	1.00	1.00			1.00			1.00				
Incremental Delay, d2	0.1	0.0			0.1			0.7				
Delay (s)	10.9	10.2			11.9			14.8				
Level of Service	B	B			B			B				
Approach Delay (s)		10.6			11.9			14.8			0.0	
Approach LOS		B			B			B			A	

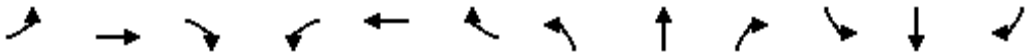
Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	63.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	10	560	10	110	10	0	0	10	10
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	11	602	11	118	11	0	0	11	11
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	623			10			359	654	10	644	649	326
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	623			10			359	654	10	644	649	326
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			78	97	100	100	97	98
cM capacity (veh/h)	960			1595			539	378	1066	345	382	670

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	312	312	129	22
Volume Left	11	0	118	0
Volume Right	0	11	0	11
cSH	1595	1700	520	487
Volume to Capacity	0.01	0.18	0.25	0.04
Queue Length 95th (ft)	1	0	24	3
Control Delay (s)	0.3	0.0	14.2	12.7
Lane LOS	A		B	B
Approach Delay (s)	0.2		14.2	12.7
Approach LOS			B	B

Intersection Summary				
Average Delay	2.8			
Intersection Capacity Utilization	38.0%	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)	80	650	20	0	0	0	0	40	10	10	10	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)	89	722	22	0	0	0	0	44	11	11	11	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												
vC, conflicting volume	10			754			937	931	392	592	942	20
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	10			754			937	931	392	592	942	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 %	94			100			100	82	98	96	95	100
cM capacity (veh/h)	1587			858			196	245	599	312	246	1043

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	450	383	56	22
Volume Left	89	0	0	11
Volume Right	0	22	11	0
cSH	1587	1700	278	275
Volume to Capacity	0.06	0.23	0.20	0.08
Queue Length 95th (ft)	4	0	18	7
Control Delay (s)	1.9	0.0	21.2	19.2
Lane LOS	A		C	C
Approach Delay (s)	1.0		21.2	19.2
Approach LOS			C	C

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

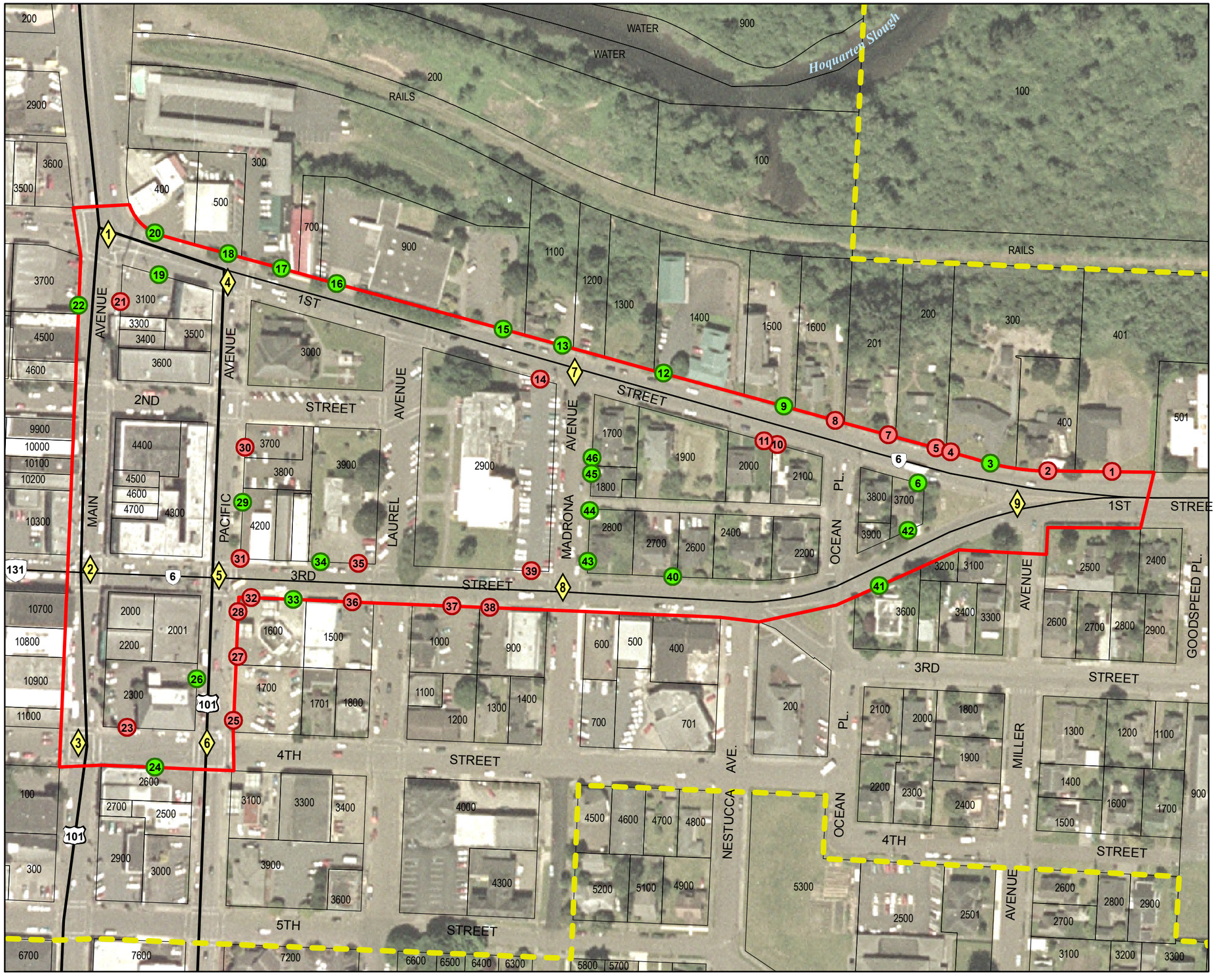
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	260	10	0	370	0	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.92	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	274	11	0	389	0	32
Pedestrians				10	10	
Lane Width (ft)				12.0	10.0	
Walking Speed (ft/s)				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			295		484	162
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			295		484	162
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	96
cM capacity (veh/h)			1255		513	847

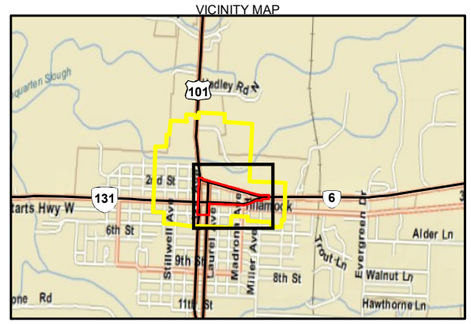
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	182	102	195	195	32
Volume Left	0	0	0	0	0
Volume Right	0	11	0	0	32
cSH	1700	1700	1700	1700	847
Volume to Capacity	0.11	0.06	0.11	0.11	0.04
Queue Length 95th (ft)	0	0	0	0	3
Control Delay (s)	0.0	0.0	0.0	0.0	9.4
Lane LOS					A
Approach Delay (s)	0.0		0.0		9.4
Approach LOS					A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix F

Figure F.1 and Table F.1 Access Inventory





LEGEND

- Study Intersections
- Access Locations in Traffic Study Area
  - Location Meets Access Standards
  - Location Does Not Meet Access Standards
- Project Study Area Boundary
- Traffic Study Area Boundary
- Taxlots

Notes:

1. Taxlots - Tillamook County, 2008
2. Airphoto - Tillamook County, 2003

N

0 50 100 200
Feet

FIGURE F.1
Surveyed Road Access Locations
US101/OR6 Intersection Refinement Plan, Tillamook

Table F.1

Tillamook: US 101/OR 6 Alternatives Study Access Inventory

Figure F.1 Approach Number	Mile Post	Tax Lot #	Property/Business Name	Approach Width (ft)	Approach Use	Side of Road (N/S/E/W)
WESTBOUND OR 6 (1ST STREET)						
1	0.29	401	Church of Christ Tillamook	17	private	N
S	0.25	N/A	Miller Ave		public street	S
2	0.23	400	Resident	10	single family residential	N
3	0.22	300	Resident	16	single family residential	N
4	0.21	300	Resident	14	single family residential	N
5	0.20	200	Resident	22	single family residential	N
6	0.20	3700	Resident	12	single family residential	S
7	0.19	201	Resident	11	single family residential	N
8	0.18	1600	Resident	11	single family residential	N
S	0.18	N/A	Ocean Place		public street	S
9	0.17	1500	Gateway Apartments	17	multiple family residential	N
10	0.16	2100	Resident	14	single family residential	S
11	0.16	2000	Resident	14	single family residential	S
12	0.13	1400	Maple Leaf Office Complex	21	2-way business	N
13	0.11	1100	parking lot	26	2-way parking lot	N
S	0.11	N/A	Madrona Avenue		public street	S
14	0.10	2900	Tillamook County Courthouse	26	2-way	S
15	0.09	900	U.S. Post Office	48	2-way	N
S	0.06	N/A	Laurel Avenue		public street	S
16	0.04	900	U.S. Post Office	37	2-way	N
17	0.02	300	McCluskey's Restaurant	15	1-way commercial	N
18	0.00	500	All Star Appliance	25	2-way commercial	N
S	0.00	N/A	Pacific Avenue		public street	S
S	-0.03	N/A	Main Avenue		public street	
19	65.66	3100	Rodeo Steak House & Grill	28	2-way commercial	S
20	65.66	400	Tillamook Shell & Grocery	38	2-way commercial	N
SOUTHBOUND US 101 (MAIN AVENUE)						
S	65.79	N/A	4th Street		public street	
S	65.74	N/A	3rd Street/OR 6 Eastbound		public street	
S	65.69	N/A	2nd Street		public street	
21	65.66	3100	Rodeo Steak House & Grill	19	2-way commercial	E

Table F.1

Tillamook: US 101/OR 6 Alternatives Study Access Inventory

Figure F.1 Approach Number	Mile Post	Tax Lot #	Property/Business Name	Approach Width (ft)	Approach Use	Side of Road (N/S/E/W)
22	65.66	3700	Tillamook Hearing Aid Center	16	1-way (exit)	W
S	65.64	N/A	1st Street/OR 6 Westbound		public street	
4TH STREET						
23	N/A	2300	Wells Fargo	19	1-way (exit)	N
24	N/A	2600	Tillamook Computers & Service LLC	17	1-way	S
NORTHBOUND US 101 (PACIFIC AVENUE)						
S	65.82	N/A	4th Street		public street	
25	65.81	1700	vacant	24	2-way	E
26	65.80	2300	Wells Fargo	30	1-way (entrance)	W
27	65.79	1600	Third St. Shell & Grocery	50	2-way commercial	E
28	65.78	1600	Third St. Shell & Grocery	21	1-way commercial	E
S	65.77	N/A	3rd Street/OR 6 Eastbound		public street	
29	65.75	4200	Little Cheese Coin-Op Laundromat	24	2-way commercial	E
30	65.73	3700	parking lot	23	2-way parking lot	E
S	65.72	N/A	2nd Street		public street	
S	65.68	N/A	1st Street/OR 6 Westbound		public street	
EASTBOUND OR 6 (3RD STREET)						
31	65.76	4200	Little Cheese Coin-Op Laundromat	19	1-way commercial	N
S	0.00	N/A	Main Avenue		public street	
S	0.03	N/A	Pacific Avenue		public street	
32	0.04	1600	Third St. Shell & Grocery	19	1-way commercial	S
33	0.06	1600	Third St. Shell & Grocery	26	2-way commercial	S
34	0.07	3900	Tillamook City Hall	21	1-way (entrance)	N
35	0.08	3900	Tillamook City Hall	16	1-way (exit)	N
36	0.08	1500	Kephart Floors	23	2-way commercial	S
S	0.09	N/A	Laurel Avenue		public street	
37	0.11	1000	La Mexicana Restaurant	24	2-way commercial	S
38	0.12	900	Ticor Title Insurance Co.	27	2-way business	S

Table F.1

Tillamook: US 101/OR 6 Alternatives Study Access Inventory

Figure F.1 Approach Number	Mile Post	Tax Lot #	Property/Business Name	Approach Width (ft)	Approach Use	Side of Road (N/S/E/W)
39	0.13	2900	Tillamook County Courthouse	32	2-way	N
S	0.14	N/A	Madrona Avenue		public street	
40	0.18	2700	Tillamook Bay Massage Center	14	residential	N
S	0.20	N/A	Nestucca Avenue		public street	S
S	0.22	N/A	Ocean Place		public street	
41	0.23	3600	Resident	23	single family residential	S
42	0.24	3700	Resident	14	single family residential	N
S	0.28	N/A	Miller Avenue		public street	
MADRONA AVENUE						
43	N/A	2800	Tillamook Police Department	25	2-way	E
44	N/A	none	Alley	16	public alley	E
45	N/A	1800	Resident	12	single family residential	E
46	N/A	1700	Resident	16	single family residential	E