



Refinement Plan Terrebonne

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Project #: 21463
ODOT Key #21162

To: Terrebonne Refinement Plan Project Management Team (PMT)

From: Marc Butorac, PE, Matt Kittelson, PE & Jacqueline Gulczynski – Kittelson & Associates, Inc.

Subject: Final Memorandum – Future System Conditions Analysis (Task 4.3)

This memorandum presents the key findings related to the year 2040 Baseline Needs Analyses (i.e., No Build) for the Terrebonne Refinement Plan (TRP). The No-Build analysis addresses the “quality of service” anticipated in the future for active modes of travel (i.e., walking, cycling, and transit) and the operational conditions projected to occur along key streets and intersections. Information contained in this memorandum will be the basis of the Alternatives Analysis and Concept Development Workshop forthcoming in the refinement planning process.

The memorandum is organized into the following sections:

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EXECUTIVE SUMMARY

The assessment of the future no-build transportation system conditions and the transportation network identified the following:

- Population forecasts estimate a 1.1% annual growth in Terrebonne and a population approaching 1,750 by the year 2040.
- Annual growth rates were applied to the six study intersections and the study segments. A 1.9% annual growth rate was applied to ODOT facility turning movements and a 3% annual growth rate was applied to County facilities.
- The following study intersections are not forecasted to meet mobility targets for either the side-street or mainline movement under 2040 conditions:
 - US 97/Lower Bridge Way
 - US 97/C Avenue
 - US 97/B Avenue
 - 11th Street/Smith Rock Way
 - US 97/11th Street
- The following intersection are expected to have 95th percentile queues that exceed available storage or exceed past adjacent intersections under 2040 conditions:
 - US 97/Lower Bridge Way (eastbound left-turn, northbound left-turn)
 - US 97/C Avenue (westbound and eastbound approaches)
 - US 97/B Avenue (westbound approach)
- Future segment volumes indicated that US 97 would operate near capacity in the study area. However, as Terrebonne continues to urbanize highway throughput capacities will likely decrease due to the need to adequately service side street approaches and result in highway breakdowns. Other communities in Central Oregon that currently experience travel demand similar to what is forecast for the Terrebonne area are served by a 4-lane highway.
- The existing pedestrian network throughout the urban area is largely incomplete. The only sidewalk facilities are present on B Avenue and a short segment of US 97. Nearly all higher order roadways scored a Level of Traffic Stress (LTS) 4 (high stress) with the exception of B Avenue. These conditions are expected to remain into the future.
- The existing B Avenue marked crosswalk at US 97 could possibly increase the risk of pedestrian related crashes if other pedestrian facility enhancements such as a Rectangular Rapid Flashing Beacon (RRFB) are not installed.
- The only dedicated bicycle facility in the community include bike lanes on a segment of US 97 between C Avenue and 11th Street. The remainder of the community relies on paved

- shoulders for bicycles. The Oregon Scenic Bikeway that bisects the community east-west does not have dedicated bicycle facilities. These conditions are expected to remain into the future.
- Speed data collected at three segments showed that the 85th percentile speeds on US 97 at Lower Bridge Way and C Avenue exceed the posted speed by 19 and 3 mph, respectively.
 - Ninety-three (93) crashes were reported in the greater Terrebonne area during the five-year study period. There were no fatal crashes during the study period.
 - Of the six study intersections, US 97/Lower Bridge Way and 11th Street/Smith Rock Way exceed the ODOT Critical Crash Rate over the past five-year period.

2040 POPULATION FORECASTS

Future needs were development based on forecast year 2040 traffic volumes. These volumes are intended to represent growth in local households, employment, and regional travel demand within the Terrebonne community.

Terrebonne is an unincorporated community within Deschutes County. As such, population estimates and forecasts have been inferred based on information contained within the Census and the Portland State University (PSU) Coordinated Population Forecast for Deschutes County¹. Table 1 shows 2010 population data for the Census as well as 2018 and 2040 estimates based on the PSU data.

Employment data forecasts for the Terrebonne community is not regularly maintained.

Table 1: Terrebonne Community Population Forecasts

Year	Population	Growth	
		Total	Annual
2010	1,257	-	
2018 (estimated)	1,368	+8.8%	1.1%/year
2040 (estimated)	1,727	+37.4%	

TRAFFIC VOLUME DEVELOPMENT

Growth factors were developed using ODOT’s historical trends method, which relies on traffic volumes from previous years to develop a growth pattern for use in projected future volumes. ODOT maintains Future Volumes Tables that summarize current and future year traffic volumes for state roadways throughout the State. To calculate the growth rate for Terrebonne, the singular Terrebonne historic count location and two locations from the north and two from the south were reviewed from the Future Volumes Table. The ODOT APM guidance states that data with an R-squared value (RSQ, a measure of fit) of less than 0.75 should not be used when calculating future growth. The Terrebonne count location exhibits an RSQ=0.16. Three of the four adjacent count locations exhibit RSQ values above 0.75. Based on these values, we propose an annual growth rate of 1.9% to evaluate future condition along US 97. Table 2 shows the ODOT Future Volumes Table and the respective values.

¹ Coordinated Population Forecast for Deschutes County, its Urban Growth Boundaries (UGB), and Area Outside UGBs, 2018-2068, Population Research Center, College of Urban and Public Affairs, Portland State University, June 30, 2018.

Table 2: ODOT Future Growth Table

HWY	MP	DIR	Location	2014	2036	RSQ ¹	Growth Rate
004 ²	105.83	1	0.10 mile south of Culver Highway	13000	18500	0.9830	1.9%
004 ²	112.83	1	Jefferson-Deschutes County Line	13600	19000	0.9361	1.8%
004	115.86	1	0.02 mile north of "A" Avenue at Terrebonne	13700	16300	0.1632	0.9%
004	118.50	1	0.02 mile north of O'Neil Highway	15600	21000	0.3341	1.6%
004 ²	119.09	1	North Redmond Automatic Traffic Recorder, Sta. 09-023, 0.57 mile south of O'Neil Highway No. 370	19700	27800	MODEL ³	1.9%
Average Growth							1.9%

¹RSQ=R-squared value, describing the fit of the data to the line

²Rows highlighted in grey = RSQ > 0.75, were used for the calculated growth rate

³MODEL = data was obtained from the Transportation Planning Analysis Unit (TPAU) Travel Demand Model

Deschutes County typically applies a 2-3% annual growth rate to forecast future volumes on county roads. A conservative 3% annual growth rate was applied to county roads including the turning movements of roads intersecting with US 97.²

2040 NO BUILD INTERSECTION AND STREETS OPERATIONS

As noted in the Plans & Policy Review Memorandum, limited transportation projects are planned in or near the Terrebonne community. Most notably, the Deschutes County Transportation System Plan identifies the need to grade-separate the US 97/Lower Bridge Way intersection. Also, the Terrebonne Community Plan identifies the need to improve pedestrian and bicycle facilities within the community, including crossings of US 97 and access to the Terrebonne Community School.

The Deschutes County TSP identifies planned improvements to US 97. The Future State Highway Project and Policies section explicitly identifies US 97 in Terrebonne by stating the following:

Deschutes County and ODOT have agreed US 97 will remain a three-lane cross section in Terrebonne...ODOT and Deschutes County will conduct a refinement plan for Terrebonne based on the goals and objectives of the adopted Terrebonne Community Plan...

Any future improvement to US 97 must comply with, or provide an amendment to the Deschutes County TSP.

² Growth of traffic volumes on County facilities is highly dependent on uncertain future development trends. To account for this variability, a lower growth rate of 1.5% for County roads will also be considered when evaluating the sensitivity of future alternatives to ensure facilities are not oversized.

No-Build Operational Analysis

This baseline analysis (also known as a “no build” alternative) has been performed assuming no improvements to the transportation network within the study area. This analysis will inform the Concept Develop Workshop that will occur in September 2018 where potential alternative solutions for the corridor, intersection, and highway transition elements of the project will be developed to address identified needs.

To evaluate year 2040 no build conditions, the study intersections and roadway segments were analyzed considering the developed future year volumes. Future 2040 weekday p.m. peak hour and daily volumes are shown in Figure 1. The operational results for the intersections and segments were compared with County and/or State performance standards to identify deficiencies. These standards are shown in Figure 3 and described in Table 3. ODOT defines intersection performance standards by “mobility targets” that are represented by a volume-to-capacity (v/c) ratio. The County defines performance standards by “level-of-service” (LOS), which is a rating from A to F to describe the experience of the user.

Table 3: Study Intersection Control and Mobility Target

Study Int. #	Intersection	Classification/ Jurisdiction	Intersection Control	Performance Standard
1	NW 19 th Street/Lower Bridge Way	County	Unsignalized	LOS D
2	US 97/Lower Bridge Way	ODOT	Unsignalized	Side-Street: v/c<0.80 Mainline: v/c<0.70
3	US 97/C Avenue	ODOT	Unsignalized	Side-Street: v/c<0.80 Mainline: v/c<0.70
4	US 97/B Avenue (Smith Rock Way)	ODOT	Unsignalized	Side-Street: v/c<0.80 Mainline: v/c<0.70
5	11 th Street/Smith Rock Way	County	Unsignalized	LOS D
6	US 97/S 11 th Street	ODOT	Unsignalized	Side-Street: v/c<0.80 Mainline: v/c<0.70

Roadway Segment Analyses

Table 4 summarizes the existing (2018) and future (2040) PM roadway segment analysis. The northbound segment on the south side of Terrebonne is expected to approach capacity with a calculated v/c ratio=0.91. However, the segment capacity estimates shown are based on a free flow, ideal conditions. As Terrebonne continues to urbanize highway throughput capacities will likely decrease due to the need to adequately service side street approaches and result in highway breakdowns.

Figure 2 shown the existing average daily traffic (ADT)³ along US 97 through Central Oregon and the number of existing travel lanes. As shown, the future estimated ADT through Terrebonne of 23,000-34,000 vehicles is similar to the ADT that currently exists in Bend and Redmond. Both areas are served by

³ Based on 2016 data provided via ODOT’s TransGIS database.

4-lane highway segments. As such, US 97 through Terrebonne should plan for the eventual need to provide a 4-lane highway.

Hourly segment volumes are provided in Appendix A.

Table 4: Study Segment Analysis Results

Roadway Segment	Direction	PM Peak Hour Capacity Estimate (vphpl)	2018 Conditions			2040 No Build		
			Daily Traffic Volume	PM Peak Hour Traffic Volumes	Calculated V/C Ratio	Daily Traffic Volume	PM Peak Hour Traffic Volumes	Calculated V/C Ratio
US 97 approx. 600 ft north of Lower Bridge Way	NB	1,700	15,213	584	0.34	23,018	884	0.52
	SB			640	0.38		968	0.57
US 97 approx. 100 ft south of C Avenue	NB	1,700	20,968	902	0.53	31,722	1,365	0.80
	SB			786	0.46		1,189	0.70
US 97 approx. 500 ft south of NW 10 th Street	NB	1,700	22,614	1,021	0.60	34,214	1,545	0.91
	SB			824	0.48		1,247	0.73

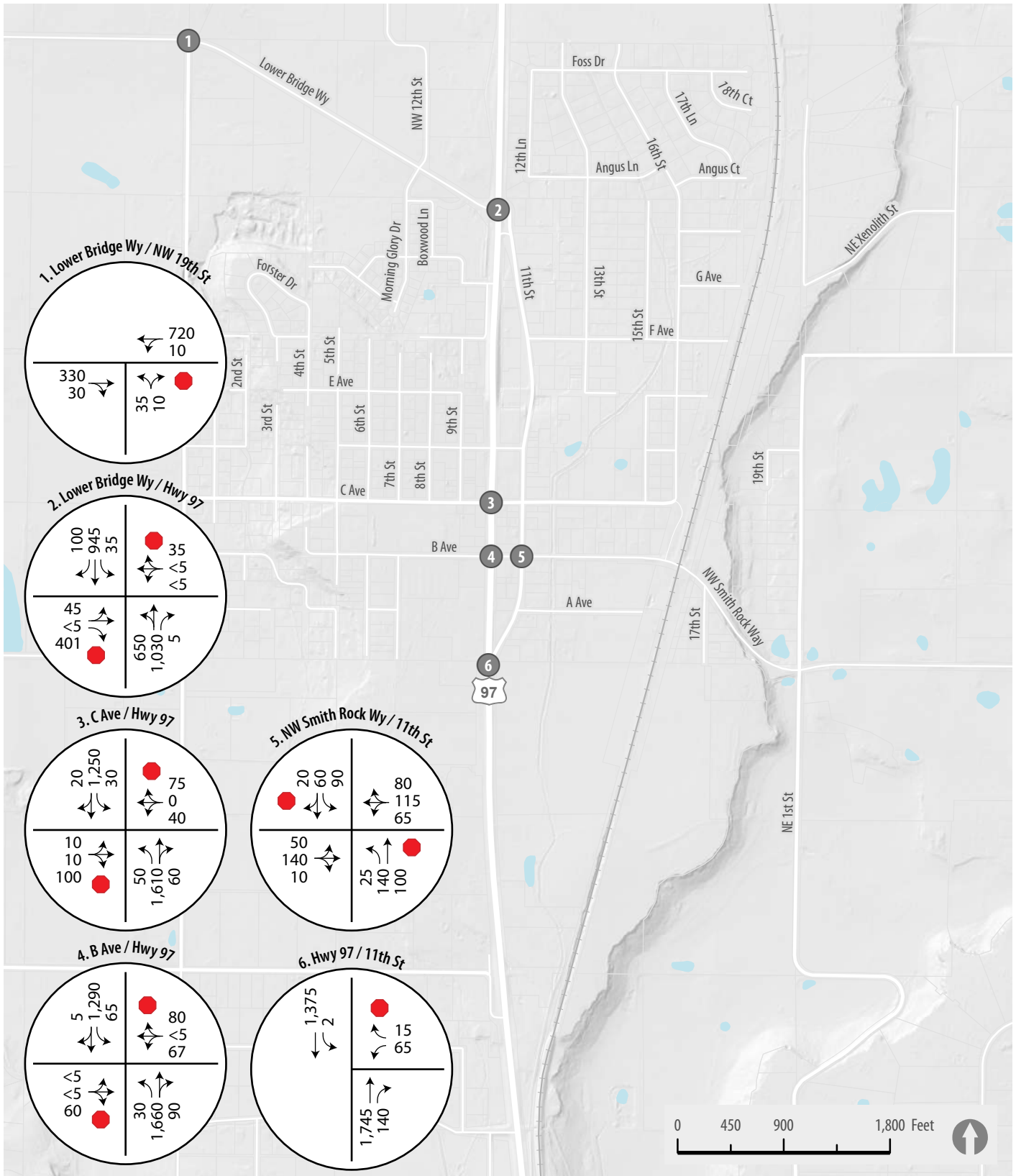
Note: Vehicles per hour per lane (vphpl)

Intersection Traffic Operations Analysis Results

The six study intersections examined in the Existing Conditions Memo (Technical Memorandum #4) were further evaluated during the future conditions analysis. The ODOT and County annual growth rates were applied to turning movements to determine future 2040 weekday p.m. peak hour forecast volumes. Appendix B contains detailed information about intersection operations and queuing under future no build conditions.

Figure 3 illustrates the future forecast weekday p.m. peak hour intersection operations. As shown in this analysis, several additional side street movements are expected to exceed mobility standards and experience significant delays. The movements that exceeded standards in the existing condition are expected to significantly worsen under the existing traffic control configuration. Additionally, the future forecast northbound left movement at US 97/Lower Bridge Way is expected to exceed ODOT standards and the 11th Street/Smith Rock Way intersection is expected to exceed county mobility standards.

The 95th percentile queue was evaluated at the six study intersections under the future forecast volumes. Figure 4 illustrates the expected length of the 95th percentile queue in the future forecast condition. Along with the westbound movement at US 97/B Avenue (identified in the Existing Conditions Memo), the westbound and eastbound movements at C Avenue are expected to exceed the mid-block spacing at the adjacent intersections. Additionally, the eastbound left-turn and northbound left-turn storage bays at US 97/Lower Bridge Way will likely experience queue spillback into the approaching through lanes. On US 97, the over-capacity conditions, combined with the side street over-capacity conditions may lead to potential safety issues for motorists, pedestrians, and bicyclists.



- Study Intersection
- Stop Sign

Figure 1

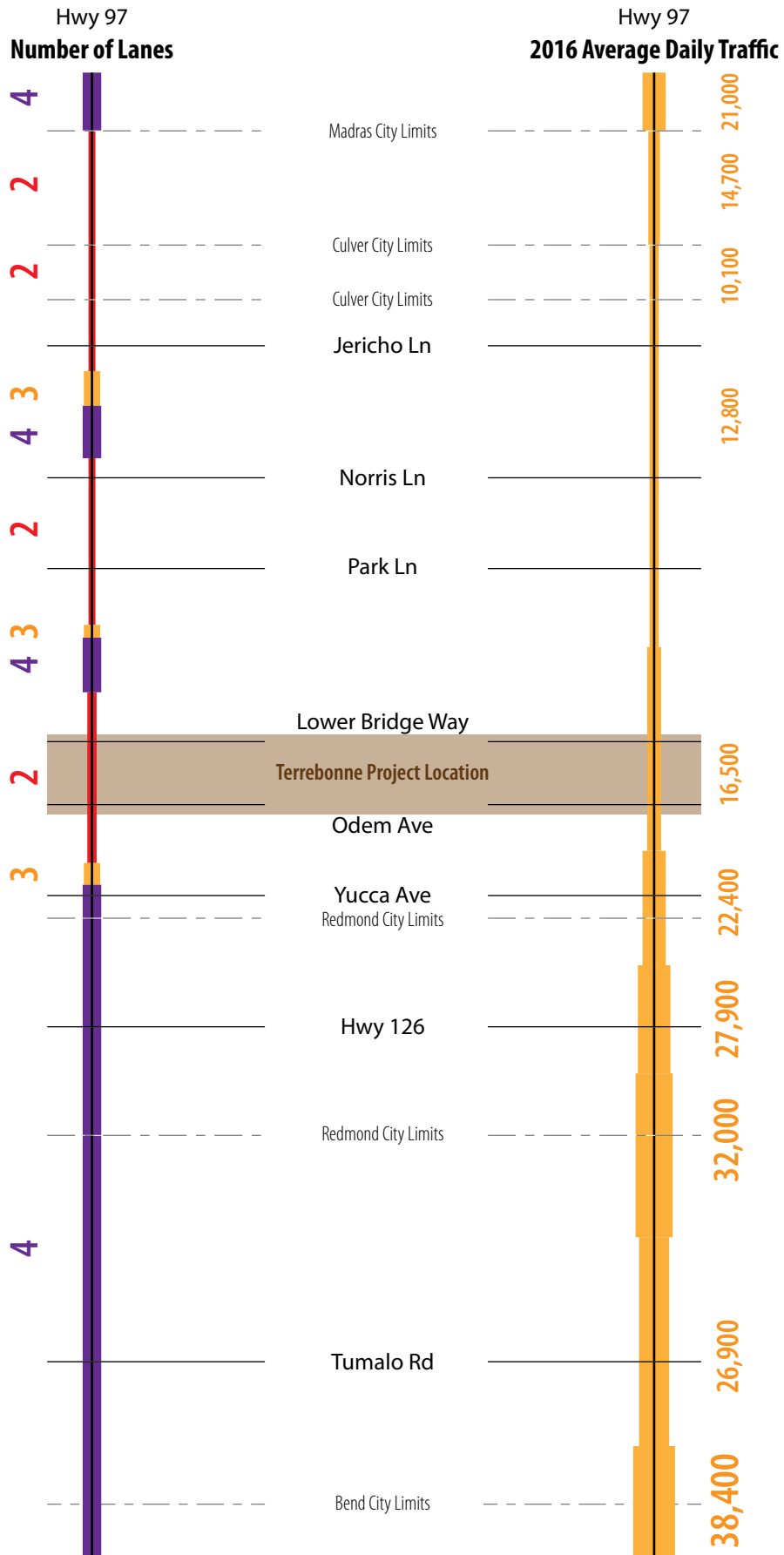
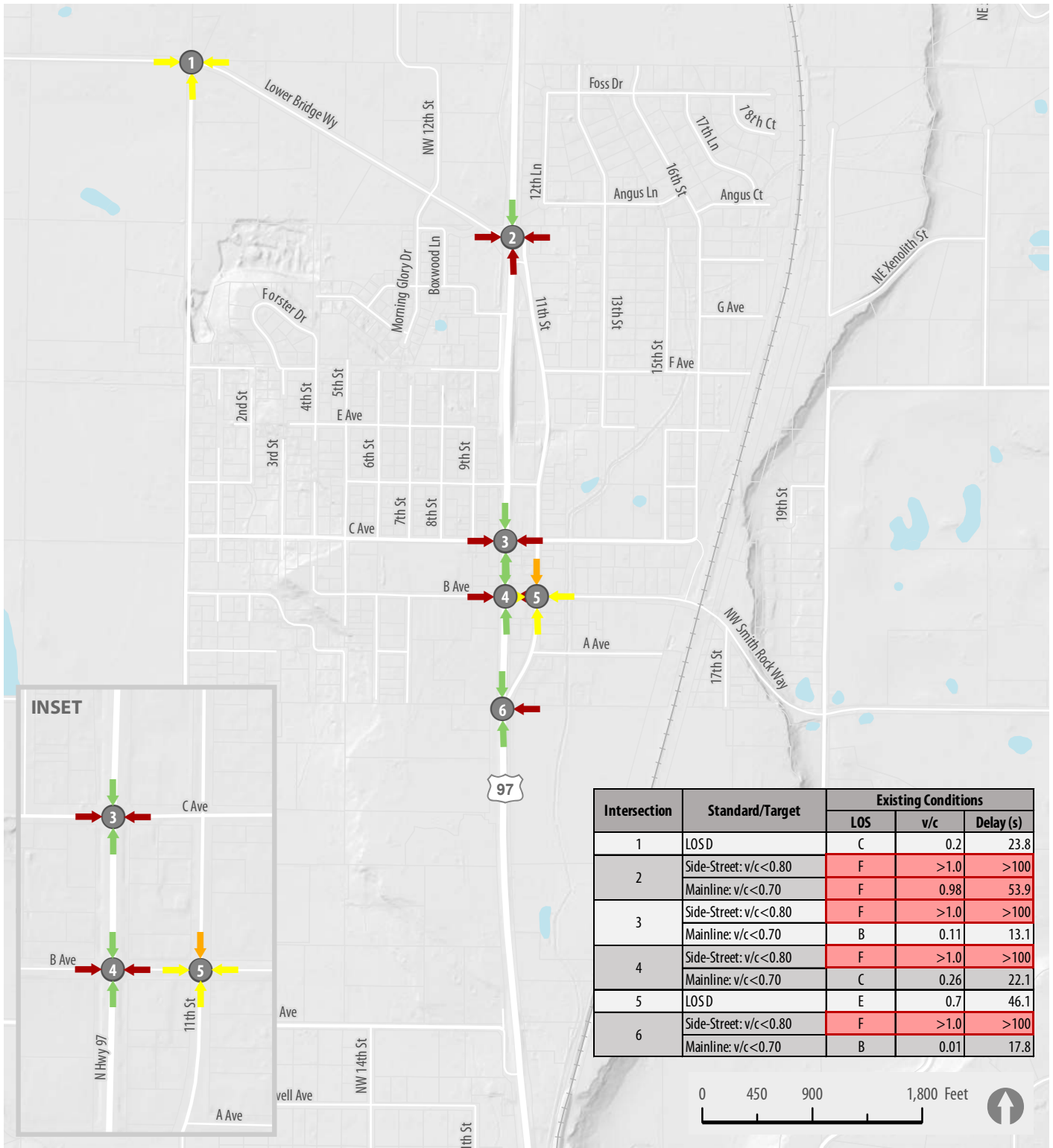


Figure 2

Number of Lane and Average Daily Traffic Volume



Level of Service by Direction

- ➔ A thru C
- ➔ D
- ➔ E
- ➔ F
- Study Intersection

Figure 3

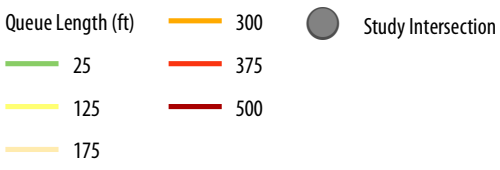
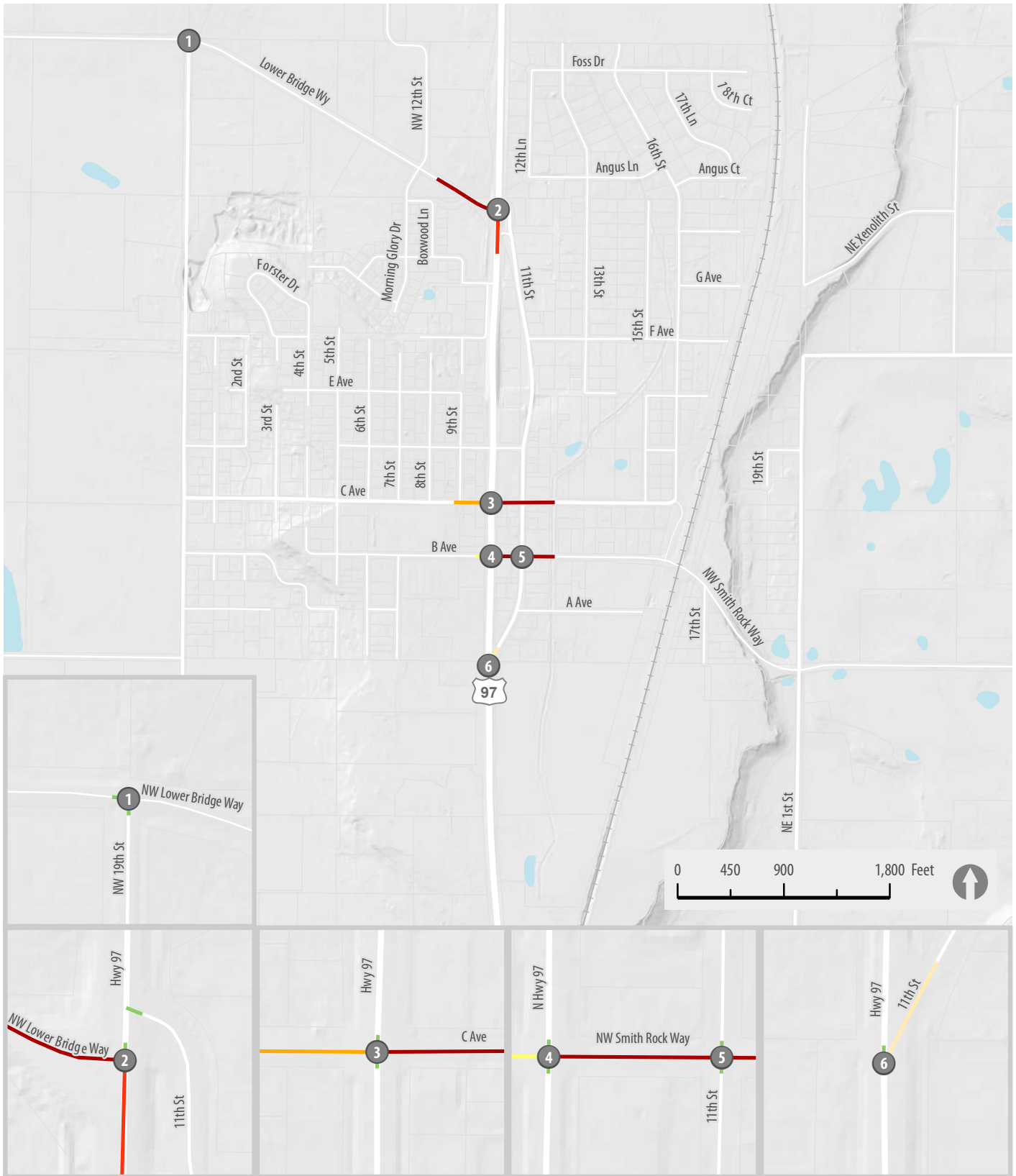


Figure 4

FUTURE MULTIMODAL FACILITIES

The existing pedestrian and bicycle network centers around the US 97/B Avenue intersection to provide access and accommodations to the school and surrounding businesses. Multimodal facilities on US 97 are crucial, however facilities on the surrounding network are critical to connectivity and commuter options throughout the community.

The Deschutes County TSP Section 5: *Planned Improvements* includes a planned Terrebonne area sidewalk map. The map is provided in Appendix C. The planned improvements center around the expansion of the existing sidewalk network surrounding the school and B Avenue. The plan shows complete sidewalks on C Ave from 19th Street to 14th Street and additional connections southeast of US 97/C Avenue.

Gaps and Deficiencies

The following section documents gaps and deficiencies in the existing pedestrian and bicycle system. Without improvements, these gaps and deficiencies are expected to remain into the future. A gap is defined as a missing link in the network, such as an identified key walking or biking route is missing sidewalk or designated bicycle facility. A deficiency is defined as a pedestrian or bicycle facility that does not meet the standard or is insufficient to meet the users' needs.

Pedestrian Facility Gaps and Deficiencies

Sidewalks currently exist in Terrebonne along US 97 from 11th Street to Central Avenue, along B Street and Smith Rock Way from the Terrebonne Community School to 11th Street, and along the northeast corner of the 11th Street/A Street intersection. A marked crosswalk with an overhead flashing beacon is in place at the US 97/B Street intersection.

As documented in the existing conditions analysis, pedestrian level of traffic stress (PLTS) in the Terrebonne community exceeds PLTS 3 except the frontage of the Terrebonne Community School along B Street. These conditions are expected to remain into the future.

A pedestrian crossing analysis was completed to evaluate whether the existing marked pedestrian crossing of US 97 at B Avenue should be enhanced. Table 11 of the Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations Final Report and Recommended Guidelines⁴ uses the roadway type (number of lanes and median type), vehicle ADT, and posted speed as contributing factors to considering a new marked crossing. US 97 is a two-lane road with vehicle ADT > 15,000 and a posted speed of 35 miles per hour at B Avenue. Based on this criterion, the existing B Avenue marked crosswalk could possibly increase the risk of pedestrian related crashes without other pedestrian facility enhancements such as a Rectangular Rapid Flashing Beacon (RRFB).

⁴ FHWA Publication Number HRT-04-100, September 2005

Bicycle Facility Gaps and Deficiencies

As noted in the existing conditions analysis, bike lanes are provided along US 97 from 11th Street to C Street. No other bicycle facilities exist within the Terrebonne community, including along the Scenic Bikeway route that travels through Terrebonne. Also, bicycle level of traffic stress is higher along all of US 97, 11th Street, Lower Bridge Way, Smith Rock Way, and other areas of the community. These conditions are expected to remain into the future.

CRASH HISTORY

As documented in the existing conditions memorandum, the crash rate the following intersections exceed the critical crash rate:

- US 97/Lower Bridge Way
- 11th Street/Smith Rock Way

These crash rates could potentially increase with the forecasted growth in traffic and increased congestion within the Terrebonne community

NO BUILD EVALUATION METRICS EVALUATION





The Goals & Objectives Memorandum for the TRP established goals, objectives, and evaluation criteria that provide a method for analyzing how project alternatives promote or detract from the key project goals. The following evaluation uses those criteria to assess the 2040 baseline traffic conditions and transportation system within the Terrebonne community. Future alternatives will be compared against these results to determine if specific project elements (corridor alignments, intersection improvements, and highway transitions) help the community move towards achieving goals.

The following evaluation criteria rating have been used to score the 2040 baseline, no-build alternative conditions:

- The alternative addresses the criterion and/or makes substantial improvements in the criteria category
- ◐ The alternative partially addresses the criterion and/or makes moderate improvements in the criteria category
- The alternative does not support the intent of, provides minor or incidental benefit and/or negatively impacts the criteria category
- N/A The alternative neither meets nor does not meet intent of criterion. The alternative has no effect, or criterion does not apply

Table 5 shows the results of this evaluation.

Table 5: Comparing the Goals, Objectives, & Evaluation Criteria to Future Conditions

Goal	Objective	Evaluation Criteria	Baseline Scenario	
			Meets?	Comment
Community & Livability: provide for a high quality of life by balancing US 97 mobility needs with community values and interests.	<ul style="list-style-type: none"> • Increase transportation choices on US 97 by adding or improving bicycle and pedestrian routes, crossing, and connections to transit, including a crossing at US 97 & B Street which serves as a school crossing and scenic bike route crossing. • Link regional and local routes to key attractors on US 97, such as shopping, schools, residential areas, and other community destinations. • Provide a transportation network that accommodates local, commuter, and region traffic, including freight movements along US 97. 	<ul style="list-style-type: none"> • Does the proposed project element serve people that live in, work in, and/or visit Terrebonne? 		<ul style="list-style-type: none"> • Current system serves users but has deficiencies being addressed by this refinement plan, including roadway capacity deficiencies, lack of multimodal facilities, and intersections that exceed critical crash rates.
		<ul style="list-style-type: none"> • Are there any significant barriers to or impacts that would result from the proposed project element, such as the presence of significant natural resources or require acquisition of property contaminated by Haz Mat? 	N/A	<ul style="list-style-type: none"> • No improvements proposed.
		<ul style="list-style-type: none"> • What are the right of way impacts of the proposed project element - # of businesses relocated, #of residential properties impacted, impacts to public facilities, etc. 	N/A	<ul style="list-style-type: none"> • No improvements proposed.
Mobility: Provide a safe and efficient transportation system for all modes of travel, including local trips, through trips on the highway, emergency services, and freight.	<ul style="list-style-type: none"> • Evaluate all potential US 97 alternatives, such as maintaining the existing US 97 alignment, creating a highway couplet with 11th Street or constructing a bypass east or west of the existing alignment. • Identify and evaluate all potential at-grade and grade separated solutions for the Lower Bridge Way/US 97 intersection in concert with the development of the alternative alignments for US 97. • Maintain the carrying and dimensional capacity for statewide freight movement on US 97. 	<ul style="list-style-type: none"> • Does the proposed project element meet mobility targets on US97 through 2040? 		<ul style="list-style-type: none"> • Operational deficiencies exist and are forecasted to worsen along US 97 and on side-street approaches at the following locations: <ul style="list-style-type: none"> ○ US 97/Lower Bridge Way ○ US 97/C Avenue ○ US 97/B Avenue ○ 11th Street/Smith Rock Way ○ US 97/11th Street ○ US 97 Mainline
		<ul style="list-style-type: none"> • Does the proposed project element represent an investment that works toward the long-term solution for the corridor? 		<ul style="list-style-type: none"> • Several existing and long-term deficiencies will continue to exist at the following locations: <ul style="list-style-type: none"> ○ US 97/Lower Bridge Way ○ US 97/C Avenue ○ US 97/B Avenue ○ 11th Street/Smith Rock Way ○ US 97/11th Street ○ US 97 Mainline
		<ul style="list-style-type: none"> • Does the proposed project element maintain or enhance the carrying and dimensional capacity for statewide freight movement? 		<ul style="list-style-type: none"> • Carrying and dimensional capacity is maintained. However, highway delay through Terrebonne along US 97 is expected to increase in the future.

Goal	Objective	Evaluation Criteria	Baseline Scenario	
			Meets?	Comment
		<ul style="list-style-type: none"> Does the proposed project element enhance east-west connectivity within the community? 	○	<ul style="list-style-type: none"> Existing deficiencies at US 97/B Street, US 97/C Street, and US 97/Lower Bridge Way are expected to further deteriorate.
Safety and Health: enable people to safely and comfortably drive, walk, run or cycle in and through the Community, including along and across US 97, for all types of trips.	<ul style="list-style-type: none"> Address safety, comfort, and security of people driving, walking, and biking along and across US 97. Use transitional and traffic calming techniques to slow traffic to posted speeds. 	<ul style="list-style-type: none"> Does the proposed project element address an area with a crash history or risk factor? Is it expected to improve safety or slow speeds? 	○	<ul style="list-style-type: none"> No crash countermeasures are proposed. The crash rates at the intersections of US 97/Lower Bridge Way and 11th Street/Smith Rock Way are observed to exceed critical crash rates today.
		<ul style="list-style-type: none"> Does the proposed project element reduce the level of stress experienced by pedestrians and/or cyclists? 	○	<ul style="list-style-type: none"> Existing level of stress deficiencies will remain.
Accessibility: provide infrastructure that supports accessible transportation options for all users.	<ul style="list-style-type: none"> Address the identified existing and future year 2040 gaps and deficiencies (needs) within the study area. Provide well-designed, visible, safe, and convenient infrastructure and crossings for all users (e.g., agricultural equipment). 	<ul style="list-style-type: none"> Does the proposed project element address existing gap or deficiency in the vehicular, transit, bicycle and/or pedestrian network? 	○	<ul style="list-style-type: none"> Existing gaps will remain in the pedestrian and bicycle system.
Financial Responsibility: use resources efficiently and invest in infrastructure that will serve the Community and statewide highway for years to come.	<ul style="list-style-type: none"> Achieve maximum return on the \$20 million allocated for improvements in the Terrebonne community 	<ul style="list-style-type: none"> What is the planning-level cost estimate of the proposed project element? 	N/A	<ul style="list-style-type: none"> No improvements proposed.
		<ul style="list-style-type: none"> Can the preferred plan be implemented with the money allocated? 	N/A	
		<ul style="list-style-type: none"> Does the benefit exceed the cost over a 20-year horizon? 	N/A	
Economic Vitality: encourage visitors and investment in the recreational, agricultural, business areas nearby and served by US 97.	<ul style="list-style-type: none"> Provide connections to businesses and natural areas within and near the Terrebonne community. Attract tourist and investment dollars to the greater Terrebonne community 	<ul style="list-style-type: none"> Does the proposed project element address mobility and serviceability for local and regional freight activity? 	○	<ul style="list-style-type: none"> Mobility and serviceability is not improved.
		<ul style="list-style-type: none"> Does the proposed project element support business activity in and around the community (e.g., the Smith Rock State Park)? 	○	<ul style="list-style-type: none"> Businesses will continue to experience challenges faced today with additional congestion in the future.
		<ul style="list-style-type: none"> Does the proposed project element improve pedestrian and/or bicycle access to businesses and natural areas in and around the community? 	○	<ul style="list-style-type: none"> Gaps in the existing bicycle and pedestrian system would remain.

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- The existing B Avenue marked crosswalk at US 97 could possibly increase the risk of pedestrian related crashes if other pedestrian facility enhancements such as a Rectangular Rapid Flashing Beacon (RRFB) are not installed.

- The only dedicated bicycle facility in the community include bike lanes on a segment of US 97 between C Avenue and 11th Street. The remainder of the community relies on paved shoulders for bicycles. The Oregon Scenic Bikeway that bisects the community east-west does not have dedicated bicycle facilities. These conditions are expected to remain into the future.
- Speed data collected at three segments showed that the 85th percentile speeds on US 97 at Lower Bridge Way and C Avenue exceed the posted speed by 19 and 3 mph, respectively.
- Ninety-three (93) crashes were reported in the greater Terrebonne area during the five-year study period. There were no fatal crashes during the study period.
- Of the six study intersections, US 97/Lower Bridge Way and 11th Street/Smith Rock Way exceed the ODOT Critical Crash Rate over the past five-year period.

Appendix A – Segment Volume Data

Terrebonne Refinement Plan Segment Volume Data

Future Growth 1.90%

Start Time	Existing			2040 Future No Build		
	US 97/NW 10th St	US 97/C Ave	US 97/Lower Bride Way	US 97/NW 10th St	US 97/C Ave	US 97/Lower Bride Way
12:00 AM	119	107	85	180	162	129
1:00 AM	95	88	72	144	133	109
2:00 AM	113	104	94	171	157	142
3:00 AM	137	131	115	207	198	174
4:00 AM	273	262	209	413	396	316
5:00 AM	488	480	338	738	726	511
6:00 AM	1083	1059	742	1639	1602	1123
7:00 AM	1449	1365	984	2192	2065	1489
8:00 AM	1343	1199	811	2032	1814	1227
9:00 AM	1386	1263	904	2097	1911	1368
10:00 AM	1348	1228	886	2039	1858	1340
11:00 AM	1384	1256	904	2094	1900	1368
12:00 PM	1460	1332	934	2209	2015	1413
1:00 PM	1504	1371	970	2276	2074	1468
2:00 PM	1590	1424	1054	2406	2154	1595
3:00 PM	1728	1569	1162	2614	2374	1758
4:00:00 PM*	1815	1624	1199	2746	2457	1814
5:00 PM	1667	1600	1198	2522	2421	1813
6:00 PM	1183	1152	808	1790	1743	1222
7:00 PM	874	840	595	1322	1271	900
8:00 PM	681	629	466	1030	952	705
9:00 PM	448	444	337	678	672	510
10:00 PM	271	261	198	410	395	300
11:00 PM	175	180	148	265	272	224

*Peak Hour

Appendix B – Future
Intersection Operational Results

HCM 6th TWSC
1: 19th Street & Lower Bridge Way

07/20/2018

Intersection						
Int Delay, s/veh	1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Vol, veh/h	331	31	10	720	33	10
Future Vol, veh/h	331	31	10	720	33	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	7	12	40	6	0	0
Mvmt Flow	368	34	11	800	37	11

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	402	0	1207
Stage 1	-	-	-	-	385
Stage 2	-	-	-	-	822
Critical Hdwy	-	-	4.5	-	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4
Critical Hdwy Stg 2	-	-	-	-	5.4
Follow-up Hdwy	-	-	2.56	-	3.5
Pot Cap-1 Maneuver	-	-	978	-	204
Stage 1	-	-	-	-	692
Stage 2	-	-	-	-	435
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	978	-	200
Mov Cap-2 Maneuver	-	-	-	-	200
Stage 1	-	-	-	-	678
Stage 2	-	-	-	-	435

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	23.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	239	-	-	978	-
HCM Lane V/C Ratio	0.2	-	-	0.011	-
HCM Control Delay (s)	23.8	-	-	8.7	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.7	-	-	0	-

HCM 6th TWSC
2: US 97 & Lower Bridge Way/11th Street

07/20/2018

Intersection												
Int Delay, s/veh	11.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖		↗			↗	↖	↗		↖	↗	↗
Traffic Vol, veh/h	44	0	401	0	0	35	648	1029	5	35	946	97
Future Vol, veh/h	44	0	401	0	0	35	648	1029	5	35	946	97
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	400	-	0	-	-	0	320	-	-	240	-	265
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	6	0	0	27	5	12	33	26	17	6
Mvmt Flow	46	0	418	0	0	36	675	1072	5	36	985	101

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	3500	-	985	-	-	1075	985	0	0	1077	0	0
Stage 1	1057	-	-	-	-	-	-	-	-	-	-	-
Stage 2	2443	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.1	-	6.26	-	-	6.47	4.15	-	-	4.36	-	-
Critical Hdwy Stg 1	6.1	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	-	3.354	-	-	3.543	2.245	-	-	2.434	-	-
Pot Cap-1 Maneuver	~ 4	0	~ 296	0	0	239	689	-	-	565	-	-
Stage 1	275	0	-	0	0	-	-	-	-	-	-	-
Stage 2	~ 43	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	0	-	~ 296	-	-	239	689	-	-	565	-	-
Mov Cap-2 Maneuver	0	-	-	-	-	-	-	-	-	-	-	-
Stage 1	~ 6	-	-	-	-	-	-	-	-	-	-	-
Stage 2	~ 1	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s		22.8	20.8	0.4
HCM LOS	-	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	689	-	-	-	296	239	565	-	-
HCM Lane V/C Ratio	0.98	-	-	-	1.411	0.153	0.065	-	-
HCM Control Delay (s)	53.9	-	-	-	237.3	22.8	11.8	-	-
HCM Lane LOS	F	-	-	-	F	C	B	-	-
HCM 95th %tile Q(veh)	15.1	-	-	-	22.3	0.5	0.2	-	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	23.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	7	9	97	37	0	74	49	1611	57	26	1250	20
Future Vol, veh/h	7	9	97	37	0	74	49	1611	57	26	1250	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	200	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	100	0	7	12	0	12	4	10	10	0	15	9
Mvmt Flow	8	10	104	40	0	80	53	1732	61	28	1344	22

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	3320	3310	1355	3337	3291	1763	1366	0	0	1793	0	0
Stage 1	1411	1411	-	1869	1869	-	-	-	-	-	-	-
Stage 2	1909	1899	-	1468	1422	-	-	-	-	-	-	-
Critical Hdwy	8.1	6.5	6.27	7.22	6.5	6.32	4.14	-	-	4.1	-	-
Critical Hdwy Stg 1	7.1	5.5	-	6.22	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	7.1	5.5	-	6.22	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	4.4	4	3.363	3.608	4	3.408	2.236	-	-	2.2	-	-
Pot Cap-1 Maneuver	~2	~9	178	~4	9	98	496	-	-	350	-	-
Stage 1	106	206	-	87	123	-	-	-	-	-	-	-
Stage 2	49	119	-	151	204	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	0	~7	178	-	7	98	496	-	-	350	-	-
Mov Cap-2 Maneuver	0	~7	-	-	7	-	-	-	-	-	-	-
Stage 1	95	190	-	78	110	-	-	-	-	-	-	-
Stage 2	8	106	-	55	188	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s\$	658.7		0.4	0.3
HCM LOS	F	-		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	496	-	-	58	-	350	-
HCM Lane V/C Ratio	0.106	-	-	2.095	-	0.08	-
HCM Control Delay (s)	13.1	-	-	\$ 658.7	-	16.2	-
HCM Lane LOS	B	-	-	F	-	C	-
HCM 95th %tile Q(veh)	0.4	-	-	11.8	-	0.3	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 6th TWSC
4: US 97 & B Avenue/Smith Rock Way

07/20/2018

Intersection

Int Delay, s/veh 1784.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	2	58	67	2	81	31	1660	88	66	1287	7
Future Vol, veh/h	2	2	58	67	2	81	31	1660	88	66	1287	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	200	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	21	0	0	6	11	6	17	15	0
Mvmt Flow	2	2	63	73	2	88	34	1804	96	72	1399	8

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	3512	3515	1403	3500	3471	1852	1407	0	0	1900	0	0
Stage 1	1547	1547	-	1920	1920	-	-	-	-	-	-	-
Stage 2	1965	1968	-	1580	1551	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.31	6.5	6.2	4.16	-	-	4.27	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.31	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.31	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.689	4	3.3	2.254	-	-	2.353	-	-
Pot Cap-1 Maneuver	4	6	173	~ 3	7	93	473	-	-	281	-	-
Stage 1	145	177	-	77	116	-	-	-	-	-	-	-
Stage 2	83	110	-	124	177	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	0	4	173	~ 1	5	93	473	-	-	281	-	-
Mov Cap-2 Maneuver	0	4	-	~ 1	5	-	-	-	-	-	-	-
Stage 1	135	132	-	~ 71	108	-	-	-	-	-	-	-
Stage 2	4	102	-	~ 58	132	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	186.4		\$ 39778.7		0.2		1.1	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	473	-	-	72	2	281	-	-
HCM Lane V/C Ratio	0.071	-	-	0.936	81.522	0.255	-	-
HCM Control Delay (s)	13.2	-	-	186.4	39778.7	22.1	-	-
HCM Lane LOS	B	-	-	F	F	C	-	-
HCM 95th %tile Q(veh)	0.2	-	-	4.7	22.8	1	-	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 6th TWSC
5: 11th Street & Smith Rock Way

07/20/2018

Intersection												
Int Delay, s/veh	16.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	51	139	12	65	116	81	23	137	97	88	58	21
Future Vol, veh/h	51	139	12	65	116	81	23	137	97	88	58	21
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	9	12	20	11	10	14	0	5	14	11	20	22
Mvmt Flow	55	149	13	70	125	87	25	147	104	95	62	23

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	212	0	0	162	0	0	617	618	156	700	581	169
Stage 1	-	-	-	-	-	-	266	266	-	309	309	-
Stage 2	-	-	-	-	-	-	351	352	-	391	272	-
Critical Hdwy	4.19	-	-	4.21	-	-	7.1	6.55	6.34	7.21	6.7	6.42
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.55	-	6.21	5.7	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.55	-	6.21	5.7	-
Follow-up Hdwy	2.281	-	-	2.299	-	-	3.5	4.045	3.426	3.599	4.18	3.498
Pot Cap-1 Maneuver	1318	-	-	1364	-	-	405	401	859	342	402	826
Stage 1	-	-	-	-	-	-	744	683	-	682	628	-
Stage 2	-	-	-	-	-	-	670	626	-	616	653	-
Platoon blocked, %		-	-	-	-	-						
Mov Cap-1 Maneuver	1318	-	-	1364	-	-	315	360	859	190	361	826
Mov Cap-2 Maneuver	-	-	-	-	-	-	315	360	-	190	361	-
Stage 1	-	-	-	-	-	-	710	652	-	651	591	-
Stage 2	-	-	-	-	-	-	549	589	-	400	623	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	2		1.9		24.5		46.1	
HCM LOS					C		E	

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	454	1318	-	-	1364	-	-	257
HCM Lane V/C Ratio	0.609	0.042	-	-	0.051	-	-	0.699
HCM Control Delay (s)	24.5	7.9	0	-	7.8	0	-	46.1
HCM Lane LOS		C	A	A	-	A	A	E
HCM 95th %tile Q(veh)	4	0.1	-	-	0.2	-	-	4.7

Intersection						
Int Delay, s/veh	7.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	↔
Traffic Vol, veh/h	67	16	1745	141	2	1377
Future Vol, veh/h	67	16	1745	141	2	1377
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	200	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	3	14	9	6	0	13
Mvmt Flow	72	17	1876	152	2	1481

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	3437	1952	0	0	2028
Stage 1	1952	-	-	-	-
Stage 2	1485	-	-	-	-
Critical Hdwy	6.43	6.34	-	-	4.1
Critical Hdwy Stg 1	5.43	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-
Follow-up Hdwy	3.527	3.426	-	-	2.2
Pot Cap-1 Maneuver	~ 8	74	-	-	283
Stage 1	121	-	-	-	-
Stage 2	206	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	~ 8	74	-	-	283
Mov Cap-2 Maneuver	~ 72	-	-	-	-
Stage 1	120	-	-	-	-
Stage 2	206	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	284.4	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	72	283
HCM Lane V/C Ratio	-	-	1.24	0.008
HCM Control Delay (s)	-	-	284.4	17.8
HCM Lane LOS	-	-	F	C
HCM 95th %tile Q(veh)	-	-	7	0

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

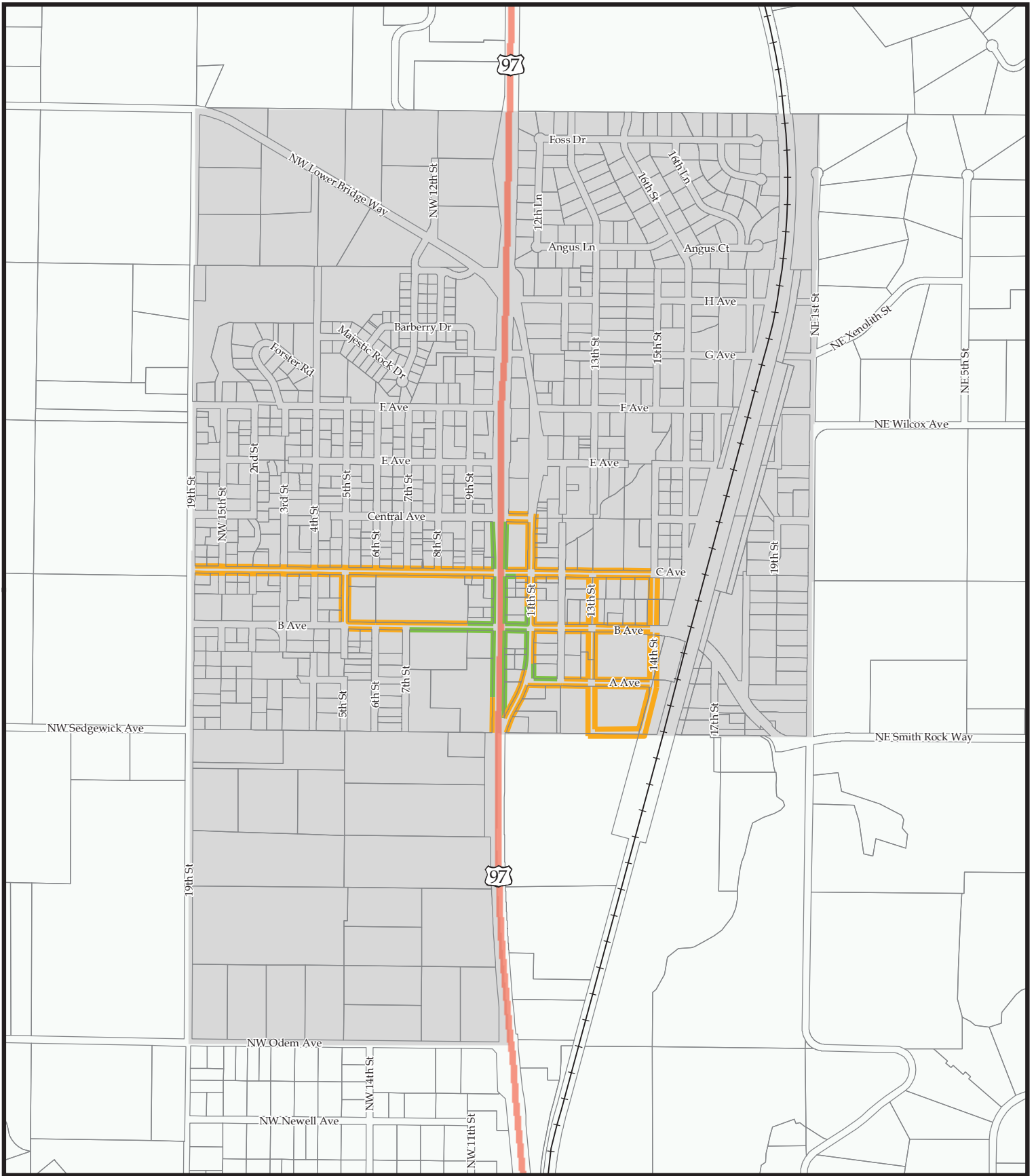
Table B1. Future 2040 No Build Operational Summary

Intersection	Standard/Target	Critical Movement	Existing Conditions			Year 2040 Conditions		
			LOS	v/c	Delay (s)	LOS	v/c	Delay (s)
19th Street/Lower Bridge Way	LOS D	NB	B	0.05	12.6	C	0.2	23.8
US 97/Lower Bridge Way (11th Street)	Side-Street: v/c<0.80	EBL	F	>1.0	>100	F	>1.0	>100
	Mainline: v/c<0.70	NBL	B	0.49	12.5	F	0.98	53.9
US 97/C Avenue (Underwood Avenue)	Side-Street: v/c<0.80	WB	F	>1.0	>100	F	>1.0	>100
	Mainline: v/c<0.70	NBL	B	0.05	10.1	B	0.11	13.1
US 97/B Avenue (Smith Rock Way)	Side-Street: v/c<0.80	WB	F	>1.0	>100	F	>1.0	>100
	Mainline: v/c<0.70	SBL	B	0.1	12.9	C	0.26	22.1
11th Street/Smith Rock Way	LOS D	SBL	B	0.18	13.3	E	0.70	46.1
US 97/South 11th Street	Side-Street: v/c<0.80	WB	E	0.29	36.1	F	>1.0	>100
	Mainline: v/c<0.70	SBL	B	0.01	11.9	B	0.01	17.8

Table B2. Future 2040 No Build 95th Percentile Queue

Intersection	Future 2040 Forecast			
	NB	SB	EB	WB
19th Street/Lower Bridge Way	25	-	-	<25
US 97/Lower Bridge Way (11th Street)	375	<25	>500	25
US 97/C Avenue (Underwood Avenue)	<25	<25	300	>500
US 97/B Avenue (Smith Rock Way)	<25	25	125	>500
11th Street/Smith Rock Way	100	125	<25	<25
US 97/South 11th Street	-	<25	-	175

Appendix C – Deschutes County
TSP Future Sidewalk Improvements
Figure



Terrebonne Area Sidewalks

F5.5.F6

Map Symbols

- Principal Arterial - (State Highway)
- Lakes & Rivers
- Terrebonne Unincorporated Community

Existing & Planned Sidewalks

- Existing Sidewalk
- Planned Sidewalk



1" = 1,100'



DISCLAIMER:
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June 30, 2011