Refinement Plan
Terrebonne

Date:	January 17, 2019	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 #6 – Alternatives Development and Analysis (Task 5.1)	

This memorandum presents the process of identifying and evaluating the most promising alternatives to address the corridor alignment, intersection, and highway transition needs in Terrebonne. All concepts and alternatives were identified through a 3-day Concept Development Workshop process involving public participants, project stakeholders, the Advisory Committee, and the Project Management Team (PMT). The project design team then reviewed each concept, grouped them into corresponding alternatives, and evaluated the alternatives with respect to the previous established project goals, objectives, and evaluation criteria. The most promising alternatives were then further evaluated in more detail to provide the Advisory Committee and Project Management Team (PMT) with initial recommendation for potential preferred alternatives. This overall process and evaluation results are presented herein.

The memorandum is organized into the following sections:

EXECUTIVE SUMMARY

The alternative development and analysis process and analysis results of the most promising alternatives is summarized below:

- A concept development workshop was conducted September 11th-13th. Approximately 135 community members, 14 Advisory Committee Members, and 6 PMT members participated in the development process. An online workshop was available for additional public comments and remained open until September 27th. Approximately 30 email, mail in, or online comments were received.
- Approximately 200 total concepts were developed through the meeting sessions and the online workshop. These concepts were grouped based on similarities into 48 alternatives. Of the 48 developed alternatives, 10 alternatives were identified as promising and feasible through an initial assessment of the evaluation criteria matrix by the consultant team. The table below shows a summary of the process:

Element	Corridor Alignment	Intersection	Transition
Day 1 – Concepts	64	102	32
Day 2 – Alternatives	14	19	15
Day 3 – Promising Alternatives	**1**[1]	**6**	**3**

- Based on feedback from the workshop and further assessment, two corridor alternatives were furthered evaluated both operationally and based on potential right-of-way, constructability, and access management related impacts:
  - (A–4A) The couplet configuration utilizing 11th Street for northbound traffic and the existing US 97 alignment for southbound traffic was found to work operationally and had limited right-of-way impacts in the vicinity of the southern couplet U-turn location and the redesigned 11st Street/Smith Rock Way intersection.
  - (A–5A) The five-lane configuration utilizing the existing US 97 alignment was found to present operational and queuing issues at the signalized US 97/ B Avenue intersection and presented some potential right-of-way impacts to existing businesses.
- Based on feedback from the workshop, further assessment, four intersection alternatives were further evaluated through a year 2040 operational analysis:

[1] While a single corridor alignment alternative was proposed during the initial evaluation, a five-lane section was added back following the completion of comments from the Concept Development Workshop and was further analyzed as part of the promising alternatives.

- (SI–7A) A five-lane cross section with a signal at the US 97/ B Avenue intersection did not meet ODOT performance measures and experience queuing blocking upstream intersection.

- (SI-1B) A one-way westbound configuration for B Avenue between 11th and US 97 under a couplet solution is expected to meet mobility standards.

- (I–6A2) A northbound left fly-under at US 97/Lower Bridge Way will meet mobility standards, however, an eastbound to southbound right-turn add lane may be required.

- (I–5B) An R-CUT at US 97/Lower Bridge Way would **not** meet operational or queuing standards for the northbound U-turn.

- Several roadway cross-sections were identified during the workshop; however, the corridor alignment and intersection selection will dictate the ultimate cross section for the highway. Transition elements including pedestrian and bicycle facilities and crossings, transit accommodations, and corridor and intersection safety improvements will be explored further in the Technical Memorandum #7 once the Advisory Committee and Project Management Team determine a preferred corridor alignment and corresponding intersection alternative(s).

BACKGROUND

Prior to the Concept Development Workshop, five technical memorandums had been developed to provide background information, develop assumptions, and identify needs (gaps and deficiencies) along US 97 and within the overall Terrebonne transportation system. These memorandums included:

1. Plans and Policy Review
2. Analysis Methodology & Assumptions
3. Goals, Objectives & Evaluation Criteria
4. Existing Conditions Analysis
5. Future System Conditions Analysis

Technical Memorandum #4 identified the existing conditions and inventory assessment of the current system. Operation and safety related deficiencies were identified within the Terrebonne community. In general, the existing weekday p.m. peak hour volumes on US 97 create challenging turning movements for the side streets and existing safety related issues for all modes accessing and crossing US 97. Technical Memorandum #5 forecasted traffic volumes for ODOT and County facilities. Based on this analysis, US 97 and the local street system within Terrebonne is not forecasted to adequately support the expected future growth scenarios without further capacity and safety related improvements. Key findings from the existing and future conditions analysis are as follows:

- Highway demand in year 2040 will necessitate some form of two northbound and two southbound lanes on US 97.
- US 97 remains a critical freight corridor for the state and west coast.
- Connectivity and access are crucial for all users accessing and crossing US 97 in the Terrebonne community.
- Mitigation actions are required to address existing capacity and safety issues at US 97/Lower Bridge Way.
- Capacity improvements are required at US 97/B Avenue.

To address these key needs within Terrebonne, an alternatives analysis has been completed through a concept development workshop process and further refinement and assessment documented herein.

PUBLIC FEEDBACK PROCESS TO DATE

Throughout the Terrebonne Refinement Plan process, public comment has been welcomed and encouraged. A public meeting was held on June 13, 2018, where over one hundred community members attended to comment on the goals, objectives, evaluation criteria and overall transportation system needs. An online map was also available for the public to provide comments related to motorist, pedestrian, bicycle, and transit concerns.

Following the project team's analysis and preparation of Technical Memorandums #1 through #5, a 3-Day Concept Development Workshop was held during the week of September 10th to further engage the community and develop potential corridor alignment, intersection, and highway transition concepts to addresses the project needs identified to date through the public engagement process and the existing and future conditions analysis. This event is further described below. In addition, a parallel online workshop was available at www.terrebonnerefinementplan.com for those unable to attend workshop sessions and remained open through September 27th.

Concept Development Workshop

The Concept Development Workshop was a three-day public event conducted September 11th-13th at the Terrebonne Community School and the Grange Hall in Terrebonne. Figure 1 illustrates the events and locations for the workshop. *PowerPoint slides and information boards presented at the meetings are provided in Appendix A and the attendance sheets for all four public meetings are provided in Appendix B.*

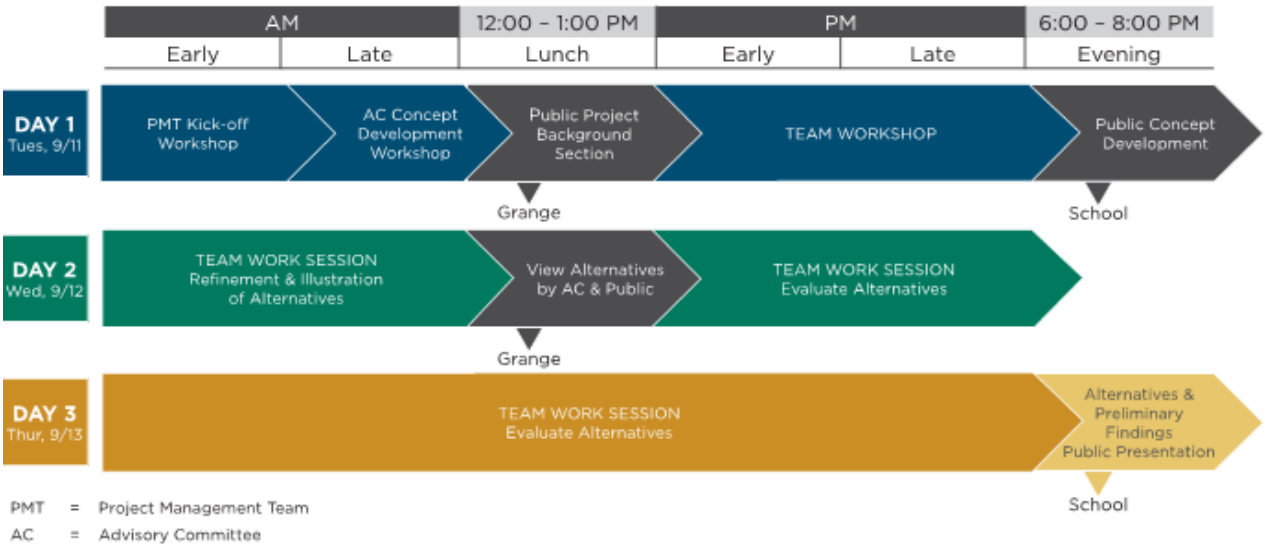


Figure 1. Concept Development Workshop Schedule

Concept Development

The PMT and Advisory Committee gathered the morning of September 11th to complete the workshop exercises associated with the concept development workshop. During the afternoon, the public was invited to view the display boards presenting background information on the existing and future conditions and the corridor alignment, intersections, and highway transitions elements of the project. Feedback, questions and comments from participants were documented and logged. Figure 2 shows photos of the afternoon public viewing session.

Figure 2. The Advisory Committee and Public during the September 11th Viewing Session

The Public Concept Development session was held on the evening of September 11th. Attendees were first briefed through a presentation on the overall project needs and workshop objectives, and then proceeded through three stations and asked to develop corridor alignment, intersection, and cross section concepts based on their local knowledge and the additional information that was provided at the workshop. Participants were provided a variety of tools including a scaled floor map, 3-dimensional (3D) terrain model of the greater Terrebonne area, scaled acetates with potential intersection alternatives, and roadway cross-section development tools. Approximately 50 community members, 14 Advisory Committee Members, and 6 PMT members participated in-person during the concept development process. Each station at the workshop is further described below. *The resulting concepts generated by the participants are provided in Appendix C*[2].

Corridor Alignment Station

Participants at this station were encouraged to develop near- and long-term concepts for the US 97 corridor. Participants were asked to develop these concepts by considering long-term capacity needs, safety, access to businesses and residents, freight mobility, and safe crossings for all users. The station included example highway alignment boards, magnitude of costs associated with highway alignment elements, a large scaled floor map, and 3D model. Participants were invited to place rope on the large floor map to identify their preferred alignment while considering right-of-way impacts. Figure 3 shows

[2] Concept Drawings provided from the online workshop are included in Appendix C.

photos of the tools used at the alignment station. At the end of workshop, 64 alignment concepts were submitted.

Figure 3. The workshop 3D map and floor map, respectively

Intersection Station

At this station, participants evaluated potential at-grade and grade separated concepts at Lower Bridge Way/US 97, B Avenue/US 97, and other intersection locations along US 97. Everyone was encouraged to consider the long-term capacity needs, safety, mobility (freight and side street), and accessibility of potential alternatives. The station included example intersection and interchange boards, magnitude of cost associated with intersection elements, and acetate overlay sheets for the north and south areas of Terrebonne. Figure 4 include pictures of the intersection tools used to develop concepts. Over 100 intersection concepts were developed during the workshop.

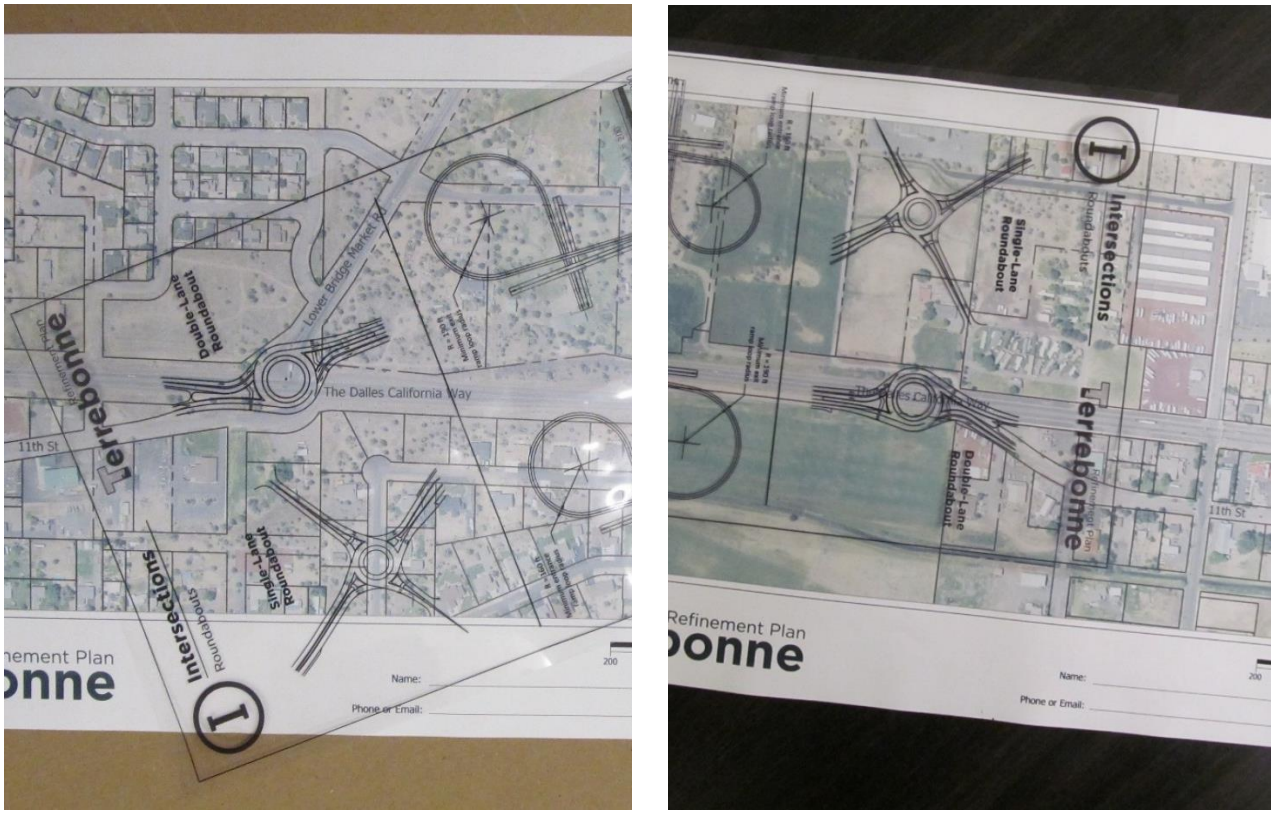


Figure 4. Acetate tools for the Intersection Station

Highway Transition Station

Participants at this station were asked to consider several elements including how to create transition zones into Terrebonne to manage speeds, a preferred roadway cross-section for US 97 and 11th Street, and where/what pedestrian crossings would be appropriate for the community. Each participant was encouraged to prepare a streetscape design including travel lanes, bike lanes, medians, landscaping, and sidewalks using the provided roadway cross-section tools. Figure 5 shows examples of the cross-section tools being used at the workshop. Over 30 cross section concepts for US 97 and 11th Street were submitted at the conclusion of the workshop.

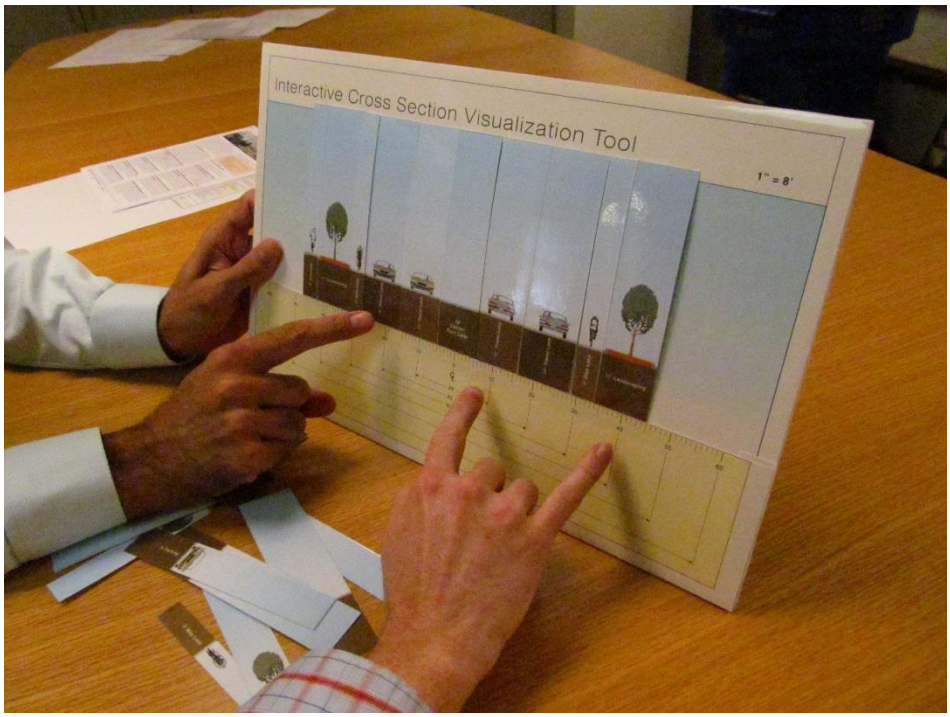


Figure 5. The Cross-Section Development Tool

Alternative Evaluation

The project team evaluated all the submitted concepts and grouped them in to specific alternatives based on concepts with similar characteristics. *Grouped concepts for the alignments, intersections, and cross sections are provided in Appendix D.* A public viewing and comment session on the 14 corridor, 19 intersection, and 15 transition cross-section alternatives was conducted September 12th. The public was encouraged to provide their initial feedback on the alternatives and identify their primary and secondary alternatives that they supported.

On the final day of the workshop, the project team assessed the grouped alternatives against the goals, objectives, and evaluation criteria for each of the project elements to identify the most promising alternatives. Photos from the September 12th and 13th sessions are shown in Figure 6. *The initial assessment matrices for the corridor alignment, intersection, and transition alternatives are provided in Appendix E*. Table 1 summarizes the number of initial concepts developed, grouped alternatives based on the concepts, and initial evaluation and identification of the promising alternatives going into the final session of the three-day workshop.

Table 1: Summary of Concepts, Group Alternatives, and Initial Promising Alternatives Presented at the Final Session of the 3-Day Workshop

Element	Corridor Alignment	Intersection	Transition
Day 1 – Concepts	64	102	32
Day 2 – Alternatives	14	19	15
Day 3 – Promising Alternatives	**11**	**6**	**3**

Figure 6. The Public during the September 12th Viewing Session and September 13th Alternative Evaluation Public Forum

Initial Alternative Assessment Results

Table 2 presents the nine initial promising alternatives that were identified through the initial evaluation matrices by the consultant team.

Table 2. Promising Alternatives Identified Using Goals and Objectives Evaluation Criteria

Corridor Alignment	Intersection	Transition
A-4A Couplet	I-4B - Roundabout with 5-Lane Section	T1-A - Couplet with bike lane, landscaping, sidewalk and parking
	I-5B - Restricted Crossing U-turn	
	I-6A2 - Northbound Fly-under	T1-C - Couplet with protected bike lane, landscaping and sidewalk
	SI-1A - Free Flow Couplet with B Avenue Two-Way	
	SI-1B - Free flow Couplet with B Avenue One-Way Westbound	T4-A - 5-Lane Section with bike lane, landscaping, and sidewalk
	SI-3A - Couplet with a Roundabout	

During the Alternative Evaluation Public Forum and the online workshop, the community provided the project team with direction for which of the promising alternatives they would like to see reviewed further and which potential alternatives not identified in the list above they would like to be considered for additional review. This was completed using the Alternative Evaluation Workbook. This workbook listed all the grouped alternatives based on the project team's initial assessment.

Alternatives were color coded based on the recommendation (green=further review, yellow=under consideration for no further review, red=no further review). Figure 7 is an example page from a community member's Alternative Evaluation Workbook. All received *Alternative Evaluation Workbook comments are provided in Appendix F (along with a complete example workbook).* Attendees were asked to identify whether they agreed with the initial promising alternatives identified by the project team. Next, they were tasked with selecting alternatives identified as either under consideration for no further review and recommended for no further review that they would like to potentially see further reviewed and placed in the "further review" category.

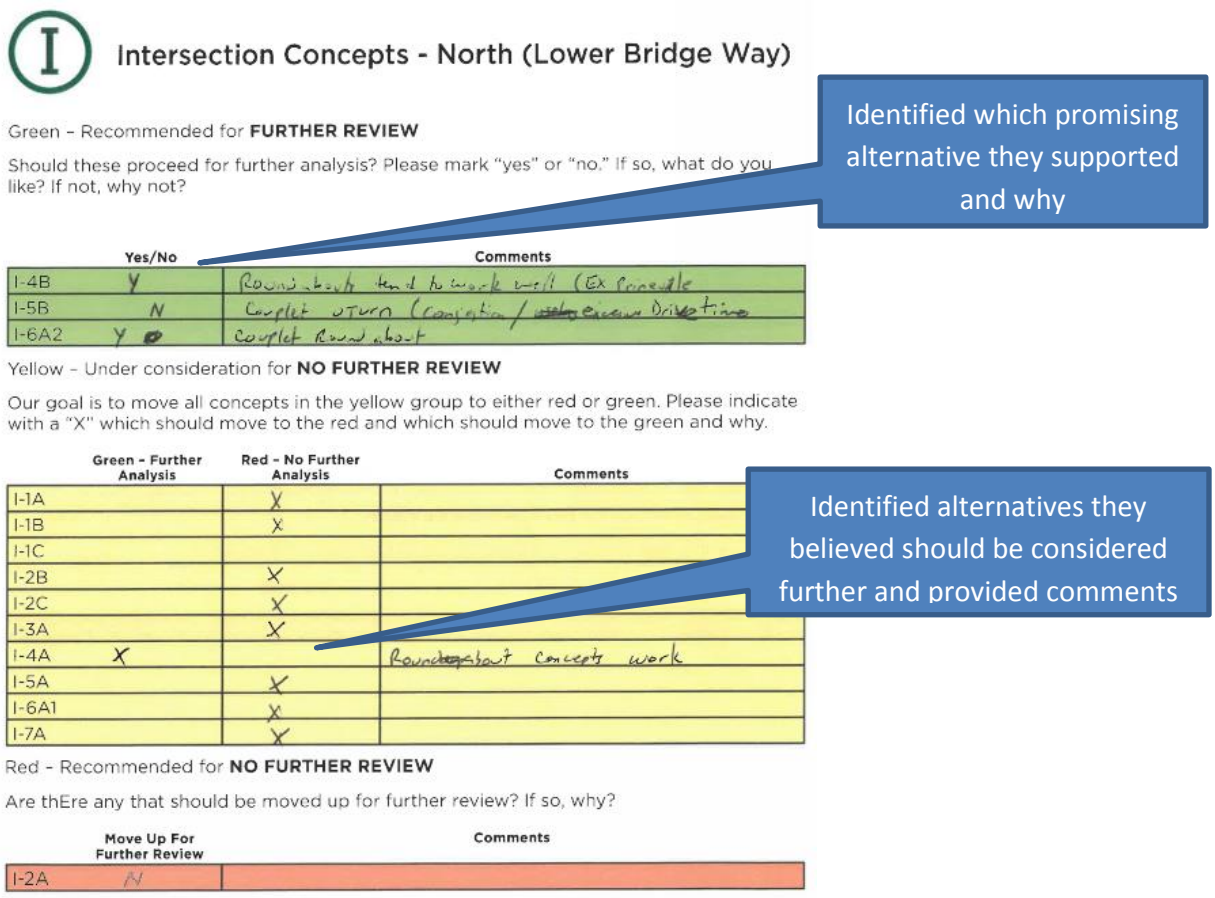


Figure 7. Example public comment from the alternative evaluation workshop

Table 3 summarizes the public approval percentages for the initially identified promising alternatives. These percentages include those who attended the meeting and online responses. Results from the public input, additional operational and geometric design assessment, and discussions with the PMT were considered in identifying which alternatives to move forward with further evaluation in the refinement planning process.

Table 3. Public Feedback Regarding the Further Assessment of the Initially Identified Promising Alternative

Alternative		Public Input		Net Results
		Yes	No	
A – 4A	Couplet	77%	23%	Yes
I – 4B	Roundabout 5-Lane	32%	68%	No
I – 5B	Restricted Crossing U-turn	47%	53%	Yes/No
I – 6A2	Northbound Fly-under	80%	20%	Yes
SI – 1A	Free Flow Couplet with B Avenue Two-Way	55%	45%	Yes
SI – 1B	Free flow Couplet with B Avenue One-Way Westbound	55%	45%	Yes
SI – 3A	Couplet with a Roundabout	48%	52%	Yes/No
T – 1A	Couplet with bike lane, landscaping, sidewalk and parking	63%	37%	Yes
T – 1C	Couplet with protected bike lane, landscaping and sidewalk	83%	17%	Yes
T – 4A	5-Lane Section with bike lane, landscaping, and sidewalk	33%	67%	No

Initial Promising Alternatives Eliminated from the Review Process

The project goals, objectives, evaluation criteria, public input, and engineering assessment were all critical components in the decision-making process to further evaluate alternatives. While Table 3 provides valuable input, additional factors such as feasibility, constructability, cost, and safety are also drivers of the selection process.

Several of the initial promising alternatives from Table 3 were eliminated from the review process. These alternatives are listed below along with justification:

- Roundabout Five Lane (I-4B)
  - Minimal public support for a roundabout at this location
  - High side street volumes would likely require a multilane configuration and slip lanes
  - High amount of northbound left-turn traffic (over 600 vehicles per hour) could cause long-term capacity related issues
  - Challenging geometric/topographical constraints
- Couplet Free Flow with B Avenue Two-Way (SI-1A)
  - Capacity constraints for side street movements would require signalization at US 97/B Avenue and 11th Street/Smith Rock Way.

- Couplet Southern Terminal Roundabout Control/Gateway Treatment (SI-3A)
    - Substantial right-of-way impacts to accommodate large freight movements
    - Potential capacity related concerns under either the five-lane or couplet configurations.

An additional concept was presented to the project team at a Neighborhood Alliance meeting on November 7th, 2018 after the completion of the concept development workshop. The presented alternative kept the existing US 97 as a three-lane cross section with various add lanes from the minor streets onto the mainline. The side streets remained stop controlled. An operational analysis was completed to evaluate the mobility resiliency of this alternative. The analysis identified that the alternative does not meet future mobility standards at US 97/B Avenue under the future 2040 scenario and therefore was not included as a promising alternative. *The concept layout and operation analysis worksheet are provided in Appendix K.*

Alternatives Reconsidered for the Review Process

As part of the review process, several alternatives were placed in the category: "considered for no further review". These alternatives likely somewhat met the overall goals and objectives but would need additional support, refinement, and assessment before moving into the "promising alternative" category. Based on the feedback and additional assessment the following alternatives were recommended by the project team for further evaluation:

Corridor Alternative (A-5) – Five Lane Section on US 97 through Terrebonne

Throughout the alternative selection process there was support by several members of the public and businesses to evaluate a five-lane corridor alignment along US 97 with a traffic signal at the B Avenue-Smith Rock Way intersection in Terrebonne. While not initially identified as a promising alternative, approximately 33% of those who participated in the alternative evaluation workshop wanted this alternative further reviewed. As such, the PMT recommended that corridor alignment Alternative A-5A be further evaluated and as a result supporting intersection Alternative SI-7A and transition Alternative T-4 were moved forwarded as well.

The project goals, public opinion, engineering assessment, and cost magnitudes were all critical to determining the promising alternatives that received additional review. While several other intersection alternatives received moderate support from the public, they did not meet the goals, constructability and/or budgetary considerations to move forward. As a result, the following alternatives were recommended for further evaluation as shown in Table 4.

Table 4 – Alternatives Recommended for Further Review by the Project Team and PMT

Corridor Alignment	Intersection	Transition
A-4A – Couplet A-5A - Five Lane	I-5B - Restricted Crossing U-turn	T1-A - Couplet with bike lane, landscaping, sidewalk and parking
	I-6A2 - Northbound Fly-under	
	SI-1B - Free flow Couplet with B Avenue One-Way Westbound	T1-C - Couplet with protected bike lane, landscaping and sidewalk
	SI-1B - Free flow Couplet with B Avenue One-Way Westbound	T4-A - 5-Lane Section with bike lane, landscaping, and sidewalk
	SI-7A - Traffic Signal with 5-lane Section	

Alternatives Evaluated in the Review Process

As a result of public feedback, the initial assessment, and further geometric, operation, and costing analysis by the project team, the following most promising corridor and intersection alternatives were recommended for further analysis:

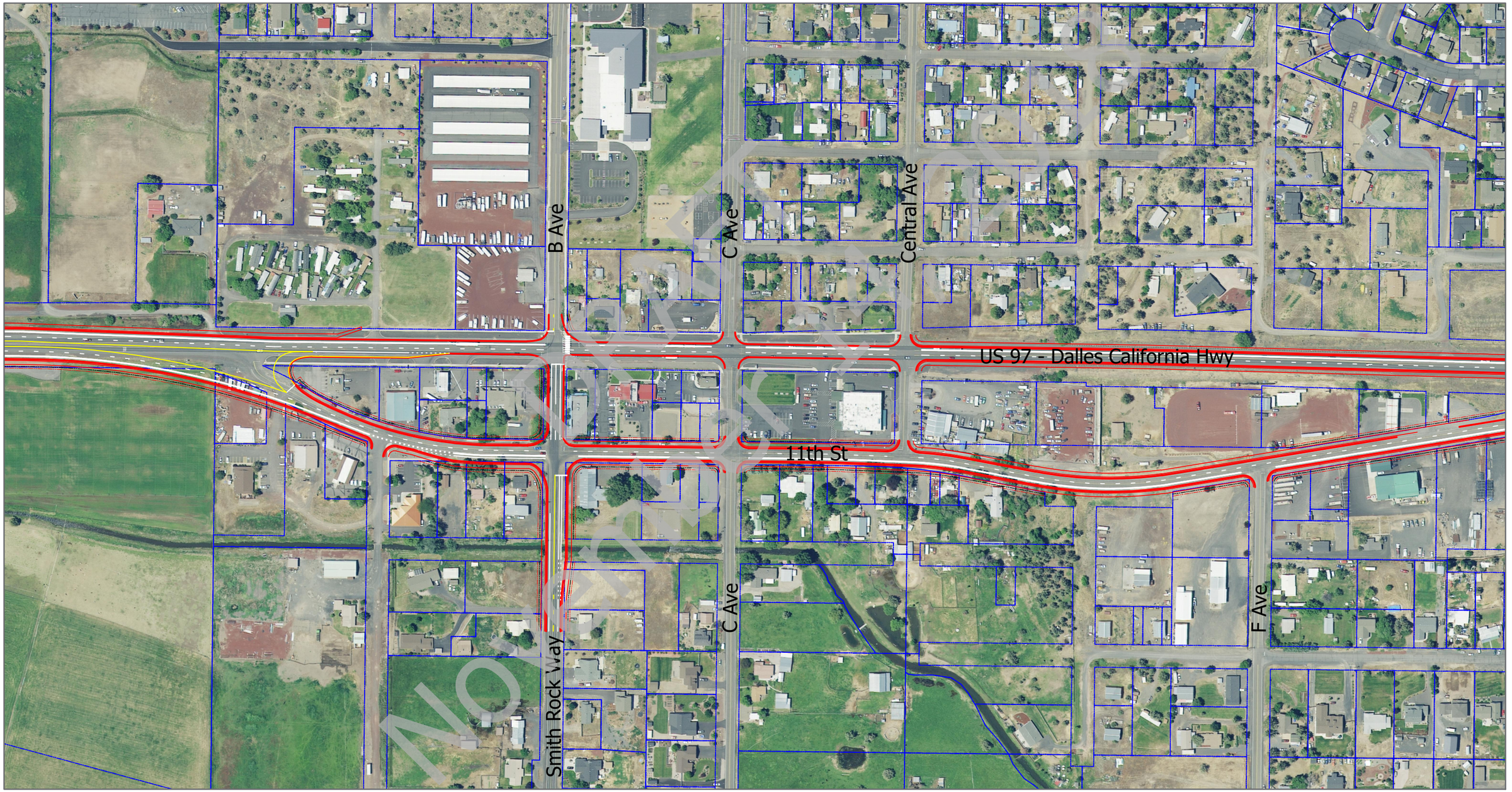
- Corridor Alignment
  - Couplet (A4A)– Creating two, one-way roads on US 97 through Terrebonne where the southbound lanes would be located on the existing US 97 alignment and the northbound lanes would be located on 11th Street. 11th Street would be upgraded to highway standards. *See Figure 8.*
  - Five-Lane (A-5A)– Redeveloping the existing alignment of US 97 to accommodate two northbound through lanes, two southbound through lanes, and a center turn lane. *See Figure 9.*
- Intersection (North)
  - Northbound Left Fly-under (I-6A2) with Couplet – Allows free flow movement for southbound and northbound through traffic while providing a grade separated undercrossing for northbound left turns. Vehicles desiring to make a westbound left-turn movement would be required to turn right onto US 97 and make a U-turn at Central Avenue. *See Figure 10.*
  - Northbound Left Fly-under (I-6A2) with Five Lane - *For the five-lane (A-5A) alternative, the fly under was converted into a two-lane continuation of 11th Avenue to/from Lower Bridge Way. To facilitate the northbound left-turn movements at Lower Bridge Way, an off-ramp from northbound US97 was developed between Central Avenue and the 11 Street/F Avenue intersection. This intersection was converted to a roundabout to accommodate the high left-turn demand movement and also to facilitate traffic desiring to travel from Lower Bridge Way to northbound US97 via the on-ramp. See Figure 11.*

- Restricted Crossing U-Turn (I-5B)– A restricted crossing U-turn (RCUT) eliminates through and left turn movements from the side streets and provides U-turn maneuvers for these movements past the intersection. The northbound U-turn would be facilitated at a new location north of Lower Bridgeway and the southbound U-turn would occur at Central Avenue. *See Figure 12.* Intersection (South)

- Free flow Couplet with B Avenue One-Way Westbound (SI-1B)– A couplet on the existing US 97 and 11th Street alignments with restricted eastbound movements at US 97/B Avenue and westbound only movements west of 11th Street/Smith Rock Way. *See Figure 13A and 13B.*

- Traffic Signal with 5-lane Section (SI-7A)– Build out US 97 to a 5-lane cross section with a traffic signal located at B Avenue. Maintain the existing north/south stop control at 11th Street/Smith Rock Way. *See Figure 14A and 14B.*

It should be noted that the transition alternatives listed in Table 4 above were set aside at this point until a preferred build alternative is identified by the PMT and Advisory Committee. At such time, the transition elements will be assessed and further refined.



Approximate R/W based on Deschutes County GIS Tax Lot information

5-foot R/W offset

10-foot R/W offset

Curb

Back of Sidewalk

Scale: 1" = 250'

250 125 0 250

N

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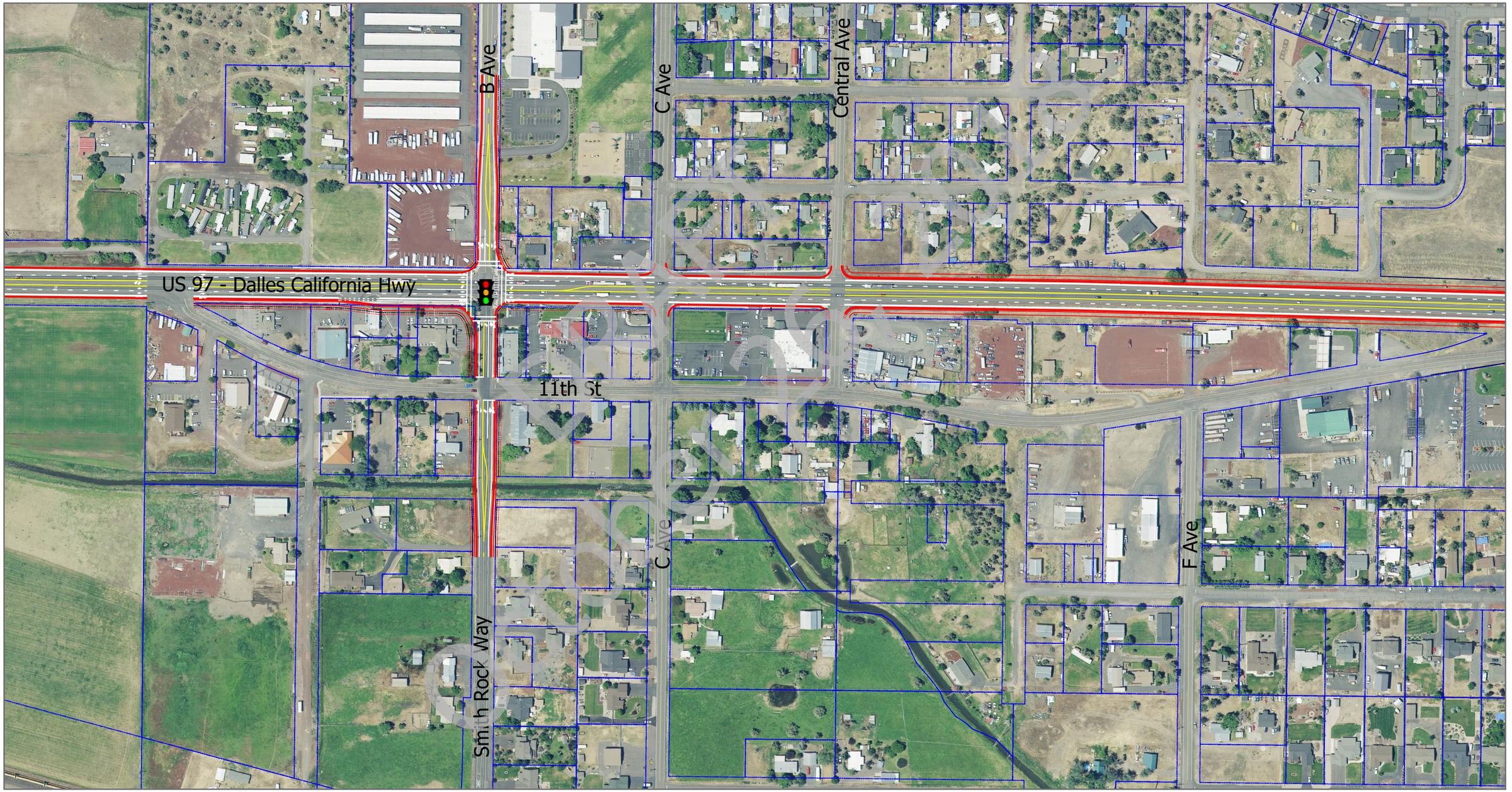
FIGURE 8: CORRIDOR COUPLET CONCEPT DESIGN



Approximate R/W based on Deschutes County GIS Tax Lot information

5-foot R/W offset

10-foot R/W offset

Curb

Back of Sidewalk

Scale: 1" = 250'

250 125 0 250

N

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FIGURE 9: 5-LANE CONCEPT DESIGN

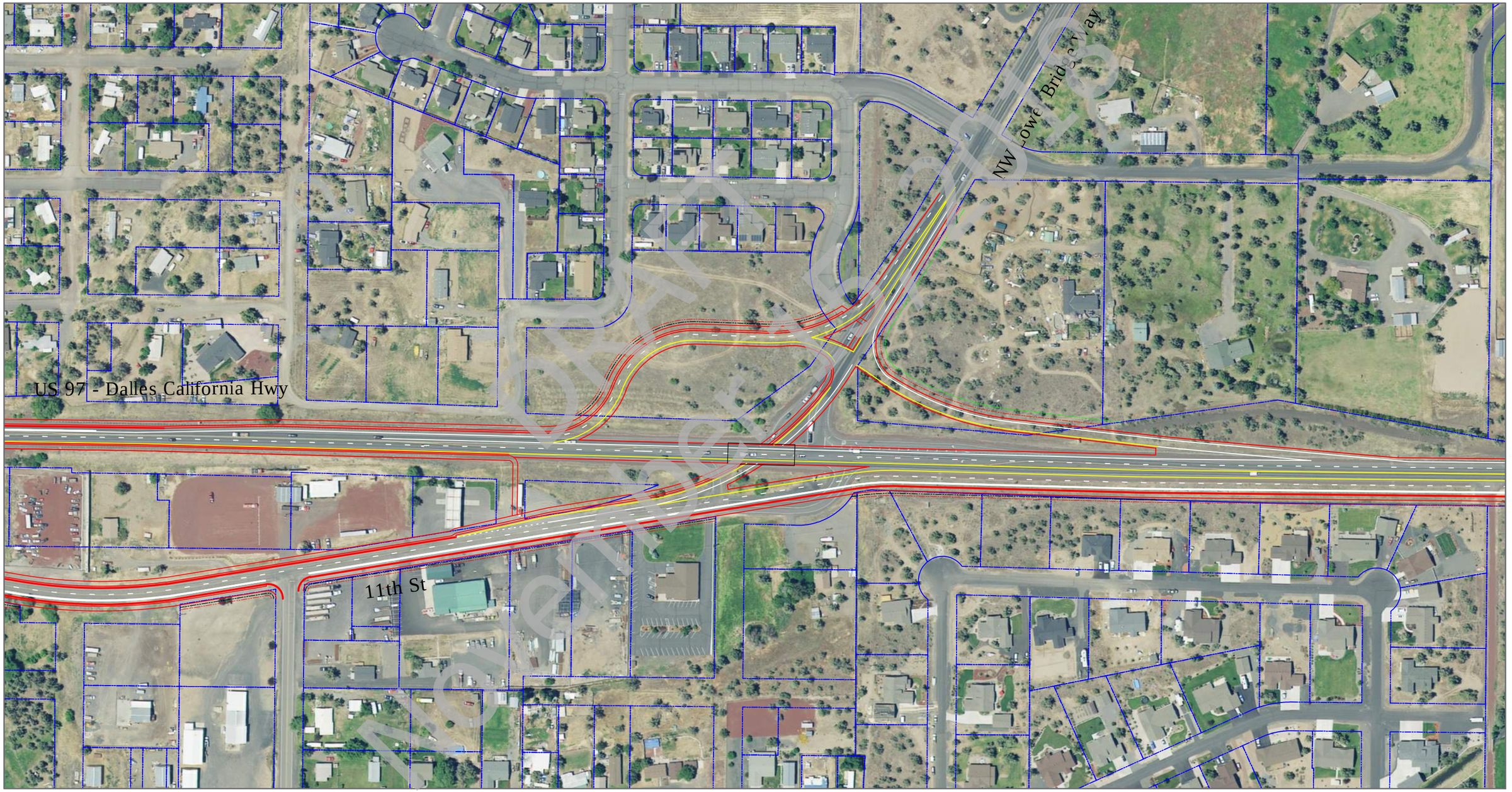

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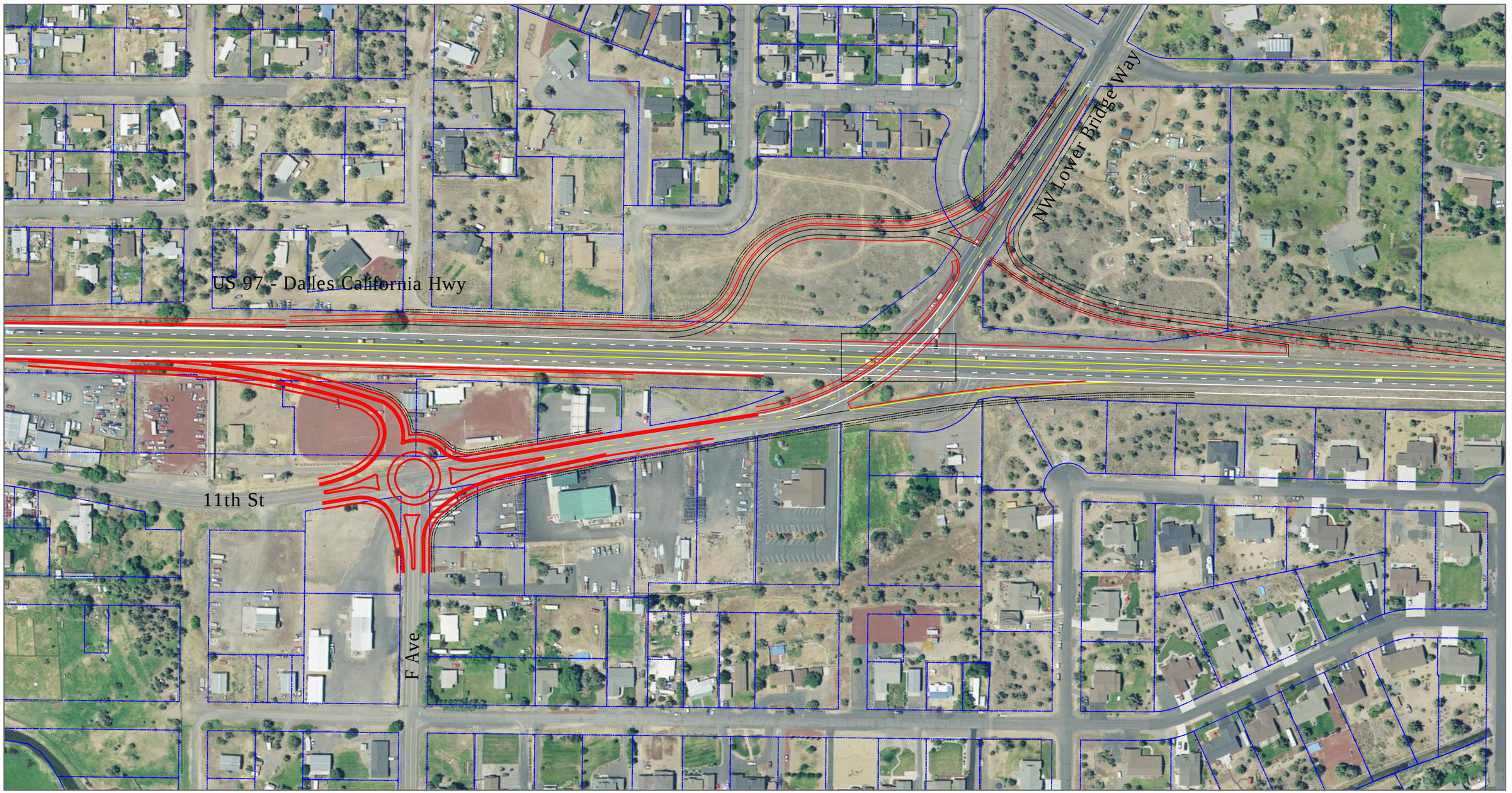
Figure 10: Flyunder Concept Design [Couplet]



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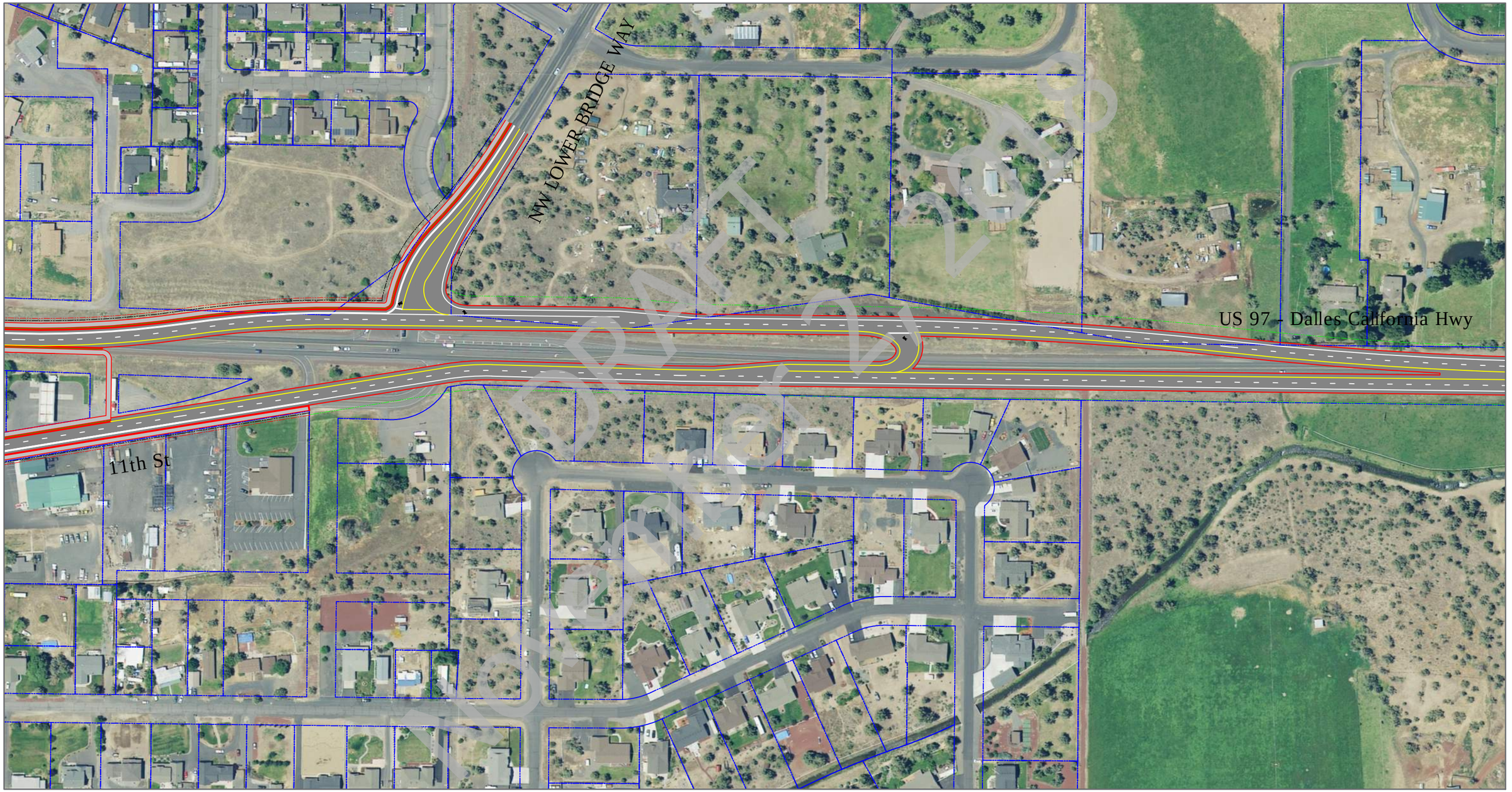
Approximate R/W based on Deschutes County GIS Tax Lot information
5-foot R/W offset
10-foot R/W offset
20-foot R/W offset
Curb
Back of Sidewalk

Scale: 1" = 200'
200 100 0 200
N

FIGURE 11: Northbound Left Fly-under (I-6A2)[Five-Lane]



Approximate R/W based on Deschutes County GIS Tax Lot information

5-foot R/W offset

10-foot R/W offset

20-foot R/W offset

Curb

Back of Sidewalk

Scale: 1" = 200'

200 100 0 200

N

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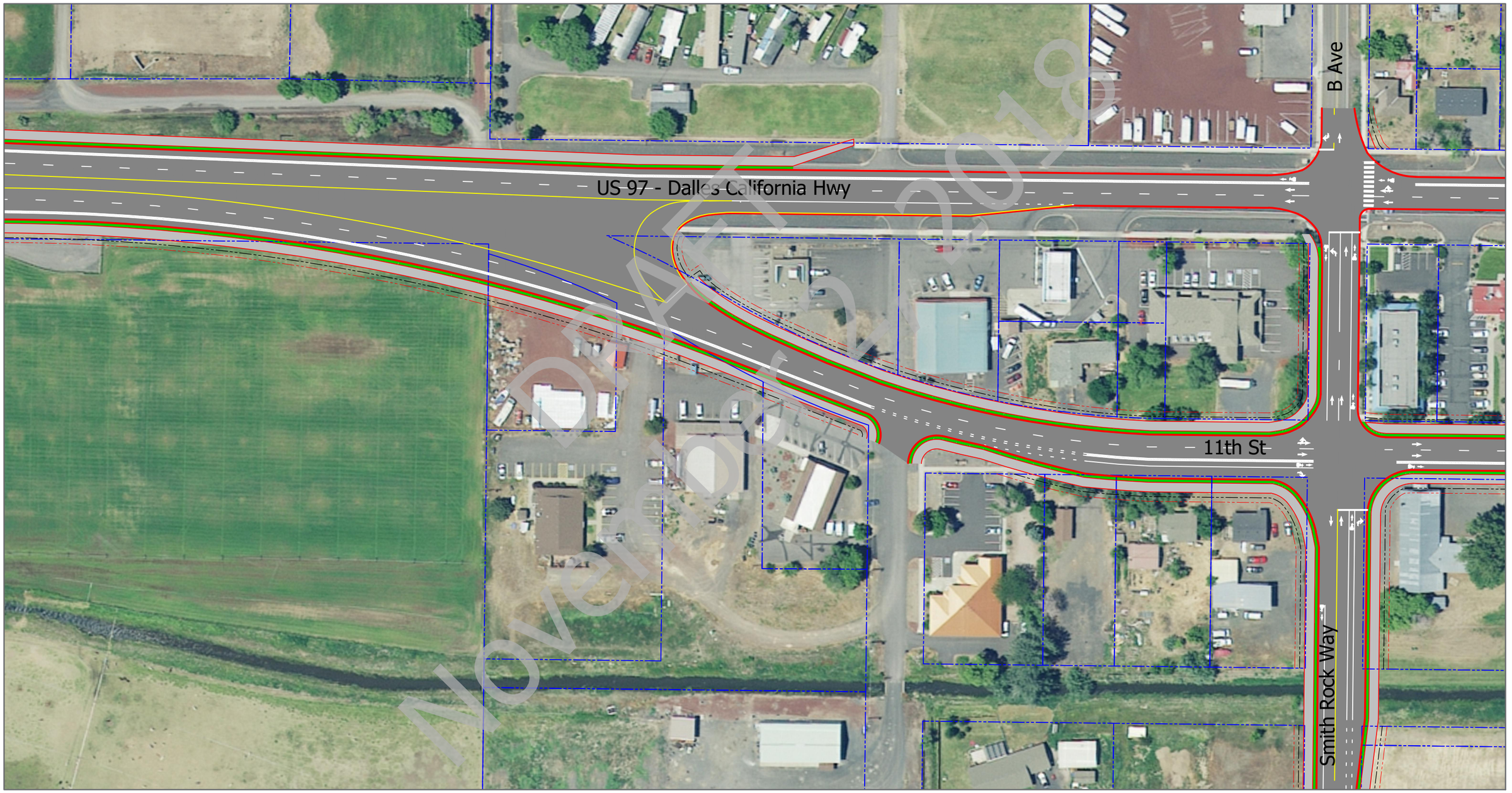
FIGURE 12: RCUT CONCEPT DESIGN



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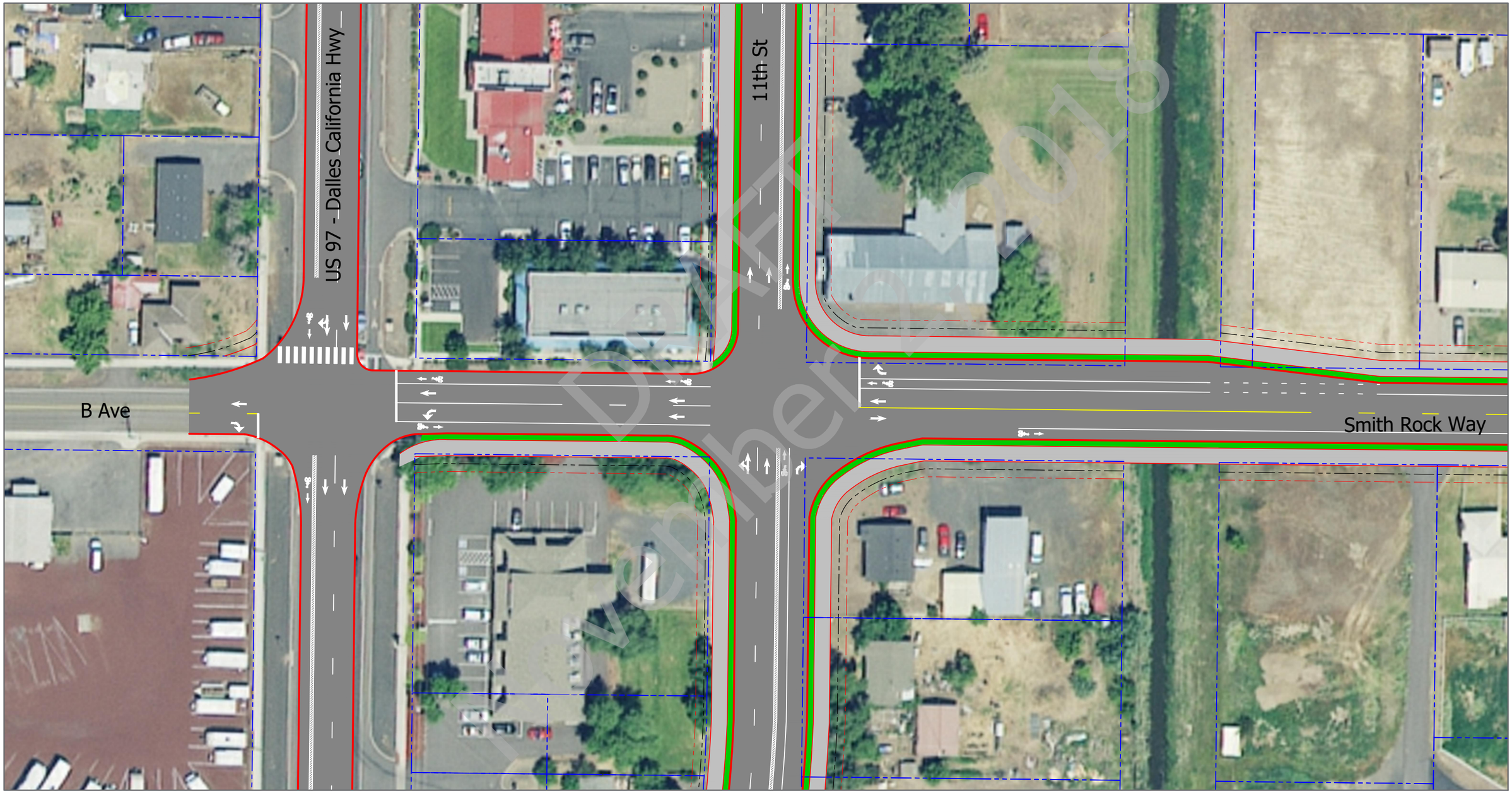
Approximate R/W based on Deschutes County GIS Tax Lot information
5-foot R/W offset
10-foot R/W offset
Curb
Back of Sidewalk

Scale: 1" = 100'
100 50 0 100
N

FIGURE 13A: "B" AVENUE ONE-WAY



Approximate R/W based on Deschutes County GIS Tax Lot information

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10-foot R/W offset

Curb

Back of Sidewalk

Scale: 1" = 60'

60 30 0 60

N

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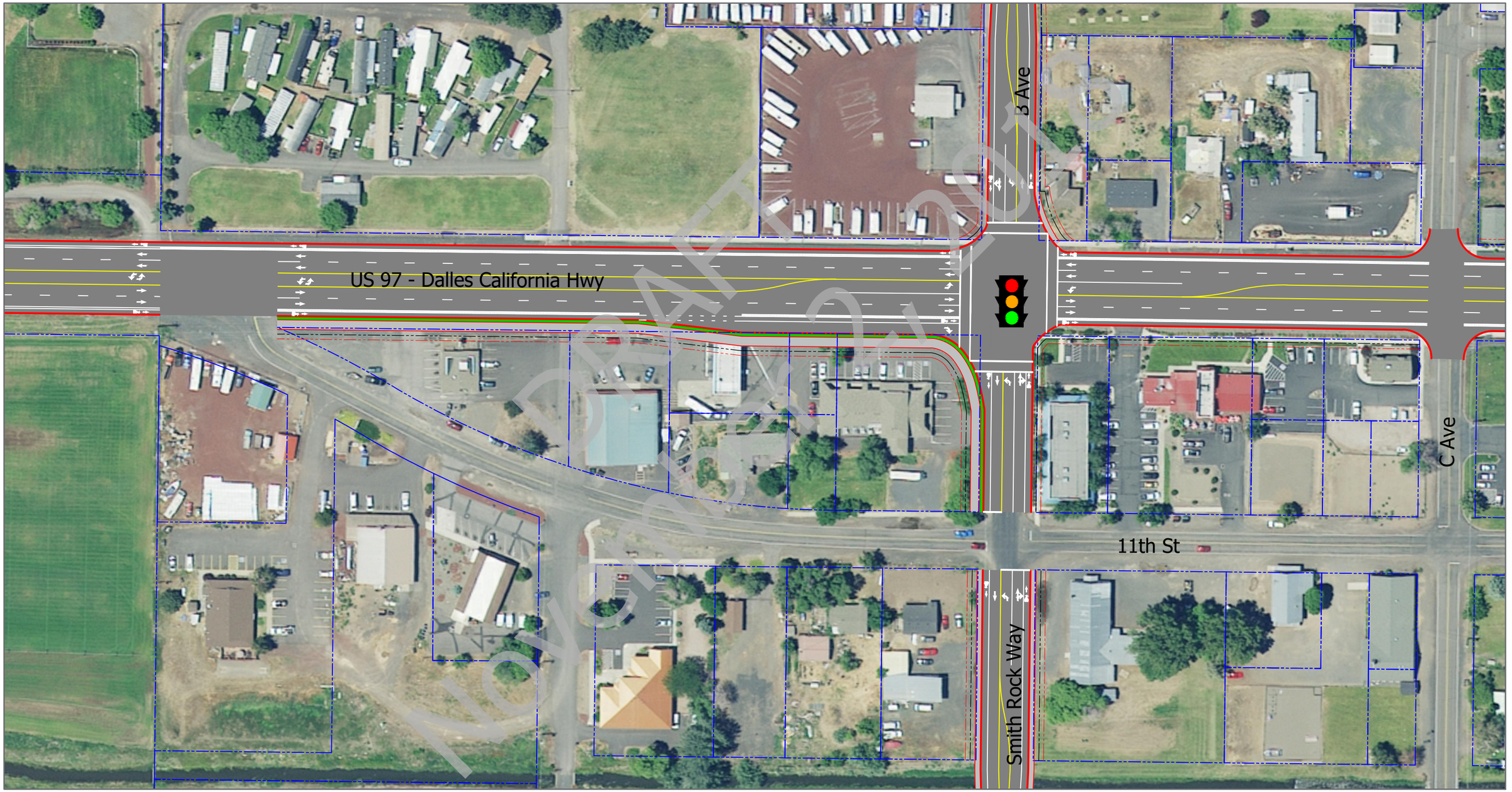
FIGURE 13B: "B" AVENUE ONE-WAY



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Approximate R/W based on Deschutes County GIS Tax Lot information
5-foot R/W offset
10-foot R/W offset
Curb
Back of Sidewalk

Scale: 1" = 100'
100 50 0 100
N

FIGURE 14A: 5-LANE SIGNAL (SOUTH)

US 97 - Dalles California Hwy

11th St

B Ave

Smith Rock Way

Approximate R/W based on Deschutes County GIS Tax Lot information

5-foot R/W offset

10-foot R/W offset

Curb

Back of Sidewalk

Scale: 1" = 60'

60 30 0 60

N

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FIGURE 14B: 5-LANE SIGNAL

MOSTING PROMISING ALTERNATIVE EVALUATION

Based on the Concept Development Workshop process, five alternatives have been identified as the most promising intersection improvements to improve operations at Lower Bridge Way (North Intersections) and B Avenue-Smith Rock Way (South Intersections) in Terrebonne. These alternatives were selected based on their compliance with the project goals, objectives, evaluation criteria, public feedback, and initial engineering assessments and cost estimates. This section evaluates the intersections alternatives in more detail based on their operational performance, geometry, potential right-of-way impacts, constructability, access management considerations, cost magnitude, multi-modal connectivity, and safety features. The remainder of this section provides an assessment of each intersection alternative based on these factors.

Operational Assessment of Most Promising Alternatives

Each of the intersection alternatives were analyzed under year 2040 weekday PM peak hour using HCM 6th Edition Methodology to ensure adequate capacity and queue storage at each applicable study intersection. *Alternative operational worksheets are provided in Appendix G. A queuing analysis summary is provided in Appendix H.*

Alternative I-6A2 - Northbound Fly-Under (Couplet)

A fly-under approach creates a grade separation for the northbound left turning movement at the US 97/Lower Bridge Way intersection. Given the topographic features of the intersection, it was assumed that US 97 southbound lanes (under a couplet configuration) would be elevated on an overpass and northbound left-turn movements to Lower Bridge Way would cross underneath the southbound US 97 travel lanes. As part of the fly-under scenario, the eastbound left turning movement would be restricted requiring all vehicles attempting to perform this low volume movement to turn right and complete a U-turn at Central Avenue. The analysis for the fly-under also assumes a couplet configuration south of Lower Bridge Way with two through lanes for both the northbound and southbound movements.

To properly account for the changing travel patterns, future traffic volumes were manually redistributed along the network before being analyzed. Figure 15 illustrates the proposes lane configuration, redistribution of trips, and future operations of the fly-under scenario. Figure 10 shows a conceptual design of the scenario.

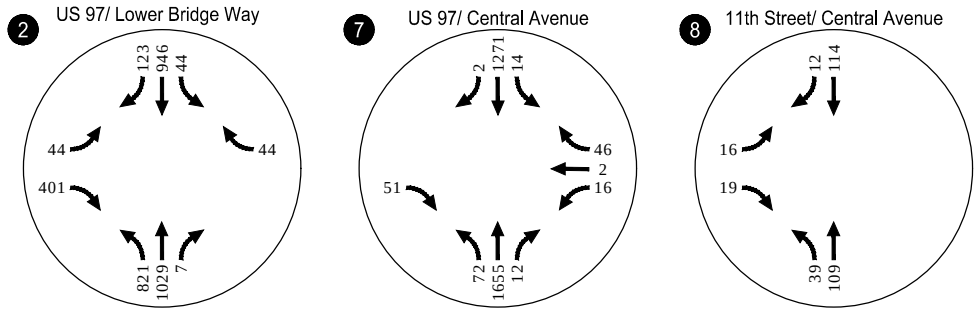
Under a stop control configuration, the eastbound right turning movement is anticipated to exceed ODOT side street mobility standards. A yield control would improve operations, however, would exceed side street standards in the future 2040 scenario. To meet standards, an add lane would create a free flow movement, resulting in minimal delay for eastbound right trips. All other intersections meet ODOT mobility requirements. A queuing analysis indicated all approaches are expected to meet the minimum mid-block spacing requirements in the PM peak hour. *A 95th percentile queue figure is provided in Appendix H.*

Alternative I-6A2 - Northbound Fly-Under (Five-Lane)

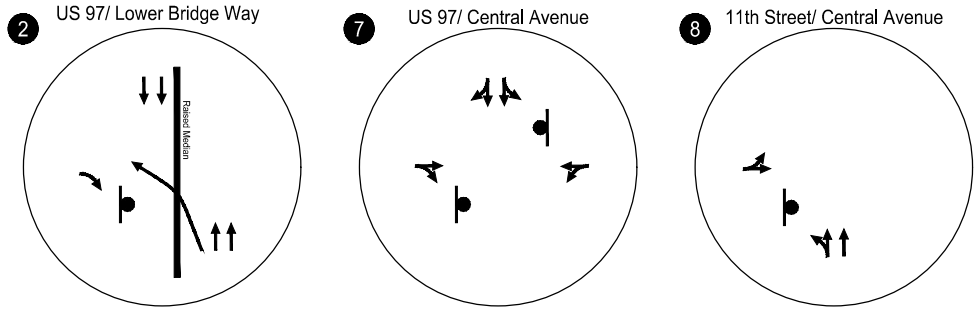
The fly-under approach for the five-lane corridor alternative is similar to the couplet scenario whereby US 97 would be elevated on an overpass and northbound left-turn movements to Lower Bridge Way would cross underneath the travel lanes. However, the five-lane corridor alternative requires a ramp for northbound left-turn traffic to access Lower Bridge Way via 11th Street. Due to the high demand, a northbound off-ramp would be developed north of Central Avenue and tie into a roundabout at the 11th Street/"F" Avenue intersection. This configuration would provide the necessary capacity as well as the ability for eastbound Lower Bridge Way to northbound US97 traffic to access the northbound on-ramp via the 11th Street/"F" Avenue roundabout.

Similar to the Couplet scenario under the fly-under alternative, all intersection north of Central Avenue would meeting ODOT mobility standards under 2040 traffic conditions. Figure 16 illustrates the proposes lane configuration, redistribution of trips, and future operations of the fly-under scenario. Figure 11 shows a conceptual design of the scenario.

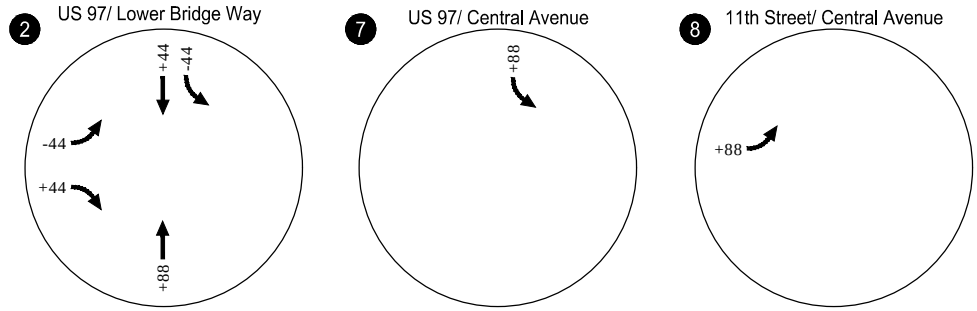
2040 No Build Volumes



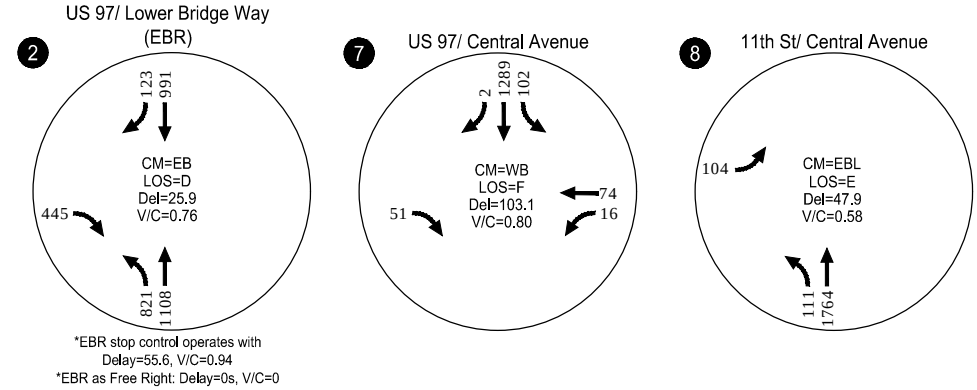
2040 North Terrebonne Fly-Under Lane Configuration



2040 North Terrebonne Fly-Under Redistribution



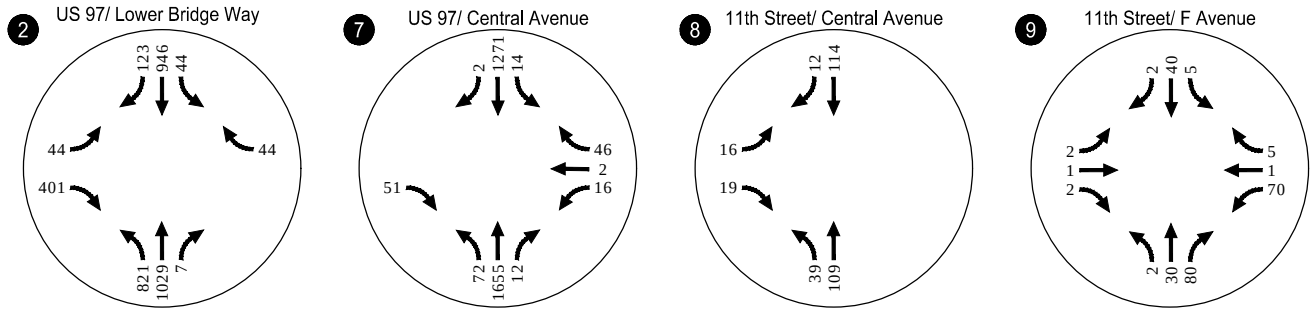
2040 North Terrebonne Fly-Under Volumes and Operations



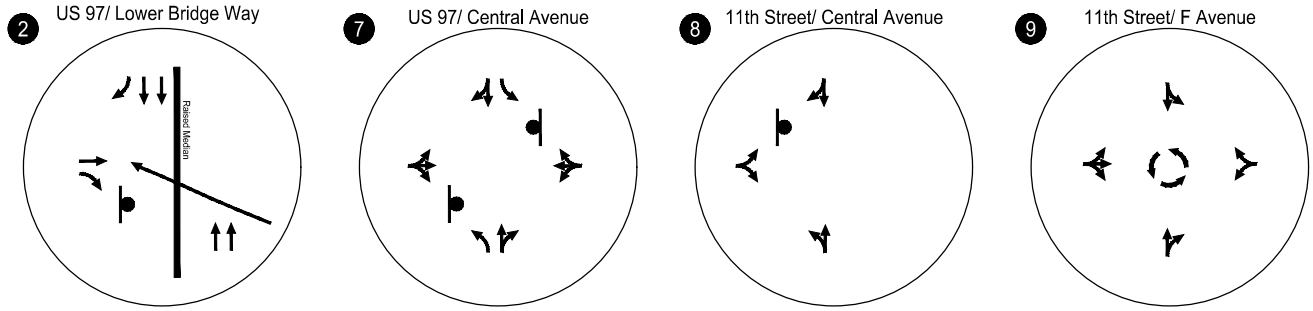
2040 North Terrebonne Fly-Under Alternative
Lane Configuration, Redistribution, Volumes and Operations

Figure
15

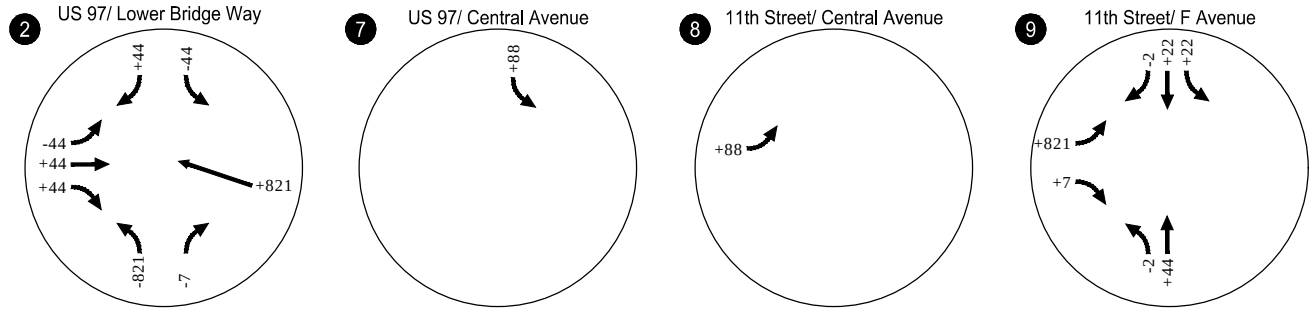
2040 No Build Volumes



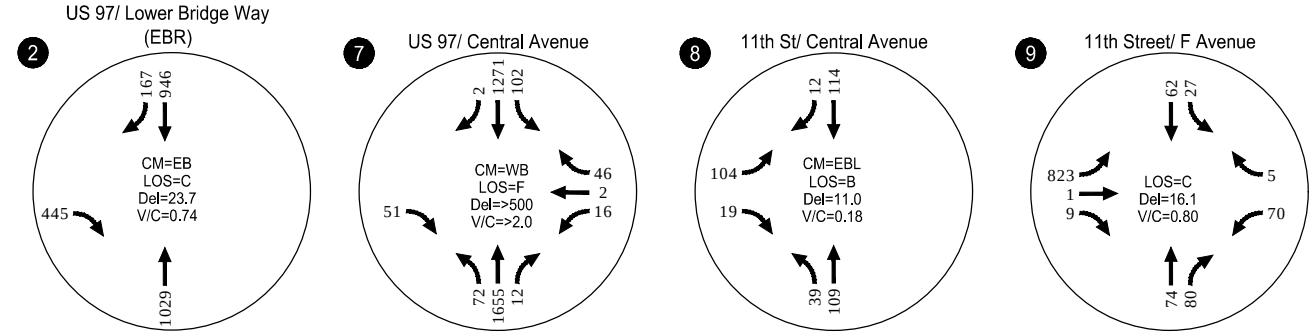
2040 North Terrebonne Fly-Under Lane Configuration



2040 North Terrebonne Fly-Under Redistribution



2040 North Terrebonne Fly-Under Volumes and Operations



2040 North Terrebonne 5-Lane Fly-Under Alternative
Lane Configuration, Redistribution, Volumes and Operations

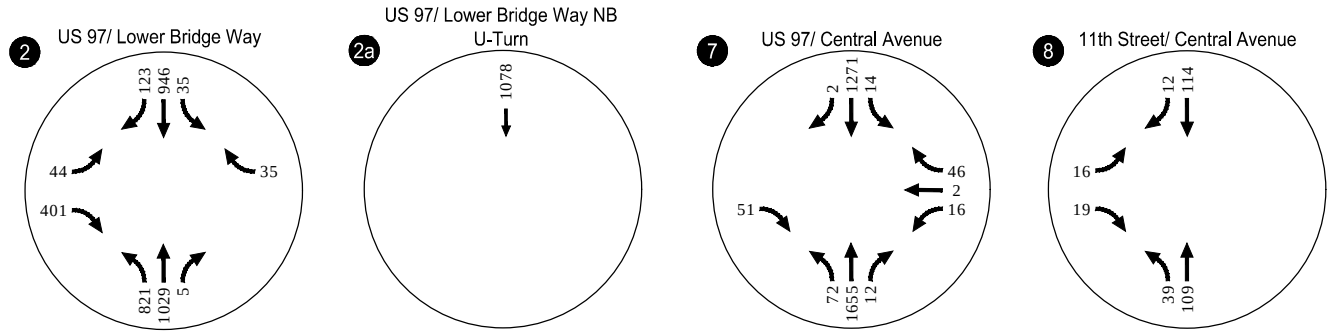
Figure 16

Alternative I-5B – Restricted Crossing U-turn (R-CUT)

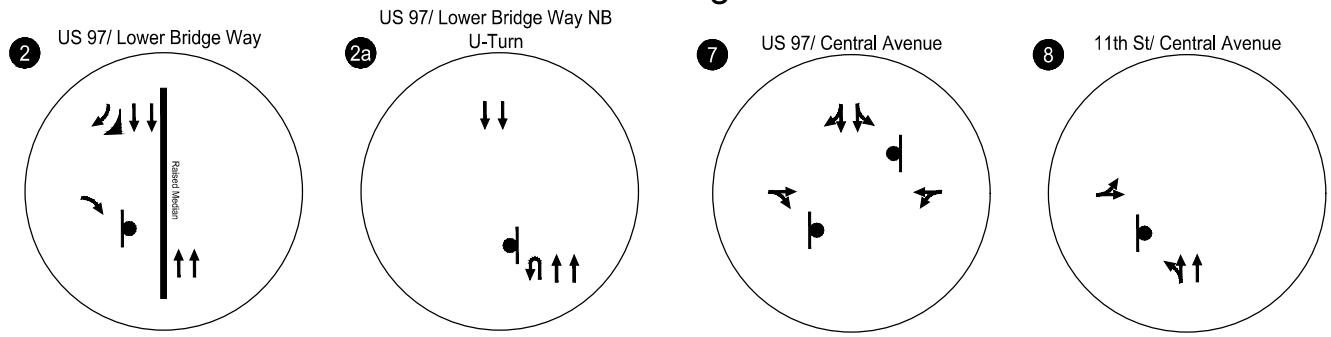
An R-CUT is an alternative intersection form that restricts left and through side street movements. This approach was analyzed at the US 97/Lower Bridge Way intersection where vehicles on Lower Bridge Way desiring to complete a left or through movement would be required to turn right and complete a U-turn at Central Avenue (vehicles desiring to go northbound) and a new intersection north of Lower Bridge Way (vehicles desiring to go southbound). The analysis for the R-CUT also assumes a couplet configuration south of Lower Bridge Way with two through lanes for both the northbound and southbound movements. Figures 12 and 17 illustrate the alternative design and the lane configuration, redistribution of trips, and future operations, respectively.

Similar to the fly-under scenario, the eastbound right turning movement would require a yield control and ultimately an add lane to accommodate the volumes. Given the high conflicting movements at the northbound U-turn (intersection 2a in Figure 17), a stop-controlled intersection would be significantly over capacity and would not meet mobility standards. Additionally, the northbound U-turn would likely produce significant queues that could spillback onto the northbound mainline. Without additional treatments for the northbound U-turn movement, ***a R-CUT is not a viable alternative from a mobility standpoint.***

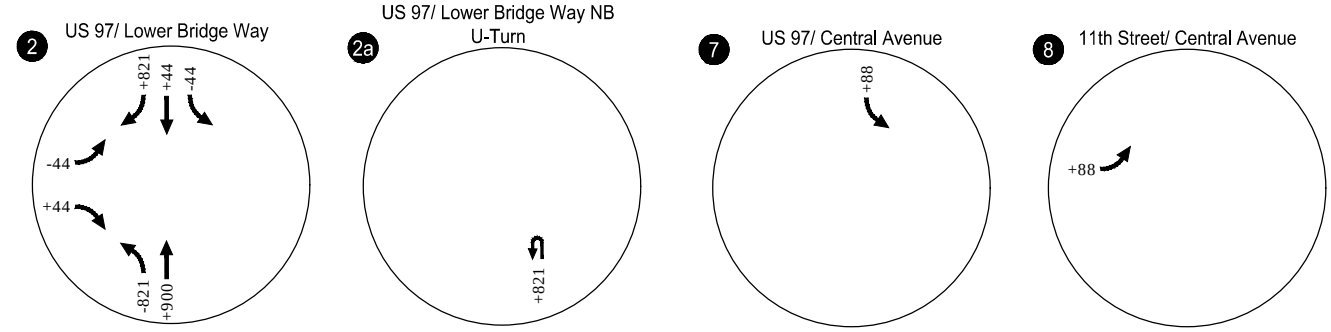
2040 No Build Volumes



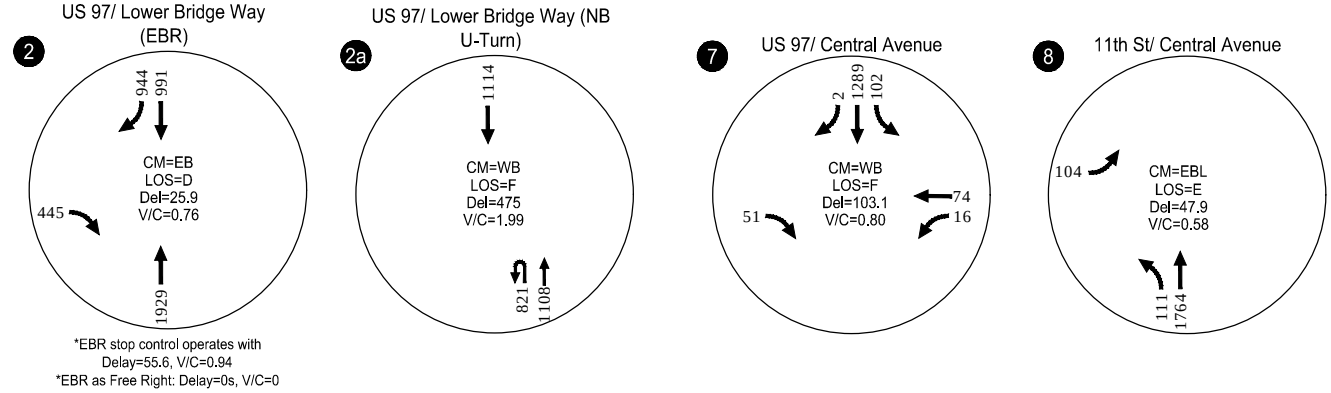
2040 North Terrebonne R-CUT Lane Configuration



2040 North Terrebonne R-CUT Redistribution



2040 North Terrebonne R-CUT Volumes and Operations



2040 North Terrebonne R-CUT Alternative
Lane Configuration, Redistribution, Volumes and Operations

Figure
17

Alternative SI-1B – Free Flow Couplet with B Avenue One-Way Westbound

A one-way stop-controlled couplet on the south end of Terrebonne would consist of converting the segment of B Avenue-Smith Rock Way between 11th Street and US 97 to westbound only. This would require eastbound vehicles on B Avenue to turn right at the existing US 97 intersection and travel south and complete a U-turn maneuver at US 97/11th Street to proceed northbound on 11th Street (northbound US 97) or east on Smith Rock Way (see Figure 13A and 13B to understand this movement scenario). To properly account for the changing travel patterns, future traffic volumes were manually redistributed along the network before being analyzed. Trips were reassigned in a manor to provide a conservative number of trips (reasonable worst case scenario) at the critical movements in the study area. Figure 18 illustrates the proposed lane configuration, redistribution of trips, and future operations of the one-way couplet scenario. A yield control would provide an interim operational solution for the southbound U-turn at US 97/11th Street, however, an add lane would likely be required to meet mobility standards in 2040.

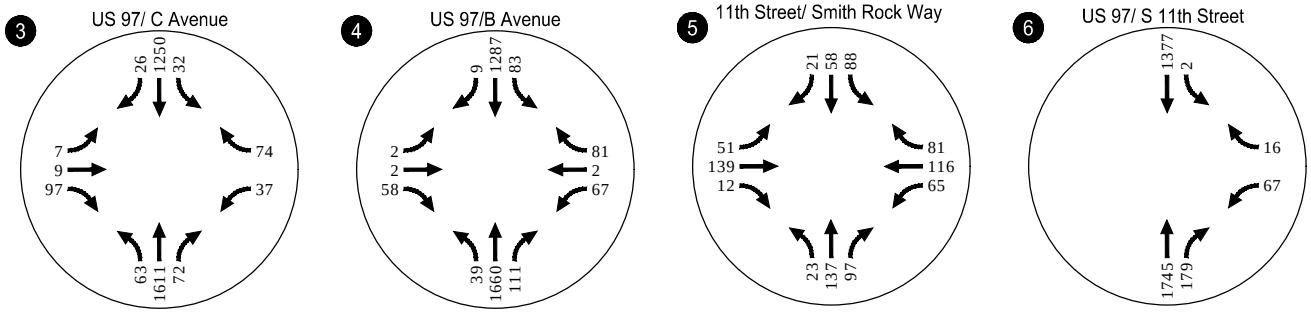
A queuing analysis indicated all approaches are expected to meet the minimum mid-block spacing requirements in the PM peak hour. *A 95th percentile queue figure is provided in Appendix H.*

Alternative SI-7A – Traffic Signal with 5-Lane Section

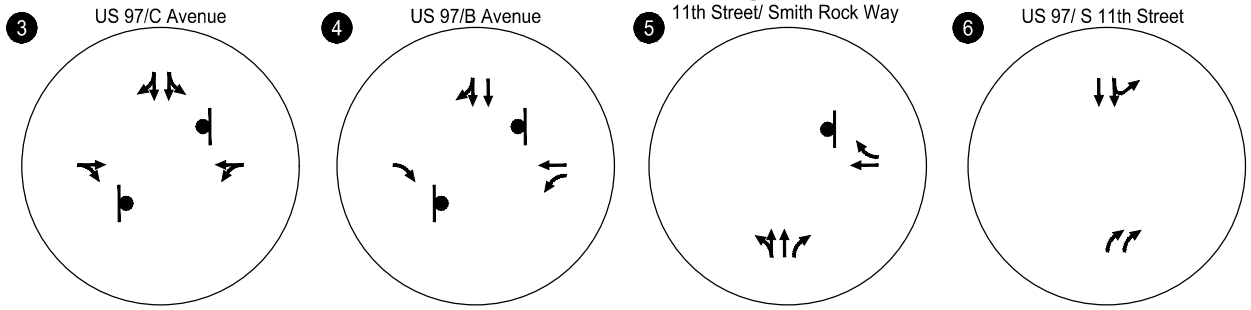
Results from the Alternative Evaluation work session indicated that the public was interested in a further review of a five-lane US 97 with a traffic signal at the B Avenue/Smith Rock Way intersection in Terrebonne. A traffic signal configuration was analyzed using future 2040 traffic volumes at the intersection of US 97/B Avenue. The analysis was conducted assuming a 5-lane section with two northbound and southbound through lanes. It was also assumed that left turn movements on US 97 were protected only and B Avenue was protected-permissive for the left turn movement. The lane configuration and operational results are shown in Figure 19. A concept design for a signal at US 97/B Avenue is shown in Figures 14A and 14B.

As shown, a traffic signal at US 97/B Avenue would require dedicated left-turn lanes on all approaches and a dedicated northbound right-turn lane. ODOT mobility standards identify a maximum mainline volume-to-capacity (v/c) ratio of 0.70. ***An intersection configuration with two through lanes in each direction on US 97 does not provide enough capacity to meet mobility standards***. To meet standards, an additional northbound and southbound lane (or three lanes in each direction) would be required at the intersection. Additionally, the queuing analysis indicated that a traffic signal would create significant queues in the weekday PM peak hour, particularly for the northbound and southbound approaches. The northbound through queue would likely extend past 11th Street and the southbound queue would extend past C Avenue. *A 95th percentile queue figure is provided in Appendix H.*

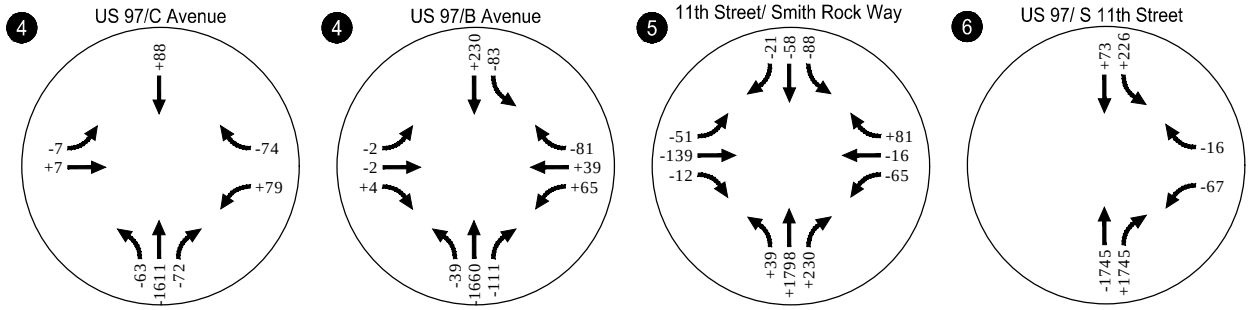
2040 No Build Volumes



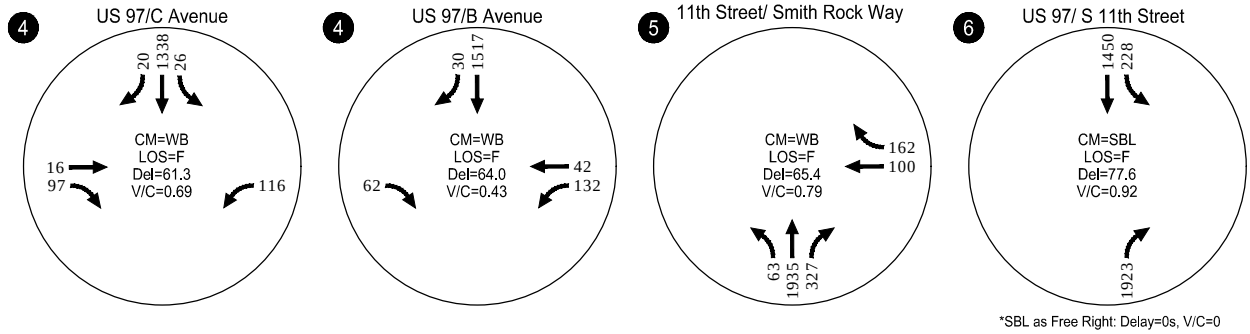
2040 South Terrebonne Couplet Lane Configuration



2040 South Terrebonne Couplet Redistribution



2040 South Terrebonne Couplet Volumes and Operations

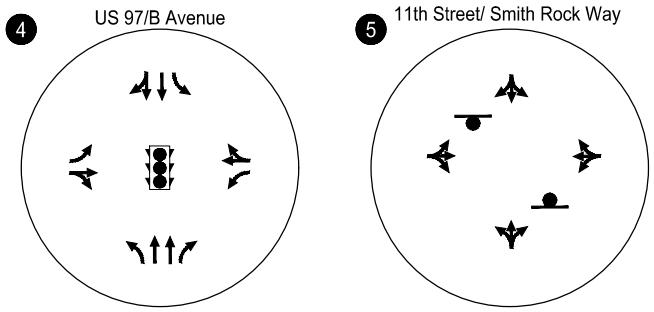


*SBL as Free Right: Delay=0s, V/C=0

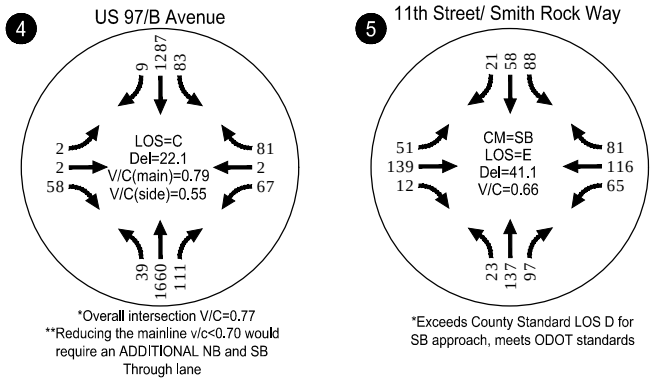
2040 South Terrebonne Couplet Alternative
Lane Configuration, Redistribution, Volumes, and Operations

Figure
18

2040 South Terrebonne Signal Lane Configuration



2040 South Terrebonne Signal Volumes and Operations



2040 South Terrebonne Signal Alternative
Lane Configuration, Redistribution, Volumes, and Operations

Figure 19

Geometric Assessment of Most Promising Alternatives

The following section provides an assessment of potential constructability, right-of-way impacts, and access management and spacing consideration for each of the most promising alternatives.

Constructability

The most promising alternative corridor alignments and intersection improvements types have their own considerations related to constructability. Layouts were prepared based design criteria for an Urban Arterial – Other; Non-Designated Traditional Downtown/Commercial Business District functional classification roadway as provided in Chapter 6 of the 2012 version of the ODOT Highway Design Manual. The following design assumptions were used for the corridor and intersections located between 11th Street and Lower Bridge Way:

- Design Speed: 35mph
- Design Vehcile: WB-67
- Lane width: 12-ft
- Bike lane: 8-ft (2-ft buffer, 6-ft bike lane)
- Sidewalk: 10-ft
- Maximum Profile Grade: 8%
- Left Side Shy (Couplet): 1-ft
- Median: 14-ft
- Max. Superelevation: 4%

The following section summarize the potential constructability considerations of each corridor and intersection alternative.

- Corridor Alignment
  - Couplet (A4A)

Potential Issues	• Curve from US97 NB to 11th Street (NB couplet) potentially impacts properties to the east of 11th Street. • 11th Street likely requires full reconstruction for pavement, curb, drainage and sidewalk. • US97 NB connection from 11th Street at north end potentially requires widening and rock cuts.
Potential Benefits	• One-lane of travel in each direction can be maintained on couplet to allow off alignment construction staging. • SB couplet mostly accommodated on existing US97 roadway requiring less widening.

	• Preserves existing sidewalks from Central Street to 11th Street. • Preserves existing water quality/drainage features on existing US97 between Central Avenue and 11th Street. • Improved bike/ped facilitates on 11th Street and US97.
Further Refinement Areas	• Explore geometry and connection revisions at 11th Street/Lower Bridge Way to provide access to NB and SB US97 • Shift US97 SB couplet alignment to reduce impacts at the south intersection.

- Five-Lane (A-5A)

Potential Issues	• Requires widening and significant grading between Lower Bridge Way and Central Ave. • Existing water quality/drainage facilitates on US97 impacted requiring reconstructed facilities • Complicated staging. Widening US97 requires construction under traffic unless detoured to another alignment. • No bike/ped facility improvements on 11th Street.
Potential Benefits	• Signalized crossing for pedestrian and bicycle movements are provided at the US 97/B Avenue intersection • Improved bike/ped facilitates on US97.
Further Refinement Areas	• Reconfigure south connection of 11th Street and US97. • Reconfigure 11th Street/Lower Bridge Way/US97 intersection.

- Intersection (North)
  - Restricted Crossing U-Turn (I-5B)

Potential Issues	• Requires realignment of US97 to the north of Lower Bridge Way to introduce a median for RCUT movement. • Rock outcroppings would potentially require rock excavation.
Potential Benefits	• Realigned US97 alignment potentially simplifies staging so realignment can be constructed off alignment.

Further Refinement Areas	• Refine turning geometry to minimize US97 realignment and potential rock cuts.

- Northbound Left Fly-under (I-6A2) [Couplet]

Potential Issues	• Intersection geometry complicates access to US97 SB and Terrebonne commercial area for properties north of Central Avenue on 11th Street. • Profile grade of US97 SB over 11th Street connection to Lower Bridge Way requires Lower Bridge Way eastbound realignment across private property and potential retaining wall between US97 SB and Lower Bridge Way. • Connection from US97 SB to Lower Bridge Way has potential high earthwork costs due to rock removal.
Potential Benefits	• Separates US97 SB and 11th Street/Lower Bridge Way connections.
Further Refinement Areas	• Refine connection to existing properties on 11th Street. • Geometry refinements to avoid or minimize rock cuts.

- Northbound Left Fly-under (I-6A2) [Five-Lane]

Potential Issues	• The northbound off-ramp will require retaining walls and impact to properties between US97 and 11th Street • The five-lane widening of US97 will likely require retaining walls along the east side of the roadway due to grade differentials between Lower Bridge Way and Central Avenue • Profile grade of US97 over 11th Street connection to Lower Bridge Way requires Lower Bridge Way eastbound realignment across private property and potential retaining wall between US97 and Lower Bridge Way. • Connection from US97 SB to Lower Bridge Way has potential high earthwork costs due to rock removal.
Potential Benefits	• Provide local route connectivity between 11th Street and Lower Bridge Way.

Further Refinement Areas	• Refine roundabout and off-ramp connection to the 11th Street/"F" Avenue intersection. • Geometry refinements to avoid or minimize rock cuts.

- Intersection (South)
  - Free flow Couplet with B Avenue One-Way Westbound (SI-1B)

Potential Issues	• Minimum radius curve for design speed has potential impacts outside right of way on the outside (east) of the NB US97 connection to 11th Street couplet.
Potential Benefits	• Couplet section generally fits within existing 11th Street right of way requiring only minor acquisition. • Improved bike/ped facilitates on 11th Street and US97.
Further Refinement Areas	• Investigate opportunities to tighten geometry on NB US97 to 11th Street.

  - Traffic Signal with 5-lane Section (SI-7A)

Potential Issues	• Lane configuration of 5-lane section on US97 and 3-lane section on B Avenue/Smith Road Way requires widening. • Design vehicle swept path impacts corners of intersection. • Larger crossing distance for pedestrians. • Need to identify additional areas for drainage retention and storage
Potential Benefits	• Signalized crossing of US97 for pedestrians. • Signalized access to US97 reduces delay from B Avenue-Smith Road Way • Improved bike/ped facilitates on US97.
Further Refinement Areas	• Drainage retention and storage

	• Refinements to minimize land and access impacts associated with widening

Right-of-Way Impacts

Although US97 through Terrebonne has a relatively wide 100-foot right of way, varying impacts are anticipated depending on which corridor and intersection type alternatives are selected. 11th Street also generally has sufficient right of width for the 2-lane NB couplet section and associated sidewalk/planters. The following section summarize the potential right-of-way impact considerations of each corridor and intersection alternative.

- Corridor Alignment
  - Couplet (A4A)

Potential Issues	• Potential impacts to properties on the inside of NB US97 to 11th Street couplet. • Intersection type at the north and south end of the couplet will drive corresponding right of way impacts (see intersection discussion below).
Potential Benefits	• Excess right of way remaining on existing US97 through Terrebonne can be used for water quality or other needed facilities. • Potentially less right of way impacts than other alternatives.
Further Refinement Areas	• Review geometry at north and south couplet ends to optimize connections.

  - Five-Lane (A-5A)

Potential Issues	• 5-lane section uses most of available existing right of way on US97 through town requiring relocation of drainage/water quality facilities. May require purchasing property for facility. • Widening of the elevated segment of US97 immediately south of Lower Bridge Way may impact existing businesses and require large retaining wall structures.
Potential Benefits	• Other intersection improvements affect private property and may provide opportunities for siting drainage/water quality facilities.

Further Refinement Areas	• Analyze hydraulics to determine sizing and location needs for drainage/water quality.

- Intersection (North)
  - Restricted Crossing U-Turn (I-5B)

Potential Issues	• Substantial right of way needed for left turning movement across median north of Lower Bridge Way.
Potential Benefits	• North of Lower Bridge Way US97 right of way widens temporarily (old US9 alignment) potentially reducing the right of way need.
Further Refinement Areas	• Refine geometry and design vehicle turning movements to minimize widening and potential impact to right of way.

  - Northbound Left Fly-under (I-6A2) [Couplet]

Potential Issues	• Connection from US97 SB to Lower Bridge Way has significant right of way impacts in the NW and SW quadrants.
Potential Benefits	• Right of way impacts are at the sag of existing US97 providing opportunities to locate drainage/water quality facilities in areas already impacted.
Further Refinement Areas	• Refine geometry to minimize impacts from roadway elements. • Refine geometry to allow location of drainage/water quality facilities on affected properties.

  - Northbound Left Fly-under (I-6A2) [Five-Lane]

Potential Issues	• Connection from US97 SB to Lower Bridge Way has significant right of way impacts in the NW and SW quadrants. • Connection from US97 NB to Lower Bridge Way has significant impacts to properties bounded by 11th Street, US97, "F" Avenue, and Central Avenue. In addition, smaller impacts will also occur in the SE and NE quadrants of the 11th Street/"F" Avenue intersection.

Potential Benefits	• Right of way impacts are at the sag of existing US97 providing opportunities to locate drainage/water quality facilities in areas already impacted.
Further Refinement Areas	• Refine geometry to minimize impacts from roadway elements. • Refine geometry to allow location of drainage/water quality facilities on affected properties.

- Intersection (South)
  - Free flow Couplet with B Avenue One-Way Westbound (SI-1B)

Potential Issues	• The Smith Rock Way/11th Street (NB US 97) intersection impacts properties on the east side of 11th Street.
Potential Benefits	• Property impacts on B Avenue are less than other options since only 2-lanes. • Couplet configuration utilizes much of the existing right of way limiting impacts from widening.
Further Refinement Areas	• Optimize intersection configuration to limit impacts from widening.

  - Traffic Signal with 5-lane Section (SI-7A)

Potential Issues	• The US97 northbound right-turn lane impacts the properties in the southeast quadrant of the intersection • Potential for right of way impacts due to widening for 3rd lane. • Large impacts on corners due to design vehicle turning radius. • Lane configuration on B Avenue and bridge/culvert widening impacts irrigation district right of way.
Potential Benefits	• Limited right of way impacts on 11th street.

Further Refinement Areas	• Review cross section elements to reduce option width and resulting right of way impacts.

Access Management and Spacing

In regard to meeting Oregon Highway Plan spacing guidelines and minimizing conflicts along the US 97 corridor within and approaching Terrebonne, an initial assessment of potential access related issues, benefits, and further refinement areas was completed for the most promising alternatives. This assessment is based on US 97 being designated a statewide highway with expressway designations north of Lower Bridge Way and south of 11th Street. The corresponding access spacing standards are 425 feet for the segment posted at 35 mph within the non-expressway area and 5,280 feet for the segments posted 45 and 55 mph in the expressway designated areas. The following section provides the initial assessment findings:

- Corridor Alignment
  - Couplet (A4A)

Potential Issues	• All properties located along 11th street (NB US 97) north of the Central Avenue intersection will need to utilize either: 1) F Avenue to NW 16th Street to C Avenue; or the Lower Bridge Way U-turn to travel south on US 97.
Potential Benefits	• Significant reduction in conflict points along US 97 and 11th Street through the elimination of two-direction conflicts for side-street left-turn movements and one-direction conflicts for mainline left-turn conflicts. • Modal crossing movements of US 97 are improved due to the reduction in two-direction conflicts • Pedestrian and bicycle exposure crossing US 97 is reduced • Direct access for businesses and properties along 11th Street to NB US 97
Further Refinement Areas	• Explore potential parallel north-south routes to facilitate local traffic between C and F Avenues. • Explore the potential relocation of the US 97/NW 10th Street (south) intersection • Explore potential for future access consolidations to minimize conflicts and move in the direction of the statewide highway spacing standard

- Five-Lane (A-5A)

Potential Issues	• Increase in conflict points and exposure due to second lane in each direction at all US 97 intersections. • Increase delay and capacity issues at unsignalized intersections (i.e., Central Avenue, C Avenue, and 11th Street) to US 97 • Exposure of all modal crossing movements of US 97 is increased due to the expanded cross section. • Northbound, southbound, and westbound vehicular queues at the B Avenue/US 97 intersection during peak hour time periods will extend beyond upstream driveways and intersections • Access consolidations will be necessary to facilitate the development of the northbound right-turn lane at the US 97/B Avenue intersection
Potential Benefits	• Signalized crossing for pedestrian and bicycle movements are provided at the US 97/B Avenue intersection
Further Refinement Areas	• Restricting (via median) or removing the B Avenue access driveway between US 97 and 11th Street due to vehicle queuing and potential rear-end collisions during the southbound left-turn phase. • Explore potential for future access consolidations to minimize conflicts and move in the direction of the statewide highway spacing standard

- Intersection (North)

  - Restricted Crossing U-Turn (I-5B)

Potential Issues	• Early wayfinding issues for motorists and those utilizing online guidance applications to access northbound US 97 from Lower Bridge Way via the Central Avenue U-turn movement under couplet configuration
Potential Benefits	• Converts the existing difficult northbound and eastbound left-turn movement conflicts at US 97/Lower Bridge Way into one-way merge and diverge movements
Further Refinement Areas	• Access refinements to the Kingdom Hall of Jehovah's Witnesses and the resident property immediately east of the US 97/NW 11th Street (north) intersection

- Northbound Left Fly-under (I-6A2) [Couplet]

Potential Issues	• Early wayfinding issues for motorists and those utilizing online guidance applications to access northbound US 97 from Lower Bridge Way via the Central Avenue U-turn movement under couplet configuration
Potential Benefits	• Eliminates the existing difficult northbound and eastbound left-turn movement conflicts at US 97/Lower Bridge Way
Further Refinement Areas	• Access refinements to the Kingdom Hall of Jehovah's Witnesses and the resident property immediately east of the US 97/NW 11th Street (north) intersection

- Northbound Left Fly-under (I-6A2) [Five-Lane]

Potential Issues	• Early wayfinding issues for motorists and those utilizing online guidance applications to access northbound US 97 from Lower Bridge Way via the 11th Street/"F" Avenue roundabout
Potential Benefits	• Eliminates the existing difficult northbound and eastbound left-turn movement conflicts at US 97/Lower Bridge Way
Further Refinement Areas	• None identified at this time

- Intersection (South)
  - Free flow Couplet with B Avenue One-Way Westbound (SI-1B)

Potential Issues	• Early wayfinding issues with online guidance applications (i.e., folks destined to Smith Rock arriving from the north via US 97)
Potential Benefits	• Reduces the number of conflict movements at the US 97/ B Avenue intersection. • Reduces conflict points along B Avenue-Smith Rock Way (i.e., no westbound movements) with the existing Red Climber Supply driveway.
Further Refinement Areas	• Proper signage and channelization to prevent potential wrong-way southbound right-turn or eastbound through movements from entering B Avenue

- Traffic Signal with 5-lane Section (SI-7A)

Potential Issues	• Northbound, southbound, and westbound vehicular queues during peak hour time periods will extend beyond upstream driveways and intersections
Potential Benefits	• Signalized crossing for pedestrian and bicycle movements are provided at the US 97/B Avenue intersection
Further Refinement Areas	• Restricting (via median) or removing the B Avenue access driveway between US 97 and 11th Street due to vehicle queuing and potential rear-end collisions during the southbound left-turn phase.

Multi-Modal and Safety Assessment of the Most Promising Alternatives

The multimodal accommodations, local connectivity, and safety of the US 97 corridor are critical components in the design of all the intersection alternatives. Each alternative is designed to meet ODOT Design Manual and Deschutes County standards. In addition, a high-level assessment has indicated that multi-modal accommodations can be made in multiple ways within each of the most promising alternatives. The specific location and identification of the appropriate multimodal and potential additional safety improvements will be further assessed once a preferred alternative is selected. These improvements will include, at a minimum pedestrian and bicycle facilities and crossings, transit accommodations, and corridor and intersection transition and speed management related improvements.

Additionally, several cross-section concepts were identified as promising alternatives. For design purposes cross-section alternatives T-1A and T-4A were incorporated into the couplet and 5-lane corridor alignment alternatives, respectively. However, these cross-sections and the corresponding transition areas into Terrebonne will be further refined following the selection of a preferred alternative. These elements will be addressed in Technical Memorandum #7: *Identification of Preferred, Cost-Constrained Alternative*.

Preliminary Cost Estimate of the Most Promising Alternatives

In developing the preliminary cost estimates for the most promising alternatives, the estimates were developed for the couplet and five-lane corridor alignments with the intersection alternatives by segmenting costs south (see Table 5) and north (see Table 6) of Central Avenue to provide a relative comparison between the corridor and intersection alternatives. Adding the respective north and south segments together provides the overall preliminary cost estimates (for construction, design engineering, construction engineering, and right-of-way) for the corridor and intersection elements of the cost at this time and does not include the transitional or potential construction phasing elements at this time.

Table 5 - Southern Segment Cost Elements (south of Central Avenue)

Corridor Element	Intersection Element	Preliminary Cost Estimate
Couplet (A4A)	Free flow Couplet with B Avenue One-Way Westbound (SI-1B)	$5.5 M
Five-Lane (A-5A)	Traffic Signal with 5-lane Section (SI-7A)	$3.6 M

Table 6 - Northern Segment Cost Elements (north of Central Avenue)

Corridor Element	Intersection Element	Preliminary Cost Estimate
Couplet (A4A)	Restricted Crossing U-Turn (I-5B)	$6.1 M
Couplet (A4A)	Northbound Left Fly-under (I-6A2) [Couplet]	$12.5 M
Five-Lane (A-5A)	Northbound Left Fly-under (I-6A2) [Five-Lane]	$17.3 M

As shown, all intersection alternatives under the couplet corridor configuration when combining the northern and southern segments appear financially feasible at this point in the evaluation process as they are either under or near the currently allocated $20 million budget. The five-lane corridor configuration appears to exceed the budget with a preliminary cost of approximately $20.9 million at this time. It should be noted that the preliminary cost estimates *do not* include pedestrian, traffic calming, beautification (other than standard landscaping), or other transition elements. *A summary of the scoring justification is provided in Appendix I*

Evaluation Criteria Matrix of the Most Promising Alternatives

The project team has conducted an evaluation of each of the most promising alternatives based on a quantitative assessment with respect to the evaluation criteria and the sections described above. The summary table is shown in Table 7. To rank each of the concepts according to the evaluation criteria, a scoring system was developed. The alternatives with the best possible outcome are indicated by a solid circle and those with the least favorable outcome are indicated by an open circle. The alternatives with neutral or marginal improvement outcomes are indicated by a half-filled circle. To quantitatively assess each outcome, the circles were evaluated by the following values: open circle=0, half circle=1, and full circle=3. *A summary of the scoring justification is provided in Appendix I.*

Table 7: Comparing the Goals, Objectives, & Evaluation Criteria to Future Alternatives

Goal	Objective	Evaluation Criteria	Intersection Evaluation					
				South		North		
			Baseline No Build	5 Lane (w/ Signal @ B Ave)	One-Way Couplet	Fly Under (5-lane)	Fly Under (Couplet)	R CUT
Community & Livability: provide for a high quality of life by balancing US 97 mobility needs with community values and interests.	• 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.	• Does the proposed project element serve people that live in, work in, and/or visit Terrebonne?						
		• 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?						
		• What are the right of way impacts of the proposed project element - # of businesses relocated, #of residential properties impacted, impacts to public facilities, etc.						
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.	• 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	• Does the proposed project element meet mobility targets on US97 through 2040?						
		• Does the proposed project element represent an investment that works toward the long-term solution for the corridor?						
		• Does the proposed project element maintain or enhance the carrying and dimensional capacity for statewide freight movement?						

Goal	Objective	Evaluation Criteria	Intersection Evaluation					
				South		North		
			Baseline No Build	5 Lane (w/ Signal @ B Ave)	One-Way Couplet	Fly Under (5-lane)	Fly Under (Couplet)	R CUT
	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.	• Does the proposed project element enhance east-west connectivity within the community?	○	◒	◒	◒	◒	◒
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.	• 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.	• Does the proposed project element address an area with a crash history or risk factor? Is it expected to improve safety or slow speeds?	○	◒	●	●	●	●
		• Does the proposed project element reduce the level of stress experienced by pedestrians and/or cyclists?	○	◒	●	◒	●	●
Accessibility: provide infrastructure that supports accessible transportation options for all users.	• 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).	• Does the proposed project element address existing gap or deficiency in the vehicular, transit, bicycle and/or pedestrian network?	○	◒	●	◒	●	●
Financial Responsibility: use resources efficiently and invest in infrastructure that will serve the Community and statewide highway for years to come.	• Achieve maximum return on the $20 million allocated for improvements in the Terrebonne community	• What is the planning-level cost estimate of the proposed project element?	●	●	●	○	◒	◒
		• Can the preferred plan be implemented with the money allocated?	●	●	●	○	●	●
		• Does the benefit exceed the cost over a 20-year horizon?	○	○	●	○	●	○

Goal	Objective	Evaluation Criteria	Intersection Evaluation					
				South		North		
			Baseline No Build	5 Lane (w/ Signal @ B Ave)	One-Way Couplet	Fly Under (5-lane)	Fly Under (Couplet)	R CUT
Economic Vitality: encourage visitors and investment in the recreational, agricultural, business areas nearby and served by US 97.	• Provide connections to businesses and natural areas within and near the Terrebonne community. • Attract tourist and investment dollars to the greater Terrebonne community	• Does the proposed project element address mobility and serviceability for local and regional freight activity?	○	◒	●	●	●	●
		• Does the proposed project element support business activity in and around the community (e.g., the Smith Rock State Park)?	○	◒	●	●	●	●
		• Does the proposed project element improve pedestrian and/or bicycle access to businesses and natural areas in and around the community?	○	◒	●	◒	●	●
		Total Evaluation Results	○	◒	●	◒	●	○

Scoring – Blank=0, Half=1, Full=3

No Build – 13
5 Lane Signal – 24
One Way Couplet – 42
Fly-under (5 Lane) – 24
Fly-under (Couplet)– 38
R-CUT – 31
Ice Interchange – 37

SUMMARY OF FINDINGS

The alternative development and analysis process and analysis results of the most promising alternatives is summarized below:

- A concept development workshop was conducted September 11th-13th. Approximately 135 community members, 14 Advisory Committee Members, and 6 PMT members participated in the development process. An online workshop was available for additional public comments and remained open until September 27th. Approximately 30 email, mail in, or online comments were received.
- Approximately 200 total concepts were developed through the meeting sessions and the online workshop. These concepts were grouped based on similarities into 48 alternatives. Of the 48 developed alternatives, 10 alternatives were identified as promising and feasible through an initial assessment of the evaluation criteria matrix by the consultant team. The table below shows a summary of the process:

Element	Corridor Alignment	Intersection	Transition
Day 1 – Concepts	64	102	32
Day 2 – Alternatives	14	19	15
Day 3 – Promising Alternatives	**1**[3]	**6**	**3**

- Based on feedback from the workshop and further assessment, two corridor alternatives were furthered evaluated both operationally and based on potential right-of-way, constructability, and access management related impacts:
  - (A–4A) The couplet configuration utilizing 11th Street for northbound traffic and the existing US 97 alignment for southbound traffic was found to work operationally and had limited right-of-way impacts in the vicinity of the southern couplet U-turn location and the redesigned 11st Street/Smith Rock Way intersection.
  - (A–5A) The five-lane configuration utilizing the existing US 97 alignment was found to present operational and queuing issues at the signalized US 97/ B Avenue intersection and presented some potential right-of-way impacts to existing businesses.
- Based on feedback from the workshop, further assessment, four intersection alternatives were further evaluated through a year 2040 operational analysis:

[3] While a single corridor alignment alternative was proposed during the initial evaluation, a five-lane section was added back following the completion of comments from the Concept Development Workshop and was further analyzed as part of the promising alternatives.

- (SI–7A) A five-lane cross section with a signal at the US 97/ B Avenue intersection did not meet ODOT performance measures and experience queuing blocking upstream intersection.

- (SI-1B) A one-way westbound configuration for B Avenue between 11th and US 97 under a couplet solution is expected to meet mobility standards.

- (I–6A2) A northbound left fly-under at US 97/Lower Bridge Way will meet mobility standards, however, an eastbound to southbound right-turn add lane may be required.

- (I–5B) An R-CUT at US 97/Lower Bridge Way would **not** meet operational or queuing standards for the northbound U-turn.

- Several roadway cross-sections were identified during the workshop; however, the corridor alignment and intersection selection will dictate the ultimate cross section for the highway. Transition elements including pedestrian and bicycle facilities and crossings, transit accommodations, and corridor and intersection safety improvements will be explored further in the Technical Memorandum #7 once the Advisory Committee and Project Management Team determine a preferred corridor alignment and corresponding intersection alternative(s).

Next Steps

The recommended corridor alignment and intersection configurations will be presented to the Advisory Committee, Project Management Team, and key stakeholders in November and December for review and feedback. Highway transition elements to better manage speeds and pedestrian crossing locations and access management features will be refined and evaluated following the selection of the preferred corridor alignment and intersection configuration.

Appendix A – PowerPoints and Information Boards

Appendix B – Attendance Sheets

Appendix C – Public Concepts from Concept Development Workshop

Appendix D – Grouped Alternatives from Concept Development Workshop

Appendix E – Alternative Evaluation Workshop Rankings

Appendix F – Alternative Evaluation Workshop Public Comments

Appendix G – Alternative Analysis
Operational Worksheets

Appendix H – Queuing Analysis Results

Table H-1. Existing Minimum Mid-Block Spacing

Intersection	Minimum Midblock Spacing (ft)			
	NB	SB	EB	WB
19th Street/Lower Bridge Way	>1000	N/A	>1000	>1000
US 97/Lower Bridge Way	>1000	>1000	725	>1000
US 97/C Avenue	425	400	200	200
US 97/B Avenue	725	425	700	225
11th Street/Smith Rock Way	800	425	225	>1000
US 97/South 11th Street	>1000	725	N/A	800
US 97/Central Avenue	400	>1000	200	200
11th Street/Central Avenue	400	925	200	N/A

Table H-2. 2040 Alternative Queuing Results

Scenario	Intersection	Future 2040				Meets Min. Spacing Requriements?
		NB	SB	EB	WB	
Restricted Crossing U-Turn	US 97/Lower Bridge Way	N/A	N/A	225	N/A	Yes
	US 97/Lower Bridge Way NB U-Turn	**>1,000**	N/A	N/A	N/A	**No - NB U-Turn**
	US 97/Central Avenue	N/A	N/A	25	100	Yes
	11th Street/Central Avenue	N/A	N/A	N/A	75	Yes
NB Fly-Under	US 97/Lower Bridge Way	N/A	N/A	225	N/A	Yes
	US 97 SBR/Lower Bridge Way	N/A	25	N/A	N/A	Yes
	US 97/Central Avenue	N/A	N/A	25	100	Yes
	11th Street/Central Avenue	N/A	N/A	N/A	75	Yes
South Free Flow Couplet	US 97/C Avenue	N/A	N/A	48	38	Yes
	US 97/B Avenue	N/A	N/A	20	80	Yes
	11th Street/Smith Rock Way	N/A	N/A	N/A	114	Yes
	US 97/South 11th Street	N/A	N/A	N/A	N/A	Yes
South Signal	US 97/B Avenue	**800**	**425**	50	75	**No - NB, SB**
	11th Street/Smith Rock Way	75	100	25	25	Yes

Appendix I – Preliminary Cost Estimates & Evaluation Matrix Justification Summary

Appendix J – Redistribution at South Couplet

Appendix K – Neighborhood Alliance Meeting Concept Drawing and Operational Worksheet