

U.S. 97 Bend North Corridor Project

Traffic Analysis Summary Memo (Draft)

1 INTRODUCTION & BACKGROUND

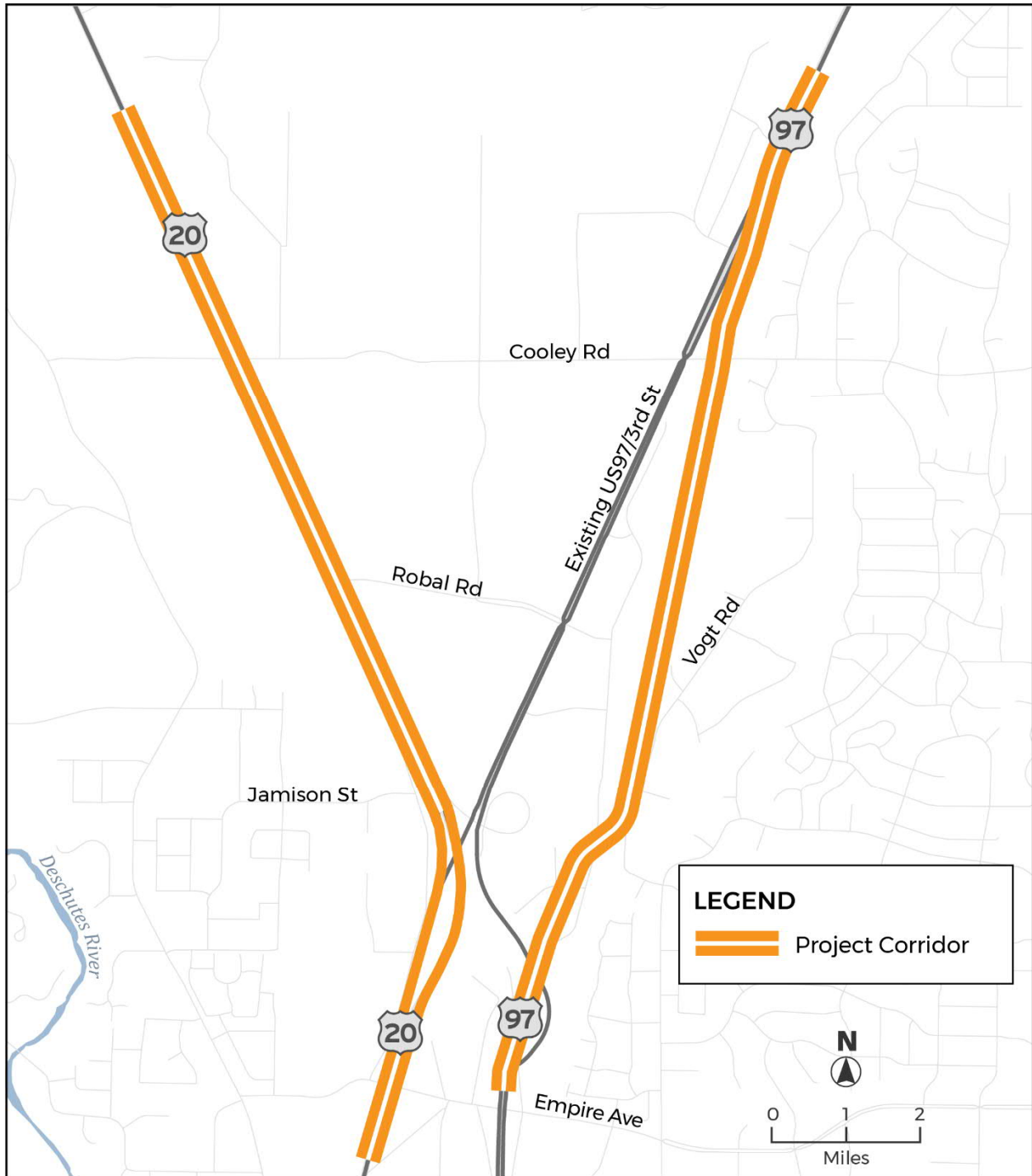
This memorandum outlines the traffic analysis that was done to develop the Base Configuration details to be incorporated with the U.S. 97/US Bend North Corridor project. A map of the project corridors is shown in Figure 1.

The purpose of this memorandum is to highlight key assumptions and findings from the traffic analysis and to provide sufficient information for the Base Configuration to be provided to the Design-Builder. The contents include a brief description of the design elements for each project improvement area and a summary of the volume projections, analysis results and findings.

Analysis Methodology

The approach used to conduct the traffic analysis work relied on the same software tools and reporting methods as those used for the previous FEIS analysis and follow-on analysis. For signalized and stop-sign-control intersection analysis, Synchro software was again used while Sidra software was applied to locations where roundabouts are proposed. Reporting methods followed Highway Capacity Manual (HCM) guidance in terms of delay and level of service (LOS) thresholds.

Figure 1: Project Study Corridors



2 EXISTING CONDITIONS

Existing traffic conditions were documented previously in the FEIS and as part of a follow-on planning effort in July 2020 by WSP. The existing conditions summary from the July 2020 document was incorporated into the traffic analysis description in the updated record of decision. The results and findings of the existing conditions traffic analysis is summarized in Table 1.

Table 1: Existing Conditions Operational Analysis Results (PM Peak Hour)

| Intersection | Results for | LOS | Avg Delay (sec) | v/c |
|--------------------------|----------------------|-----|-----------------|------|
| U.S. 97 and Cooley Road | Overall Intersection | D | 52 | 0.85 |
| U.S. 97 and Chavre Way* | Westbound Right** | B | 12 | 0.08 |
| U.S. 97 and Robal Lane | Overall Intersection | D | 49 | 0.85 |
| U.S. 20 and Cooley Road* | Eastbound Approach** | F | 228 | 1.08 |
| U.S. 20 and Robal Lane | Overall Intersection | C | 24 | 0.77 |

Note: Synchro 10 software used for analysis

*Denotes stop-controlled intersection

**HCM results reported for the side street worst approach/movement

As shown in Table 1, existing intersection delays at the targeted study intersections along U.S. 20 and U.S. 97/3rd Street are generally less than a minute corresponding to a level of service range of LOS B to LOS D. The exception lies with the two way stop controlled intersection at U.S. 20 and Cooley Road. The eastbound stop-controlled approach for this location currently experiences severe delays longer than three minutes during the PM peak hour.

3 FUTURE 2040 VOLUME PROJECTIONS

The PM peak hour traffic volume projections represented in FEIS required updates as the City of Bend Transportation System Plan and ODOT's Parkway Plan have been adopted. The volumes were refined and adjusted to better align with these updated transportation plan long range horizons. In addition, the Base Configuration has been refined in more detail and minor changes in routing were necessary. The volumes used in this analysis were coordinated with, and developed through, ODOT and City of Bend staff and were agreed upon prior to commencement of the updated traffic analysis.

The 2040 PM peak hour volumes for each intersection are summarized in the sections below.

4 FUTURE U.S. 20 IMPROVEMENTS

The proposed improvements along U.S. 20 focus on the intersections of U.S. 20/Cooley Road and U.S. 20/Robal Road. For both locations, multi-lane roundabouts are proposed which allow for a continuous flow environment and improvements in safety. The proximity of these two roundabouts to one another is shown in Figure 2 and the updated analysis inputs and findings are discussed in the following sections.

Figure 2: Study Intersections along U.S. 20



Based on the evaluation of 2040 conditions, both roundabouts would require slip lanes to meet volume to capacity (v/c) standards by the long range 2040 horizon. However, these slips lanes would only be needed if development occurs in the OB Riley Urban Growth Area and the vacant lots that front U.S. 20 near these roundabouts. The configuration of the paths along the

roundabouts where slip lanes will be needed are pushed further out to support the future need for these movements. The anticipated future slip lanes not included in this project are:

- U.S. 20 at Cooley Road northbound right
- U.S. 20 at Robal Road northbound right

Both roundabouts will include Rectangular Rapid Flashing Beacons (RRFBs) for all legs with more than one lane of travel. RRFB's were not included in the analysis.

U.S. 20 and Cooley Road (Roundabout)

The U.S. 20/Cooley Road roundabout Basic Configuration is a two-lane roundabout with four (4) approach legs. This would include two entry lanes for each approach and two exit lanes with the exception of the eastbound Cooley Road exit leg. The concept design provides bicycle and pedestrian paths greater than the Blueprint for Urban Design (BUD) for this corridor to support greater distances from the circular area and more direct paths to crossings of each leg of the roundabout. As highlighted previously, each leg of the roundabout would include RRFBs. Figure 3 and Figure 4 below shows the concept design and 2040 PM peak hour volumes at the U.S. 20 and Cooley Road intersection.

As development continues to occur in and around the U.S. 20/Cooley intersection and as a roundabout is installed at Cooley Road and Hunnel Road (as part of the City's transportation improvement program), the Scenic Drive access point (full movement) would be converted to a right-in/right-out.

Figure 3: Concept Roundabout Design at U.S. 20 and Cooley Road

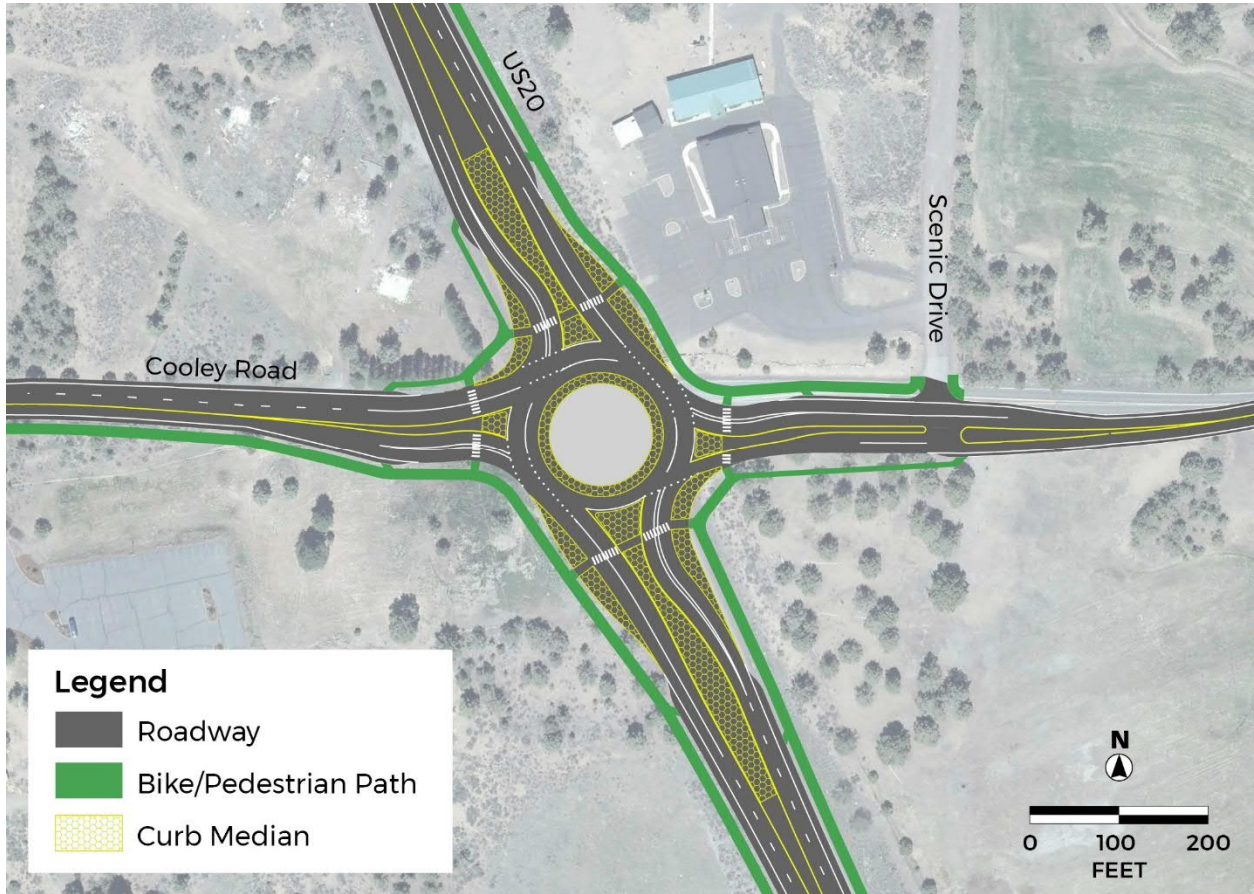
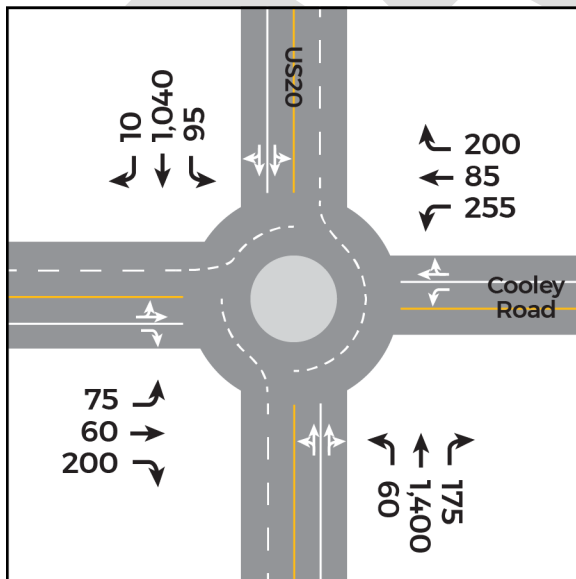


Figure 4: U.S. 20 and Cooley Road 2040 PM Peak Hour Volumes



Traffic Analysis Findings

With the concept roundabout design, the intersection would be expected to operate with average delays of less than 35 seconds per vehicle (LOS D) under 2040 PM peak hour conditions. However, the intersection would operate at a v/c ratio of 1.01 which exceeds the allowable v/c threshold. The roundabout would meet volume to capacity (v/c) standards by the long range 2040 horizon if a right turn slip lane for U.S. 20 northbound to Cooley eastbound get added as development occurs nearby. The operational analysis results are summarized in Table 2.

Table 2: U.S. 20 and Cooley Road 2040 PM Peak Hour Operational Analysis Results

| Intersection | Results for | LOS | Avg Delay (sec) | v/c |
|-------------------------|----------------------|-----|-----------------|------|
| U.S. 20 and Cooley Road | Overall Intersection | D | 32 | 1.01 |

U.S. 20 and Robal Road (Roundabout)

The U.S. 20/Robal Road roundabout concept designs calls for is a two-lane roundabout with three (3) approach legs with consideration for the fourth leg. The proposed design would include two entry and exit lanes for each approach. The concept design provides bicycle and pedestrian paths greater than what is listed in the Blueprint for Urban Design (BUD) for this corridor to support greater distances from the circular area and more direct paths to crossings of each leg of the roundabout. As highlighted previously, each leg of the roundabout would include RRFBs. Figure 5 and Figure 6 show the concept roundabout design and 2040 PM peak hour volumes at the U.S. 20 and Robal Road intersection.

Figure 5: Concept Roundabout Design at U.S. 20 and Robal Road

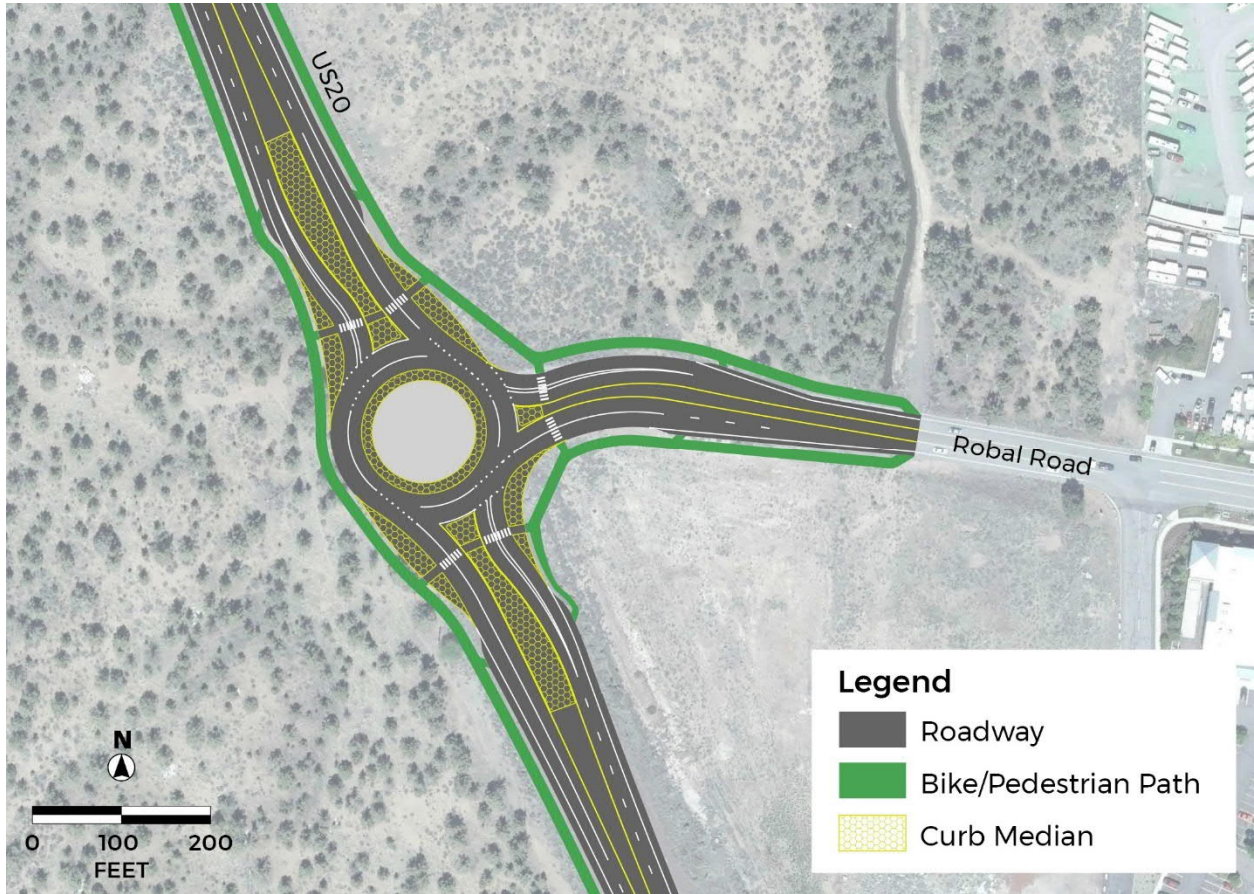
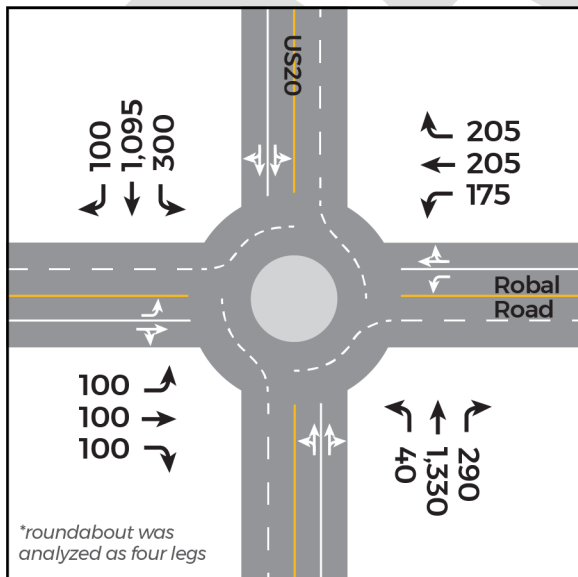


Figure 6: U.S. 20 and Robal Road 2040 PM Peak Hour Volumes



Traffic Analysis Findings

The roundabout traffic analysis was performed using Sidra software. Even though the proposed roundabout design only has three legs, the operations analysis also included the west leg as that is anticipated to be constructed immediately after this project is complete by a development. The intersection would operate with a delay of less than 50 seconds per vehicle (LOS E) under 2040 PM peak conditions. However, the intersection would operate at v/c ratio of 1.13 under 2040 PM peak conditions. The roundabout would meet volume to capacity (v/c) standards by the long range 2040 horizon if a right turn slip lane (U.S. 20 northbound to Robal Lane eastbound) get added as development occurs nearby. However, these slips lanes are not needed until that development occurs. The operational analysis results are summarized in Table 3 below.

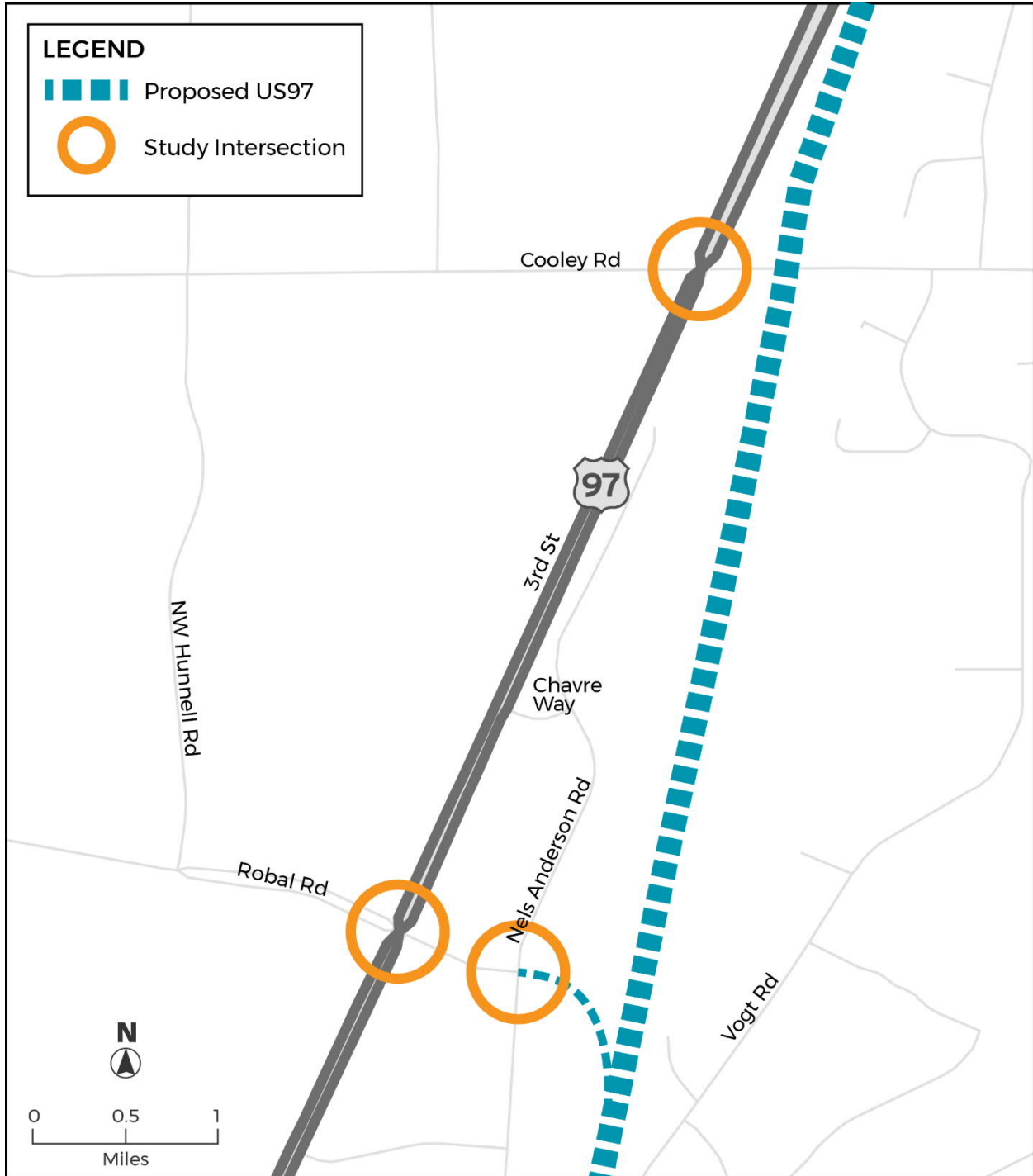
Table 3: U.S. 20 and Robal Road 2040 PM Peak Hour Operational Analysis Results

| Intersection | Results for | LOS | Delay (s) | v/c |
|------------------------|----------------------|-----|-----------|------|
| U.S. 20 and Robal Road | Overall Intersection | E | 48 | 1.13 |

5 U.S. 97 (EXISTING)/3RD STREET IMPROVEMENTS

The Basic Configuration improvements along U.S. 97 (Existing)/3rd Street focus on the two primary intersections of U.S. 97 (Existing)/Cooley Road and U.S. 97 (Existing)/Robal Road. The Basic Configuration includes a new ramp entry intersection at Robal Lane and U.S. 97/Nels Andersen Road that can be accessed by traveling through the U.S. 97 (Existing)/Robal Road intersection. The signals at U.S. 97 (Existing)/Cooley and U.S. 97 (Existing)/Robal Road exist today, the project will fully reconstruct the signal at Cooley Road and provide ADA updates to the signal at Robal Road. The three intersections analyzed are shown in Figure 7 and the analysis inputs and findings for each location are discussed in the following sections.

Figure 7: Study Intersections along U.S. 97 (Existing)/3rd Street



The Existing U.S. 97 facility will remain in ODOT’s jurisdiction but it will shift from a portion of the parkway to a facility that is more consistent with 3rd Street south of Empire. . The Basic

Configuration includes ADA improvements at all curb ramps along the corridor between Cooley Road and the U.S. 20 loop ramp and a fully re-constructed Cooley Road intersection.

U.S. 97 (Existing)/3rd Street and Cooley Road (Signal)

The U.S. 97 (Existing) and Cooley Road intersection will be fully reconstructed as part of the project. The Basic Configuration includes changes in existing lane geometry, channelization, pedestrian and bicycle amenities and signal infrastructure. Figure 8 and Figure 9 show the Basic Configuration intersection design and 2040 PM peak hour volumes at the U.S. 97 (Existing)/3rd Street and Cooley Road intersection.

Figure 8: U.S. 97(Existing)/3rd Street and Cooley Road Concept Intersection Design

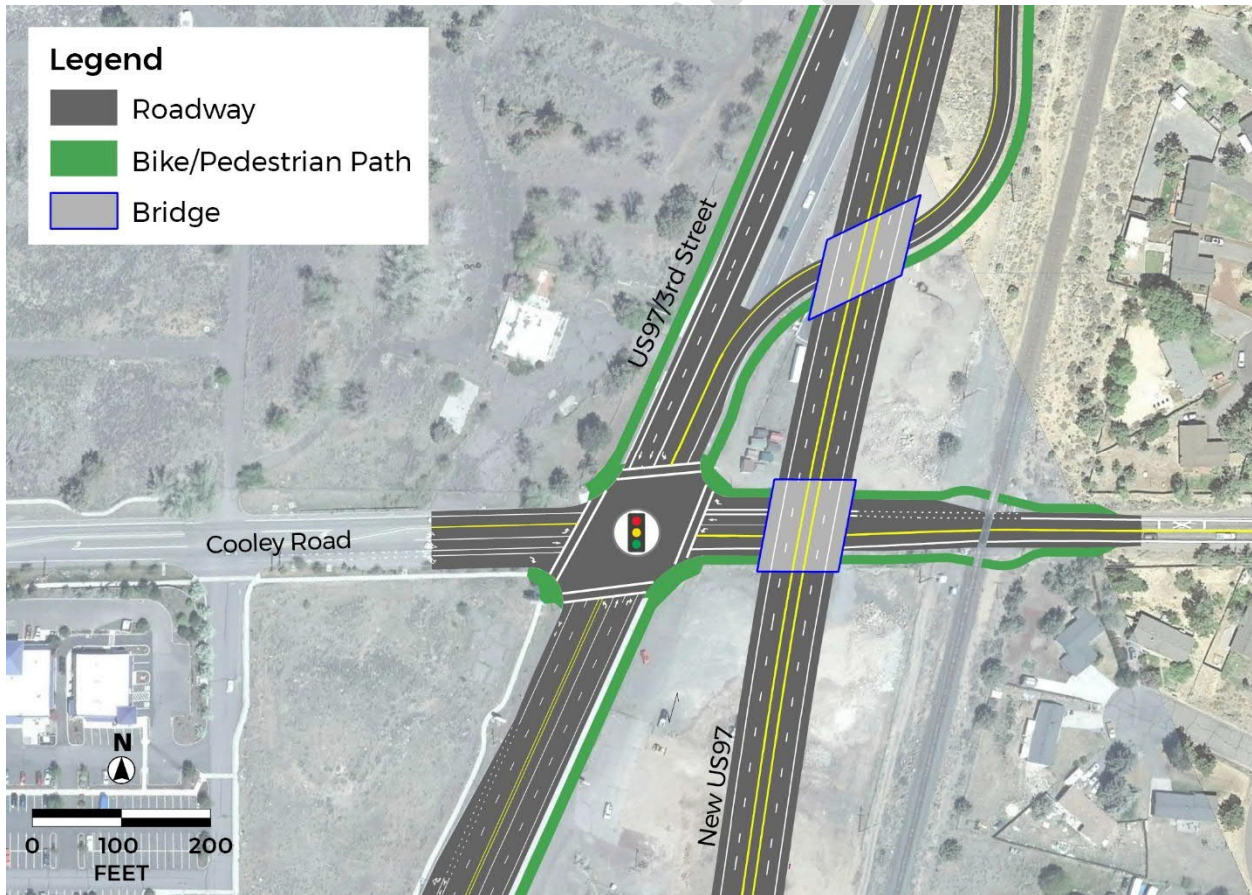
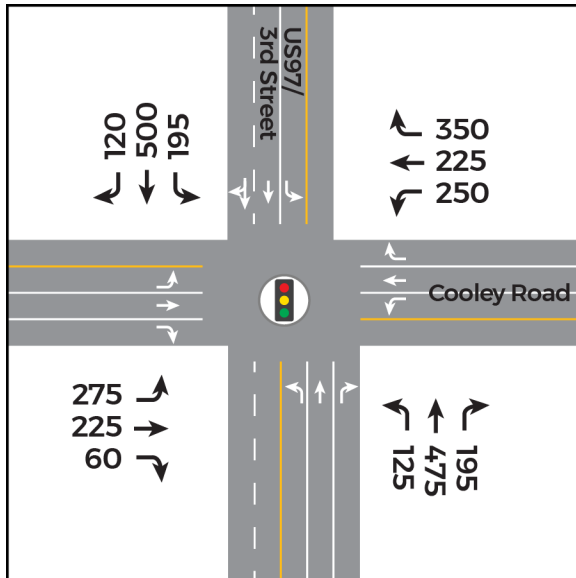


Figure 9: U.S. 97(Existing)/3rd Street and Cooley Road intersection 2040 PM Peak Hour Volumes



Traffic Analysis Findings

The intersection operations analysis was performed using Synchro software. With significant number of U.S. 97 through vehicles using the new bypass, the overall traffic volume along U.S. 97 (Existing)/3rd street would be reduced significantly thereby improving operations and reducing congestion. As a result, the U.S. 97 (Existing)/3rd Street and Cooley Road intersection would operate with significantly lower intersection delays of 41 seconds and at LOS D under 2040 PM peak conditions. The intersection would operate at v/c ratio of 0.70 under 2040 PM peak conditions. The intersection operational analysis results are summarized in Table 4 below.

The 95th percentile queue calculations during the PM peak hour were performed using SimTraffic, a microsimulation model. Table 5 below summarizes the 95th percentile queues for the turn movements at the U.S. 97 (Existing)/3rd Street and Cooley Road intersection based on an average of five simulation runs. The queue lengths were rounded to the nearest 25 feet.

Table 4: U.S. 97 (Existing) and Cooley Road 2040 PM Peak Hour Operational Analysis Results

| Intersection | Results for | LOS | Delay (s) | v/c |
|------------------------------------|----------------------|-----|-----------|------|
| U.S. 97 (Existing) and Cooley Road | Overall Intersection | D | 41 | 0.70 |

Table 5: U.S. 97 (Existing) and Cooley Road 2040 PM Peak Hour Queuing Analysis Results

| Movement | 95 th Percentile Queue (feet) |
|-----------------------|---|
| Northbound Left Turn | 100 ft |
| Northbound Right Turn | 75 ft |
| Southbound Left Turn | 350 ft |
| Eastbound Left Turn | 225 ft |
| Eastbound Right Turn | 25 ft |
| Westbound Left Turn | 200 ft |
| Westbound Right Turn | 275 ft |

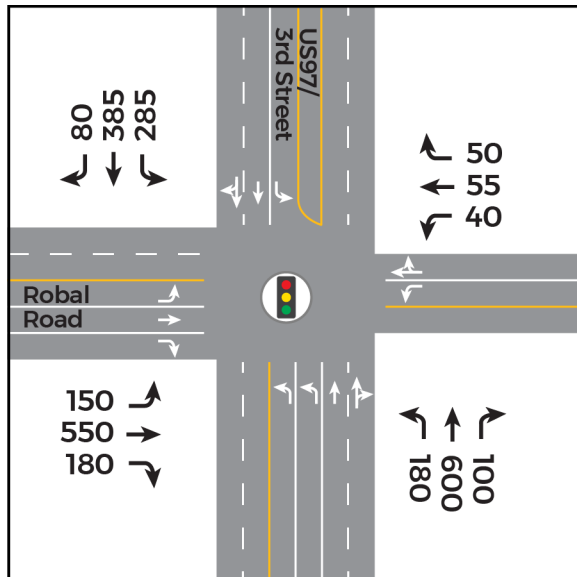
U.S. 97 (Existing)/3rd Street and Robal Road (Signal)

The U.S. 97 (Existing)/3rd Street and Robal Road intersection Basic Configuration will be largely retained in terms of geometry. Updated curb ramp amenities to meet ADA standards are part of the Basic Configuration at the intersection. Figure 10 and Figure 11 below show the Basic Configuration intersection layout and 2040 PM peak hour volumes at the U.S. 97 (Existing)/3rd Street & Robal Road intersection.

Figure 10: U.S. 97 (Existing)/3rd Street and Robal Road Basic Configuration



Figure 11: U.S. 97(Existing)/3rd Street and Robal Road intersection 2040 PM Peak Hour Volumes



Traffic Analysis Findings

The intersection operations analysis was performed using Synchro software. With significant number of U.S. 97 through vehicles using the new bypass, the overall traffic volume along 3rd street would be reduced significantly thereby improving operations and reducing congestion along 3rd Street. As a result, 3rd Street and Robal Road intersection would operate with significantly lower intersection delay of 52 seconds and at a LOS D under 2040 PM peak conditions. The intersection would operate at v/c ratio of 0.93 under 2040 PM peak conditions. The intersection operational analysis results are summarized in Table 6 below.

The 95th percentile queue calculations during the PM peak hour were performed using SimTraffic, a microsimulation model. Table 7 below summarizes the 95th percentile queues for the turn movements at the U.S. 97 (Existing)/3rd Street and Robal Road intersection based on an average of five simulation runs. The queue lengths were rounded to the nearest 25 feet.

Table 6: U.S. 97 (Existing) and Robal Road 2040 PM Peak Hour Operational Analysis Results

| Intersection | Results for | LOS | Delay (s) | v/c |
|------------------------|----------------------|-----|-----------|------|
| U.S. 97 and Robal Road | Overall Intersection | D | 52 | 0.93 |

Table 7: U.S. 97 (Existing) and Robal Road 2040 PM Peak Hour Queuing Analysis Results

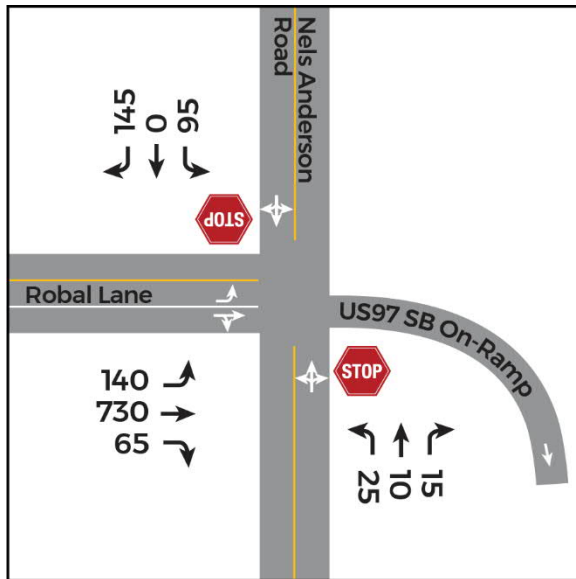
| Movement | 95 th Percentile Queue (feet) |
|----------------------|--|
| Northbound Left Turn | 300 ft |
| Southbound Left Turn | 400 ft |
| Eastbound Left Turn | 450 ft |
| Eastbound Right Turn | 475 ft |
| Westbound Left Turn | 100 ft |

Robal Lane at U.S. 97/Nels Anderson Road (Two-Way Stop Sign Control)

The Robal Lane intersection at Nels Anderson Road would be modified to include a new southbound ramp connection to the new US 97 limited access freeway segment. The intersection will retain the existing control with free-flow heading eastbound and stop control along Nels Anderson north/south

Figure 12 show the 2040 PM peak hour volumes at the Robal Lane at U.S. 97/Nels Anderson Road.

Figure 12: Robal Lane at U.S. 97/Nels Anderson Road 2040 PM Peak Hour Volumes



Traffic Analysis Findings

The intersection operations analysis was performed using Synchro software. Based on the operational analysis results, southbound stop-controlled approach at this intersection would experience delay of 73 seconds per vehicle (LOS F) for the southbound approach under 2040 PM peak conditions. Overall, the largest volumes traveling eastbound would experience no delay. The operational analysis results are summarized in Table 8 below.

Table 8: Robal Lane at U.S. 97/Nels Anderson Road 2040 PM Peak Hour Analysis Results

| Intersection | Results for | LOS | Delay (s) | v/c |
|--|----------------------|-----|-----------|------|
| Robal Lane at U.S. 97/Nels Anderson Road | Southbound Approach* | F | 73 | 0.91 |

*HCM results reported for the side street worst approach