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US 97 High Bridge to Madras Safety Study

TM#3 – Roadway Characteristics and Safety Analysis

Prepared by
Oregon Department of Transportation, Region 4
Planning and Technical Center
63055 N. Hwy 97, Bldg M, Bend OR 97703

Project Contact
Ken Shonkwiler, Principal Planner
Oregon Department of Transportation, Region 4
63055 N. Hwy 97, Bldg M, Bend OR 97703
Cell: 541-815-6877

Kenneth.d.shonkwiler@odot.oregon.gov

Table of Contents

List of Figures and Tables

1. Introduction

This memorandum provides an inventory of transportation and environmental resources in support of the US 97 High Bridge to Madras Safety Study. This information provides a baseline understanding of the corridor conditions, informs the development of safety-related countermeasures, and serves as a foundation for later work to develop the Safety Study and conceptual corridor improvements.

1.1 Project Goal Statement

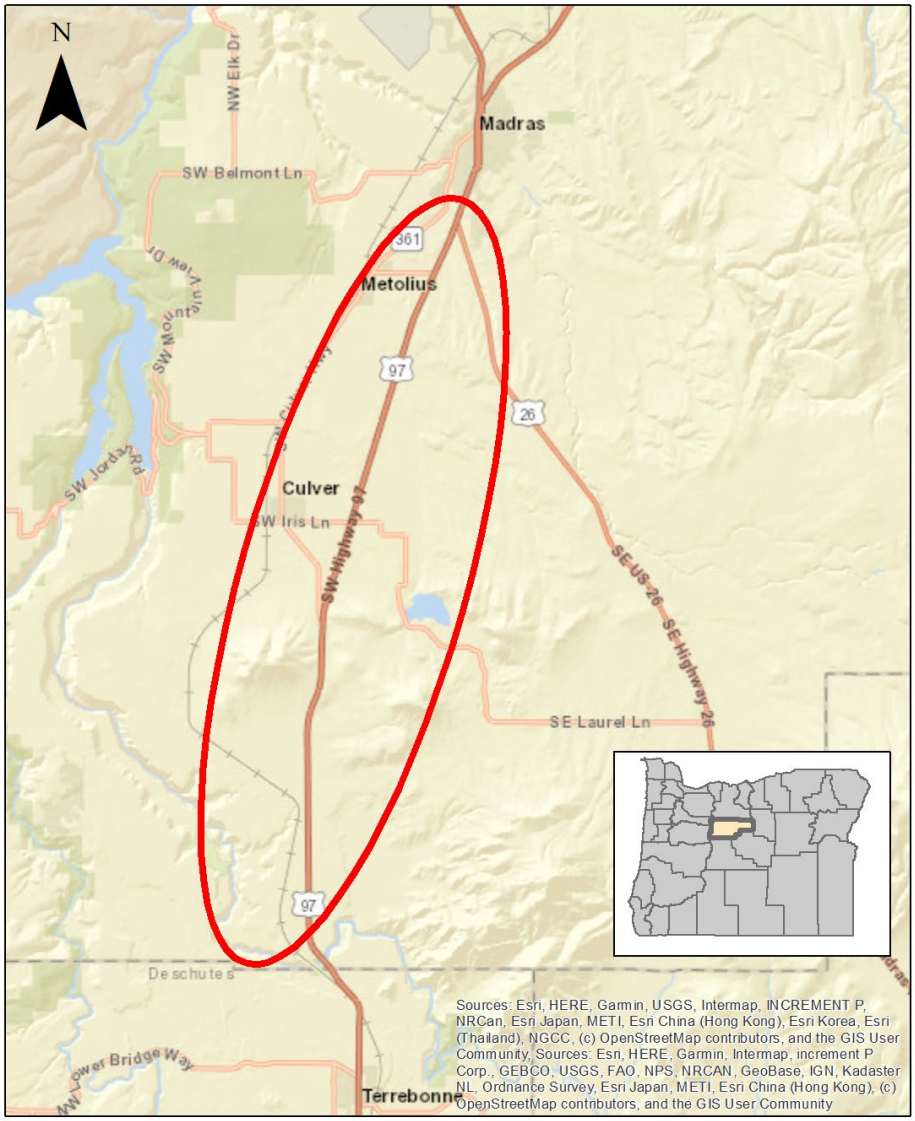
The project goals were drafted by the ODOT Project Manager and subsequently reviewed by the Participant Advisory Committee (PAC). The PAC was invited to comment on the draft goals. The exercise resulted in the project goals as follows:

- Ensure that the US 97 corridor is safe for everyone using the highway, including drivers, freight, and people who use active transportation or take transit.
- Reduce fatal and serious injury crashes on the US 97 corridor and improve travel time reliability via safety-focused improvements.
- Balance the need for access with safety improvements and corridor through movement.
- Protect the natural and built environments with practical design solutions.
- Incorporate equity in the decision-making process and reduce transportation-related disparities.

1.2 Study Area

The study area for the safety study is US 97 from the Madras city limits (MP 97.3) to High Bridge (MP 112.6), roughly the Deschutes County boundary line. For the purpose of the project, crash analysis is being included to MP 115 in case it would be logical to extend countermeasures to the border of the Terrebonne project.

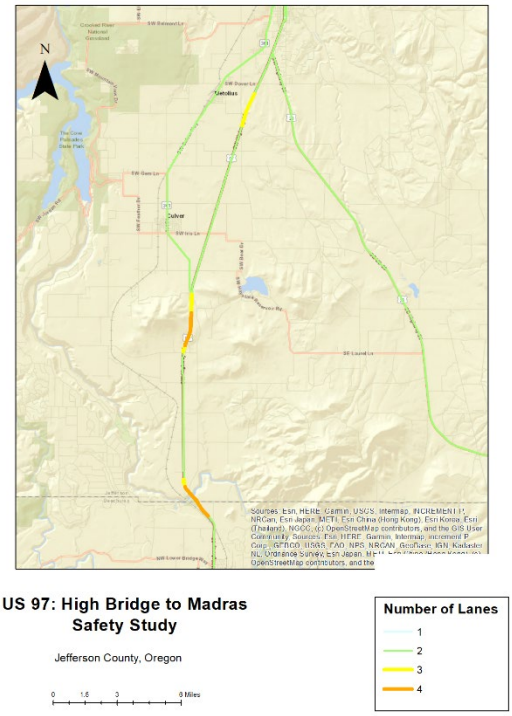
Figure 1.1: Project Map



2. Existing Conditions System Inventory

2.1 Roadway Characteristics

The Dalles-California Highway (US 97) through the study limits (MP 97 to 115) runs north-south, is part of the National Highway System (NHS), is an Expressway, is an urban principal arterial from MP 97 to 98.37, and a rural principal arterial from MP 98.37 to 115. It is primarily a relatively flat, two-lane section with southbound passing lanes at MP 98.74 to 99.87, at MP 105.73 to 107.10, and MP 111.97 to 113.47. Northbound passing/climbing lanes exist from MP 107.55 to 106.36, and MP 112.23 to 113.47.

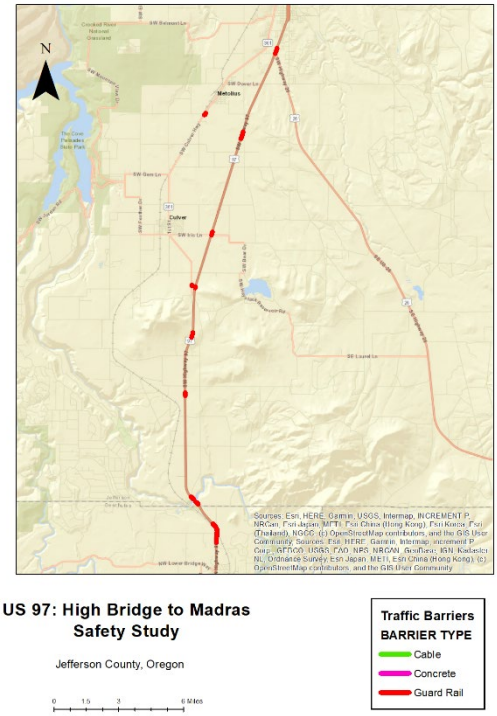


Shoulders are ACP and are typically 8’ (with possibly some 6’ sections), and some 5’ shoulders adjacent to passing lane locations and on the right side of the railroad overcrossing structure at MP 114.

Generally side slopes provide adequate clear zone, and intermittent guardrail is installed throughout. Guardrail installations at the MP 109 irrigation canal bridge has non-standard radiused ends at all four corners.

There are no sidewalk facilities present.

The are no bike facilities present beyond the available ACP highway shoulders.



2.2 Bridges

The existing condition of structures along the US 97 study limits were evaluated. Three bridges exceed twenty feet in span length and are included in the National Bridge Inventory (NBI). All three bridges were constructed in the early 2000s and feature modern bridge clearances and compliant bridge rail. The bridges are in good condition overall; specific repair recommendations are noted in the table below.

Current load ratings indicate that all three bridges have sufficient capacity to carry all legal and permit vehicles. Specialized emergency vehicles (EV) have not yet been included in the assessment. Anticipated performance under EV-3 loading can be approximated by comparing the rating factor (RF) for a similar Type 3 legal load. If the RF for a Type-3 vehicle is above 1.85, the bridge is likely to be sufficient to carry EVs without restriction. All bridges pass this test, which indicates a low risk of load restriction. Final determination pending updated bridge load ratings.

Two culverts, Structure No. 0P023 and 06961, are located within the study limits. Both culverts span less than twenty feet and as such, they are not included in the NBI. Both culverts were constructed in 1956 and were assigned a 'fair' condition rating due to structure age and heavy abrasion found on concrete surfaces. There are no specific structural repair recommendations documented in the inspection reports. No load rating is required for these culverts due to their status as non-NBI structures.

One variable message sign board faces northbound traffic at MP 97.13 (Structure No. 20254), which is in very good condition.

Table 2.2 Bridge Structures

Structure No.	Structure Name	MP	Bridge Roadway Width (ft)	Bridge Shoulder (ft)	Bridge Rail	Load Posting	Suffeciency Rating	Overall Condition	Notable Repair Work
20254	VMS Butterfly Br. Hwy 4 NB at MP 97.13	97.13	_	_	_	_	NA	Very Good	NA
0P023	Siphon, Hwy 4 at MP 99.90	99.90	_	_	_	_	11	Fair	NA
06961	Siphon, Hwy 4 at MP 102.71	102.71	_	_	_	_	26	Fair	NA
19960	North Unit Main Canal, Hwy 4 at MP 105.44	105.44	44	10	Meets std.	NA	98	Good	Joint seal repair at bents and ends of approach panels
19961	North Unit Main Canal, Hwy 4 at MP 108.99	108.99	44	10	Meets std.	NA	98	Good	Joint seal leakage at bent 4
18211	Crooked R Gorge, Hwy 4 (Rex T Barber Veterans)	112.63	76.9	10	Meets std.	NA	71.3	Good	Damage to strip seal joint header bar and gland Spalling in bent 4 bearing pads

2.3 General Right of Way

The Dalles - California Highway No. 004 varies in right of way width throughout the project corridor, but a typical section ranges between 100 and 160 feet. The majority of the corridor is owned in fee with the main exception being where the highway crosses federally owned land.

This corridor contains access control; however, breaks in the access control do exist. Please see access management section for additional details.

The above summary is a broad generalization and numerous improvement projects over the years have created exceptions throughout the corridor. If specifics are needed for any locations within the project limits, please reach out the ODOT Region 4 Right of Way group.

2.4 Accesses

The Oregon Department of Transportation (ODOT) has the responsibility of providing the traveling public with a safe and efficient transportation facility, and therefore is expected to manage highways in the best interest of the public for the protection of the highway or road and the traveling public. Access management is balancing access to developed land while ensuring movement of traffic in a safe and efficient manner.

ODOT refers to a permitted private driveway or public road connection to a state highway as a "highway approach." Access management spacing standards for highway approaches are based on the classification of the highway defined in the Oregon Highway Plan and the type of area (urban or rural), the posted speed and the average daily traffic (ADT). The spacing standards for US 97 within the study area are set forth in Oregon Administrative Rule (OAR) 734-051-4020 and are shown in Table 1 below. The ODOT Region Access Management Engineer (RAME) may approve or deny requests for deviations from the spacing standards.

Based on the highway's classification as a Statewide Expressway in a rural area, posted speed of 55 mph and ADT of approximately 12,000 vpd in the study segment of Mile Point 97.3 to Mile Point 115.0, the access management spacing standard is 5,280 feet, or one mile, as shown in Table 1 below. Ideally, in this 18-mile segment, there should be no more than 18 approaches on the east side of the highway and no more than 18 approaches on the west side of the highway, for a total of 36 approaches, based on the spacing standard. In actuality, there are approximately 150 existing approaches in the study segment.

Table 2.4 Access Spacing Standards

Access Management Spacing Standards for Statewide Highways with Annual Average Daily Traffic > 5,000 vpd				
	Expressway	Expressway		
	Rural Areas	Urban Areas	Rural Areas	Urban Areas
Speed (mph)	Spacing (ft)			
55 or higher	5,280	2,640	1,320	1,320
50	5,280	2,640	1,100	1,100
40 & 45	5,280	2,640	990	800
30 & 35	-	-	770	500
25 & lower	-	-	550	350

2.5 Active Transportation

Cascades East Transit operates the Route 22 bus line along the US 97 corridor between Madras and Redmond (Figure 2.5.1). This route accesses the cities of Culver and Metolius along OR 361 before merging with US 97 at the Culver Highway exit at MP 105.73. There are no stops along the study segment, but Route 22 operates Monday to Friday with six trips in each direction and serves as a key transportation connection for students in Jefferson County accessing the Redmond Proficiency Academy.

Central Oregon Breeze and Pacific Crest Bus Lines also operate along this US 97 study corridor, each offering a single daily trip with no stops along the corridor as part of their Bend to Portland bus services.

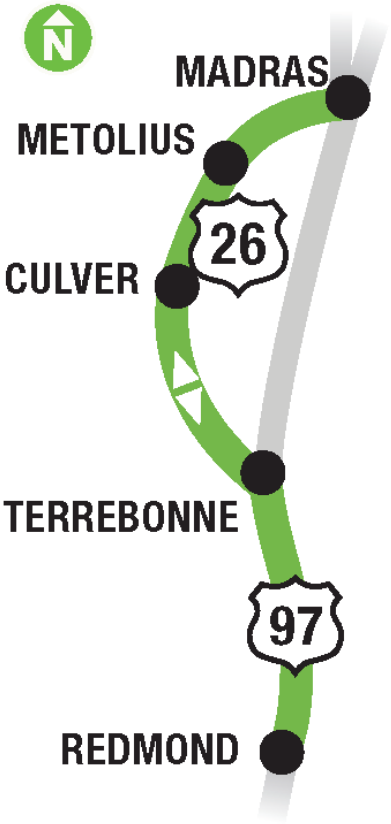


Figure 2.5.1 Transit Route

Pedestrian and Bicycle Facilities

Travel by people walking, biking, and rolling is limited due to the rural nature of this segment and the absence of dedicated bicycle and pedestrian facilities such as sidewalks, bicycle lanes, and shared-use paths. The following section provides an overview of current bicycle and pedestrian facilities along the US 97 study corridor.

The entire US 97 study corridor is classified as a Rural highway, and as such there are no dedicated pedestrian or bicycle facilities such as sidewalks, bicycle lanes, or shared-use paths. People must walk and ride in unprotected shoulders varying in width from 2'-9' with no dedicated bicycle pavement markings or signage. There are no marked crosswalks of US 97 or the side streets.

Regional and Local Trails

Although there are nearby Oregon Scenic Bikeway Routes (Madras Mountain Views and Sisters to Smith Rock) and Adventure Cycling Routes (TransAmerica), none of these routes intersect with the US 97 study corridor.

Strava Heatmap data shows people on foot crossing the highway at MP 112.43, connecting between the Peter Skene Ogden State Scenic Viewpoint and the Old Culver Highway. The Strava data also shows extensive crossings by people on bicycles at MP 112.43, Culver Highway, SW Bear Drive, and SW Dover Lane.

Figure 2.5.2 Pedestrian crossing area on US 97

Dirty Freehub, a website providing gravel bicycle routes across the Western USA, has several routes listed that cross US 97 at MP 112.43, connecting Peter Skene Ogden State Viewpoint and the Old Culver Highway.

2.6 Freight

ODOT is committed to keeping freight moving safely and efficiently throughout Oregon in support of the State's economy. US 97 is a major north-south corridor that is utilized by commuter traffic, recreational traffic, and freight traffic for local and long-haul trips. This section of US 97 is classified as a Statewide Highway, a federally designated truck route, an Oregon freight route, a reduction review route, and an expressway on the National Highway System. In addition, US 97 has been identified as a regional lifeline route as part of a network of emergency access corridors for the state in case of a major seismic event.

Within the project limits, freight traffic accounts for approximately 23-28% of the average annual daily traffic (AADT) according to the *2022 State Highway Inventory Reports Traffic Volumes and Vehicle Classification*. Just south of the US 97/Culver Highway intersection there is a northbound weigh station (MP 106.8) and a southbound weigh station (MP 108) along with weigh in motion sensors.

The ODOT Freight Mobility Map identifies US 97 as an "Orange Route," indicating that the route is generally unrestricted for oversized/overweight freight and is one of the most heavily used truck routes in the state. The route is a 14' wide annual route (allowed to travel during daylight hours) and sees use of loads greater than 14' wide via Single Trip Permits (STPs). At night, this route allows for continuous trips of loads up to 10' wide. This section of US 97 is also part of both the I-84 and I-5 Critical Route Pairs (CRPs). This means if a route on the critical route pairs needs to be temporarily restricted, ODOT will take steps to make sure that the identified alternate paired critical route is not restricted at the same time.

US 97 is subject to ORS 366.215 – Reduction of Vehicle Carrying Capacity as an identified reduction review route. If permanent features, such as raised medians/barriers/curbs or structures over the highway are proposed as new safety features that reduce the width or height across/over the highway, it will require presenting proposed design to the Mobility Advisory Committee (MAC) Forum for support.

2.7 Rail and Air

The US 97 corridor is paralleled by the BNSF railway. Starting at the northern end of the project limits (MP 97.3), the rail line is on the western side of OR 361 and continues south past the City of Metolius and City of Culver. The rail line becomes closer in distance to US 97 at MP 109. No-at grade railroad crossings exist on US 97 in this section and there is one crossing below the roadway at MP 114.

The closest public airport near the project limits is the Madras Municipal Airport which is classified as a general aviation airport. Commercial flights are not offered at the Madras airport. Several private landing airstrips exist north of the project limits as well. Airways and airports are not anticipated to be a consideration in the safety study as extensive airport usage does not occur near the project limits.

Utilities

Due to the relatively large size of this corridor, there are many utilities that operate facilities in the Safety Study area's footprint. See the "Utilities in Corridor, High Bridge to Madras.xlsx" document in Appendix XXX for a complete list of known utilities in the corridor. Critical utilities in this corridor include multiple irrigation districts (North Unit Irrigation District and Central Oregon Irrigation District), a municipal water utility as defined by ORS 366.321 (Deschutes Valley Water District), and City of Madras facilities. Impacts to any of these utility's facilities has a high probability of being reimbursable, and relocations of these utility's facilities are potentially complex. Long lead time coordination will be imperative so that facilities are relocated in a timely manner and that impacts to reimbursable facilities are minimized to the maximum extent practical.

In addition to water and irrigation utilities in the corridor, there are also multiple communications and power providers, as well as a natural gas provider. Impacts to these facilities has a lower potential for being reimbursable. No significant facilities are known in this corridor at this time, however further outreach with utilities will be required once a concept scope is more well defined.

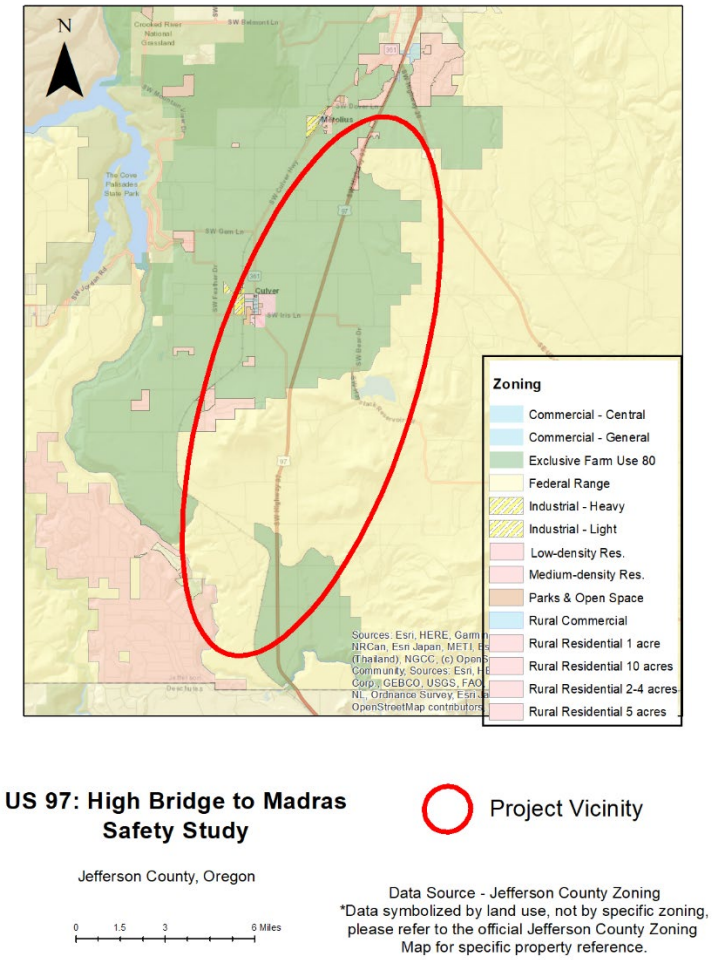
3. Planning and Land Use

3.1 Land use and zoning (Ken)

The project area is located both within and outside of the urban growth boundary. It is located both within and outside of the Madras city limits. The land use and zoning within the corridor can largely be described as farmland and federal range, with rural residential and farmsteads characterizing much of the housing-related uses. Some commercial zoning does exist at the northern end of the corridor. Zoning within the project area (US 97 corridor) consists of the following:

General Zone	Land Use	Description
Cg	Commercial	Commercial - General
Ag	Agriculture	EFU-40 Zone
Ag	Agriculture	EFU-80 Zone
Rng	Range	Federal Range
RR2	Rural Residential	Rural Residential Zone
Nat Res	Natural Resource	Open Space Conservation Zone

Figure 3.1 Zoning



3.2 Key Community Destinations

Community destinations exist throughout the corridor and are accessed either directly from US 97 or via key intersections that direct travelers on county road facilities to their destination. These destinations are key points of travel generation on the corridor either throughout the year or with seasonal fluctuations. Trip volumes are discussed in the Existing Conditions Systems Analysis chapter below.

Below are the key community destination locations in the corridor. This list is not intended to be exhaustive but rather show destinations that may be traffic generators at intersections or locations directly on US 97.

Table 3.2 Community Destinations

Key Community Destination	Common intersection or access	US 97 Milepost
Lake Billy Chinook	Various	
City of Metolius	US 97/ Colfax Lane	97.3
	US 97/ Dover Lane	98.38
Pape Machinery and Agricultural	Direct Access	97.9
Charlie's Pizza	Direct Access	98
Central Oregon Livestock Yard	Direct access	98.9
Cove Palisades State Park	US 97/SW Ford Lane	101.3
City of Culver	US 97/Iris Lane	103.65
	US 97/OR361	105.7
Haystack West Campground	US 97/SW Jericho Lane	104.95
	US 97/OR361	105.7
Redmond/Central Oregon KOA	US 97/Jericho Lane	104.95
Peter/Skene Ogden State Viewpoint	Direct Access	112.8
Smith Rock State Park	US 97/NW Eby Ave	114.45
	US 97/Smith Rock Way	115.8
Crooked River Ranch	US 97/Lower Bridge Way	115.25

3.3 Demographic Summary

Data from the 2021 American Community Survey (ACS) was analyzed for both Jefferson County and the State of Oregon (DP05 data). These five-year estimates provide an overview of demographic information to inform the PIP of targeted needs for public outreach. Data is provided in the table below and summarized in comparison between Jefferson County and the State of Oregon:

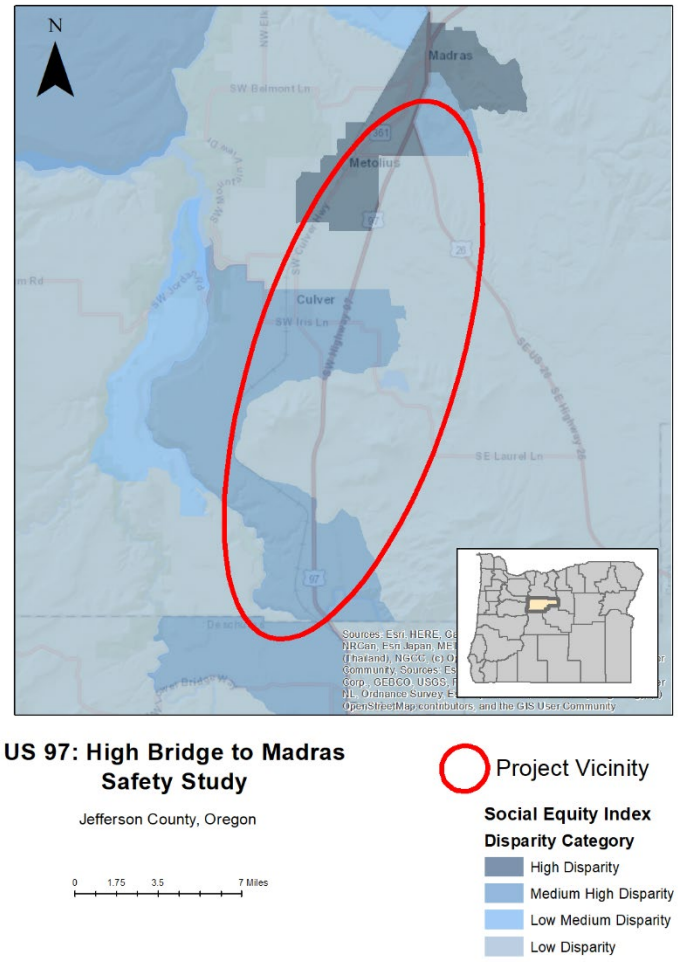
- Jefferson County has a higher percentage of over 65 residents than Oregon, a higher percentage of under 18 residents, as well as a higher median age.
- Jefferson County has a higher percentage of residents that identify as two or more races.
- Jefferson County has a lower percentage of residents that identify as White.
- Jefferson County has a higher percentage of Hispanic residents.
- Jefferson County has a higher percentage of American Indian and Alaskan Native residents/populations.

Table 3.3.1 Demographic Summary

ACS 5 Year - 2021 Data - DP05	Jefferson County, Oregon		Oregon	
Label	Estimate	% of Total Population	Estimate	% of Total Population
Total population	24,232		4,207,177	
Median age (years)	40.7		39.6	
Under 18 years	5,706	23.55%	873,486	20.76%
65 years and over	4,677	19.30%	743,125	17.66%
RACE				
Total population	24,232		4,207,177	
One race	21,360	88.15%	3,881,565	92.26%
Two or more races	2,872	11.85%	325,612	7.74%
White	16,315	67.33%	3,394,838	80.69%
Black or African American	175	0.72%	77,913	1.85%
American Indian and Alaska Native	3,506	14.47%	46,075	1.10%
Asian	102	0.42%	186,724	4.44%
Native Hawaiian and Other Pacific Islander	7	0.03%	17,272	0.41%
Some other race	1,255	5.18%	158,743	3.77%
Hispanic or Latino (of any race)	4,999	20.63%	570,511	13.56%
Total housing units	10,170		1,798,864	

The ODOT social equity index (SEI) map is a support tool to reference areas of social equity disparity in Oregon. The SEI indicates areas of low, low/medium, medium/high, and high disparity. Sections of the US 97 corridor on the northern project limits between MP 97 and 101 are adjacent to areas of high disparity on the map. Areas of medium disparity include MP 102.5 to 105 and MP 109 to 115. Special consideration to impacts and access related to social equity should be included when discussing crash history, potential projects, and public involvement within these vicinities of the corridor.

Figure 3.3.2 Social Equity Map



3.4 Relevant Planning document summary

The following section discusses relevant local and regional plans that would provide guidance, support, or direction on the US 97 High Bridge to Madras Safety Study. This study is intended to support the Jefferson County Transportation System Plan and is specifically identified as a short-term project in that TSP. For a complete reference of statewide modal plans related to this study, please reference Tech Memo 1 – Plans and Policy of the Jefferson County TSP. The following discussion includes topics from the updated 2021 TSP.

Jefferson County TSP (2021)

The Jefferson County Transportation System Plan (TSP) (2021) is a long-range policy guide for developing and managing the transportation system in the unincorporated areas within the county, outside of city urban growth boundaries (UGBs). The TSP addresses all travel modes currently available to move people and goods within or through the County. The TSP includes goals and objectives that were used to guide

development of the key recommendations and policy directives established for each travel mode in the TSP.

For US 97, a safety planning project is specifically identified in the 2021 TSP as a near-term project. Guided by technical analyses and public engagement, the corridor study is described as including projects higher in cost than projects in the TSP and could have broader impacts to existing access and change travel patterns on the County roadway system. Some of the key considerations of the study may include:

- Facilitating turning movements and east-west crossing traffic at key intersections such as Colfax Lane/US 26, Dover Lane, Iris Lane, and OR 361;
- Closing or modifying allowable turning movements at key intersections throughout the corridor;
- Identifying County roadway projects necessary to support the highway changes;
- Accommodating local needs such as agricultural traffic and school traffic;
- Improving safety along the corridor by reducing crash frequency, severity, and risk;
- Providing adequate capacity along the corridor;
- Encouraging appropriate speeds and behavior; and
- Accommodating freight traffic

The 2021 TSP includes a number of projects related to the study area that likely have a positive impact to safety. These are summarized in the table below:

Table 3.4 Jefferson County TSP Projects

Project ID	Project Name	Description	Planning Cost	Lead Agency
S-4	US 97/Iris Lane Intersection Improvements	Install advanced stop ahead signage on Iris Lane to increase visibility and awareness.	$20,000	ODOT
S-6a	US 97/Dover Lane Intersection Safety Improvements	Evaluate intersection skew to determine if geometrix or sight distance improvements are needed.	$10,000	ODOT
S-7	US 97/Ford Lane Intersection Safety Improvements	Install signing, striping, and reflectivity enhancements to increase visibility and awareness of the intersection.	$40,000	ODOT
S-1	US 97 Corridor Study	Conduct a corridor study of US 97 south of Madras to determine the long-term safety and capacity needs and vision for the corridor. Operational data shows a high delay for side streets along this corridor. Crash history revealed 17 fatal/severe crashes on US 97 between 2013 and 2017. Treatments to be evaluated may include access modifications, intersection control changes, highway capacity enhancements, roadway	$150,000	ODOT

		network modifications, and other treatments to reduce crashes.		
S-2	Speed and Safety Education/ Enforcement Campaigns	Conduct outreach campaigns targeted at speed reduction and behavioral safety, in conjunction with increased enforcement along the US 97 corridor in partnership with the Oregon State Patrol (OSP) and Deschutes County.	Varies	Various
S-Sa	US26/Colfax Lane/US 97 Intersection Safety Improvements - Systemic	Install speed treatments on the northbound approach to the intersection to encourage slower speeds as vehicles approach Madras. Treatments may include: transverse speed reduction markings and speed feedback signs (in conjunction with posted speed limit signs). Create maintenance agreement between jurisdictions for speed feedback signs.	$117,000	ODOT
S-5b	US26/Colfax Lane/US 97 Intersection Safety Improvements – Infrastructure	Modify intersection approaches to encourage slower turning speeds and reduce crossing distance for vehicles. Install activated intersection warning sign to warn drivers on US 97 when vehicles are waiting on the side streets at the intersection. Widen centerlines to reduce travel lane width.	$1,000,000	ODOT
S-6b	US 97/Dover Lane Intersection Safety Improvements- Infrastructure	Install intersection warning system that is activated when vehicles are waiting on side streets. Widen shoulders near the intersection by 2'.	$1,000,000	ODOT
S-10a	Bear Drive/US 97 Intersection Safety Improvements- Systemic	Install speed feedback signs. Create maintenance agreement between jurisdictions for maintaining and replacing speed feedback signs.	$100,000	ODOT
S-10b	Bear Drive/US 97 Intersection Safety Improvements- Infrastructure	Install speed treatments. Consider lane narrowing (using centerline spacing or recessed pavement markers) to reduce speed. Consider limited shoulder widening to increase recoverable area for roadway departure crashes. (Cost is reflective of lane narrowing with recessed pavement markers and shoulder widening of 2').	$1,000,000	ODOT

B-20	US 97 North Bicycle Facility	Increase shoulder widths to 8' along 17 mile section of road. Project design may include other alternatives such as a multi-use path instead. (Cost reflective of increasing shoulder widths).	Visionary Project	ODOT
B-2	Culver Highway Multi-Use Path	Culver Highway Multi-Use Path, although not located along the US 97 study segment, most impacts the walking and biking conditions between Madras and Terrebonne by calling for a 10' shared-use path along Culver Highway to connect Madras to Peter Skene Ogden State Park.		Multi Jurisdiction
B-31 and B-33	US 97 pedestrian crossings	Projects call for an evaluation of pedestrian and bicycle crossings of US 97 at Culver Highway (MP 105.74) and near Peter Skene Ogden State Park (MP 112.43) to improve connections to Project B-2.		ODOT

Historical and future STIP

Below is a list of recent projects that have been completed by ODOT either as part of maintenance improvements or via projects included in ODOT's Statewide Transportation Improvement Plan (STIP_

- 2017 – US 97: US 26 JCT – NW 10th Street: Paving project with safety edge, rumble strips, centerline recessed pavement markers and intersection warning signs at Dover, Bear, Iris and Culver Highway.
- 2018 – US 97 @ Dover Ln: Quick Fix project to remove existing overhead span-wire and overhead intersection flashers and replace with solar powered advance flashing beacons on right side intersection warning sign. Also installed oversized stop signs and doubled up intersection warning signs with 24" stop bars for Dover Ln.
- 2021 – SW & SE Bear Drives and SW Eureka Dr was closed by maintenance forces.
- 2022 – Improvements were made to the turning radius at Ford and Falcon Lanes by maintenance forces.

- 2023 – K22520 US 97: Dover Ln - Bear Dr Safety Improvements Project: constructed a left turn lane at US 97 and Dover Ln. This included improvements to the closed intersections of SW & SE Bear Drives and SW Eureka Dr formalizing the temporary closures.
- Enforcement Grants through Transportation Safety Office
- 2020 – High Visibility Enforcement: $7,000 funding awarded to Jefferson County.
- 2020 – Roadway Departure: 85 hours funding to Oregon State Police for enforcement between Madras and Redmond.
- 2023 – Roadway Departure Enforcement: Funded 111 enforcement hours on the Madras – Terrebonne section of US 97 (MP 93-112) which resulted in 239 traffic stops.

4. Environmental Summary

Environmental resource information is catalogued at this early stage to inform development of conceptual corridor improvements and avoid impacts early in the planning process. The environmental summary in Appendix B considers only the study area (not a defined project) and identifies potential resources that should be noted as the process more forward. Further environmental work would be conducted by the Oregon Department of Transportation (ODOT) in the future during project development, including National Environmental Policy Act Classification and associated environmental review.

Air Quality

The project is not located in an air quality non-attainment or maintenance area. The study corridor is in an area that is designated by the Environmental Protection Agency as being in attainment of the National Ambient Air Quality Standards.

Archaeology/Historic

The study corridor is not within an area considered to be high probability for the presence of cultural materials. Archaeological surveys from previous projects within the study limits did not result in any cultural materials being present. However, all projects developed within the study limits will need to have archaeological review to determine if field surveys will be required.

A search of the Oregon State Historic Preservation Office Historic Sites Database resulted in several existing resources that are eligible for listing on the National Register of Historic Places. In addition to resources listed on the SHPO database, there are several resources throughout the corridor that have the potential to be considered historic/eligible. All projects developed within the study limits will need to have historic review to determine if potential historic resources will be impacted.

Biology

No known potential habitat for threatened, sensitive, or endangered species is located within the focus area. All projects developed within the study limits will need to have a biological review to determine if potential impacts to biological resources will occur. Noxious weeds are present throughout the study corridor and will need to be addressed on a project-by-project basis depending on presence.

Energy

Projects that may develop from the safety study are not anticipated to be significant enough to warrant an energy analysis.

Hazardous Materials

A search of the State Fire Marshal's website databases did not indicate any hazardous materials concerns in study corridor. The Department of Environmental Quality website databases did not indicate any Environmental Cleanup Site Information (ESCI) sites within the project area. One property has structures and features that may indicate that there was previous operation of a garage or service station. This will need to be further researched should any project activities impact the property.

The main hazardous materials concern/issue through the corridor is the potential for roadside soils to be classified as unclean fill. Any future projects will need to have analysis of roadside soils to determine if the soils meet clean fill criteria or will be required to be disposed of at an appropriate facility.

Land Use/Planning

The project area is located both within and outside of the urban growth boundary. It is located both within and outside of the Madras city limits. Goal exceptions and/or conditional use permits may be required for work outside of the city limits and within EFU and Natural Resource/Open Space Conservation zoning. The local transportation plan and comprehensive plan may require amendments.

Noise

Projects that may develop from the safety study will need to be evaluated to determine whether they are considered Type I projects under FHWA noise regulations. If any part of the project is a Type I, then the entire project limits must be part of a noise analysis study. When traffic noise impacts are identified, ODOT must consider feasible and reasonable noise abatement measures. For abatement, primary consideration is given to frequently used exterior areas. When traffic noise impacts are identified, ODOT is, at a minimum, required to analyze barrier walls. Local ordinances may restrict nighttime construction noise levels or high noise levels on the weekend or holidays.

Section 4(f) Potential

There are eligible historic resources present within the study corridor. There are parks and areas of special interest within the potential area of project impact. If there are any impacts to these resources, a 4(f) evaluation will have to be prepared. Mitigation for impacts may not be required depending on the significance of the impact to the Section 4(f) resource.

Figure 4.1 Historic Properties

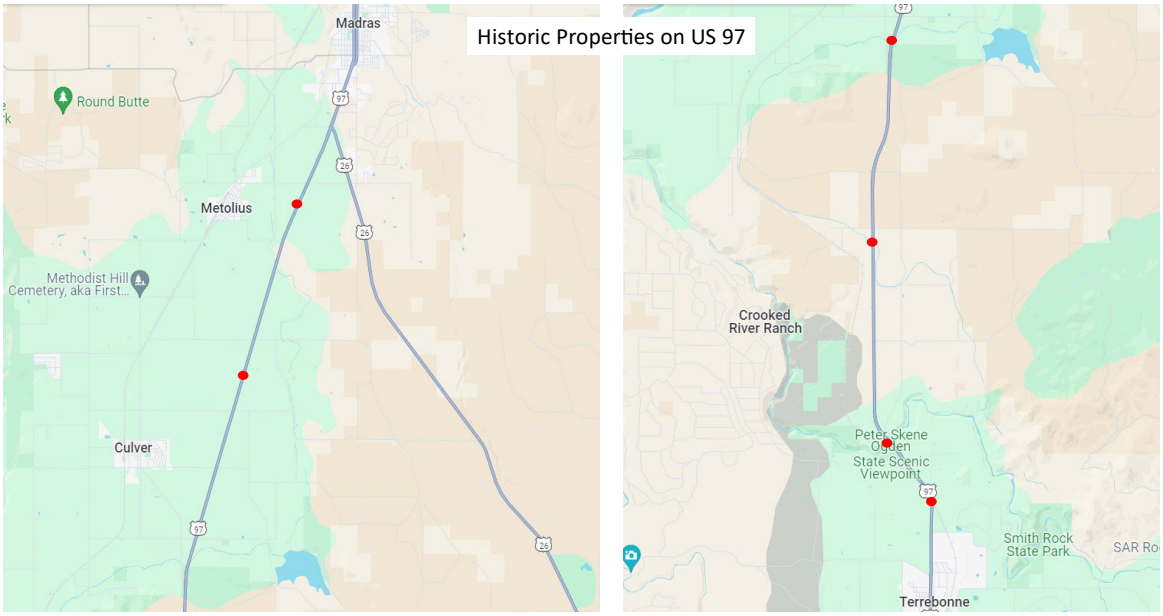
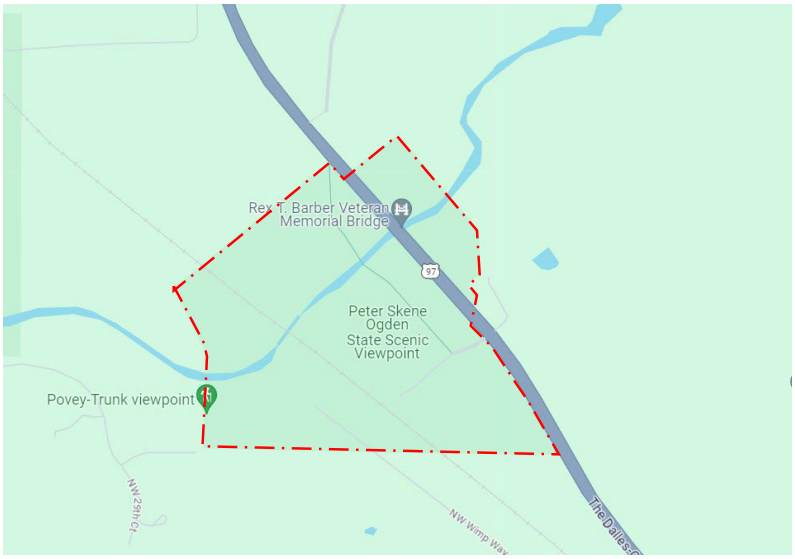


Figure 4.2 Section 4F Resources



Socioeconomics/Environmental Justice

For each project identified in the study corridor, benefits of the project once constructed will need to be summarized. Indirect and cumulative effects should be discussed. Measures to avoid or minimize adverse socioeconomic impacts should be identified. No minority or low-income populations have been identified that would be adversely impacted by projects. Therefore, the determination is that projects identified in the safety study will not cause disproportionately high and adverse effects on any minority or low-income populations in accordance with the provisions of E.O. 12898. No further EJ analysis is anticipated.

Visual

The project is not located on a tour route or a scenic highway, does not go through U.S. Forest Service property, nor is it in the vicinity of any known visually protected areas. There are no state or federal scenic waterways or wild and scenic rivers within the study corridor. The Peter Skene Ogden State Scenic Viewpoint is located within the study corridor. Any projects that occur within the proximity of the Viewpoint will need to be evaluated via a Visual Impact Assessment scoping questionnaire. There is no anticipation that a full Visual Impact Assessment would be required for projects identified within the study corridor.

Waterways/Water Quality

There are no lakes or delineated wetlands in the project area. There are irrigation canals that run adjacent and under US 97, and US 97 crosses the Crooked River. Irrigation canals are not jurisdictional under the Oregon Department of State Lands. Main canals are jurisdictional under the U.S. Army Corps of Engineers. Laterals may be jurisdictional if there is a direct connection (ingress or egress) to a jurisdictional waterway. If there are project impacts that result in fill material being placed in canals, jurisdictional determinations will need to be made and a determination made as to whether the project will be exempt from permitting requirements.

An Erosion Control Plan (ECP) will be prepared and implemented during construction for all projects developed in the study area. If soil erosion and sediment resulting from construction activities is not effectively controlled, the amount of disturbed area will be limited to that which can be adequately controlled.

Wetlands

National Wetlands Inventory maps indicate no wetland resources within the immediate project area. There may be potential wetland areas associated with canals within the project area. Surveys will need to be conducted to address the presence/absence of wetlands along canals.

No soils in the study corridor contain hydric capabilities.

NEPA

Prior safety projects that have been completed within the study corridor have been classified as CEs or PCEs. It is expected that projects developed out of the safety study will be classified the same as prior projects. However, there is always a chance that a project could require preparation of an EA or EIS,

depending on the significance of impacts. Each project will be individually evaluated to determine NEPA classification once they are identified and scope is being determined.

5. Existing Systems Analysis

The following sections present necessary traffic and crash data and analysis to support identifying locations for possible safety concern.

5.1 Traffic Data and Analysis

The following presents traffic data and analysis for the project corridor, including traffic counts, volume adjustment factors, future growth rates, existing and future year intersection operation analysis, a review of passing zones, and speed and travel time data.

Traffic Volume Data

Traffic counts were collected on January 23, 2024 at the following locations:

1. US 97/US 26/SW Colfax Ln
2. US 97/SW Dover Ln
3. US 97/SW Falcon Ln
4. US 97/SW Ford Ln
5. US 97/SW Highland Ln
6. US 97/SW Iris Ln
7. US 97/SW Jericho Ln
8. US 97/SW Culver Hwy
9. US 97/SW Monroe Ln
10. US 97/SW Norris Ln
11. US 97/SW Opal Ln
12. US 97/SW Park Ln

Table 5.1.1 presents 24-hour turning movement counts and Table 5.1.2 presents PM peak hour turning movement counts (3:30 PM). Peak hour factors for the PM peak hour ranged between 0.92 and 0.99 (see Synchro reports in the Appendix C). To use these January counts for further traffic analysis, factors were developed to estimate average annual daily traffic (AADT) and peak hour 30th highest hour volumes (30HV), consistent with guidance in the ODOT Analysis Procedures Manual for developing existing year volumes. These factors were based on a nearby automatic traffic recorder (ATR 16-002) on US 97 just north of US 26, which demonstrate that July is the peak month. The following are the resulting factors:

- AADT factor: 1.27
- 30HV factor: 1.53

Table 5.1.4 presents the resulting estimated AADT based on the 1.27 factor, and Table 5.1.5 presents the resulting estimated 30HV for the PM peak hour based on the 1.53 factor.

Average daily traffic volumes for ATR 16-002 were collected to demonstrate seasonal variation for the corridor. Figure 5.1.3 presents ATR volumes in 2023, which shows how traffic volumes on the corridor fluctuate by time of year.

To estimate future year traffic volumes (year 2044), an annual growth rate was determined from the ODOT Future Volume Table. The site at mile point 105.83 (just south of SW Culver Highway) was selected given its high R-squared value, which presents an estimated annual growth rate of 1.7%. Table 5.1.5 presents the resulting 2044 AADT and Table 5.1.6 presents the resulting 2044 30HV.

Twenty years of AADT were collected from ATR 16-002 to demonstrate traffic growth on the corridor over the last 20 years. These volumes, presented in Figure 5.1.8, show a 20-year growth of 22.0% (1.1% annual growth) and a 10-year growth of 22.8% (2.3% annual growth). The reason the 10-year and 20-year growth rates are so similar is likely due to slow growth post 2008 Recession. As shown in Figure 5.1.8, it wasn't until 2015 that traffic volumes returned to 2007 levels. This figure also shows a drop in traffic volumes resulting from the 2020 COVID Pandemic; however, traffic volumes quickly rebounded in 2021 to exceed 2019 levels. Given the slow rate of traffic growth post 2008 Recession, reviewing the most recent 10 years provides a better picture of expected growth on the corridor. Therefore, the 1.7% annual growth rate assumed in this analysis for 2024 to 2044 is not likely an aggressive assumption.

Table 5.1.1 : US 97 2024 Traffic Counts (January) – Daily

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	LTV	TEV
SW Colfax Ln	49	5,037	47	634	5,526	306	155	27	80	27	28	934	2,287	12,850
SW Dover Ln	92	4,833	171	26	5,297	240	119	117	112	147	105	31	1,160	11,290
SW Falcon Ln	0	4,763	9	65	5,076	0	0	0	0	9	0	54	137	9,976
SW Ford Ln	3	4,719	13	23	5,045	17	30	14	4	12	14	23	153	9,917
SW Highland Ln	8	4,688	23	18	4,992	51	33	15	10	29	15	14	216	9,896
SW Iris Ln	97	4,538	35	43	4,787	201	134	24	118	27	22	47	748	10,073
SW Jericho Ln	3	4,600	64	37	4,873	21	27	47	11	55	49	40	354	9,827
SW Culver Hwy	1,170	4,901	3	7	5,247	8	8	4	1,103	0	5	8	2,316	12,464
SW Monroe Ln	94	5,487	1	7	6,321	15	15	1	73	0	1	0	207	12,015
SW Norris Ln	5	5,578	3	0	6,392	3	5	0	4	4	0	0	24	11,994
SW Opal Ln	3	6,279	0	0	6,415	2	2	0	2	1	0	4	14	12,708
SW Park Ln	20	6,259	51	10	6,792	9	4	0	26	35	0	13	168	13,219

Notes:
LTV: Local Traffic Volumes (sum of all traffic volumes minus US 97 through volumes)
TEV: Total Entering Volume (sum of all traffic volumes)

Table 5.1.2 : US 97 2024 Traffic Counts (January) – Peak Hour (3:30 – 4:30 PM)

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TEV
SW Colfax Ln	10	396	2	65	478	27	8	1	16	2	3	74	1,082
SW Dover Ln	9	389	20	4	461	20	9	13	7	12	8	1	953
SW Falcon Ln	0	383	0	5	457	0	0	0	0	1	0	5	851
SW Ford Ln	2	377	1	2	457	1	3	2	0	0	0	3	848
SW Highland Ln	1	379	3	0	453	4	0	0	1	1	0	1	843
SW Iris Ln	14	365	2	10	426	19	9	4	5	0	4	9	867
SW Jericho Ln	0	374	4	3	420	7	1	2	1	10	9	6	837
SW Culver Hwy	140	400	1	0	445	0	0	1	77	0	0	1	1,065
SW Monroe Ln	11	515	0	1	535	2	3	0	11	0	0	0	1,078
SW Norris Ln	2	525	0	0	545	1	1	0	1	0	0	0	1,075
SW Opal Ln	1	592	0	0	591	0	1	0	1	0	0	0	1,186
SW Park Ln	0	559	5	0	590	4	1	0	2	5	0	2	1,168

Figure 5.1.3: Average Daily Traffic in 2023 (ATR 16-002)

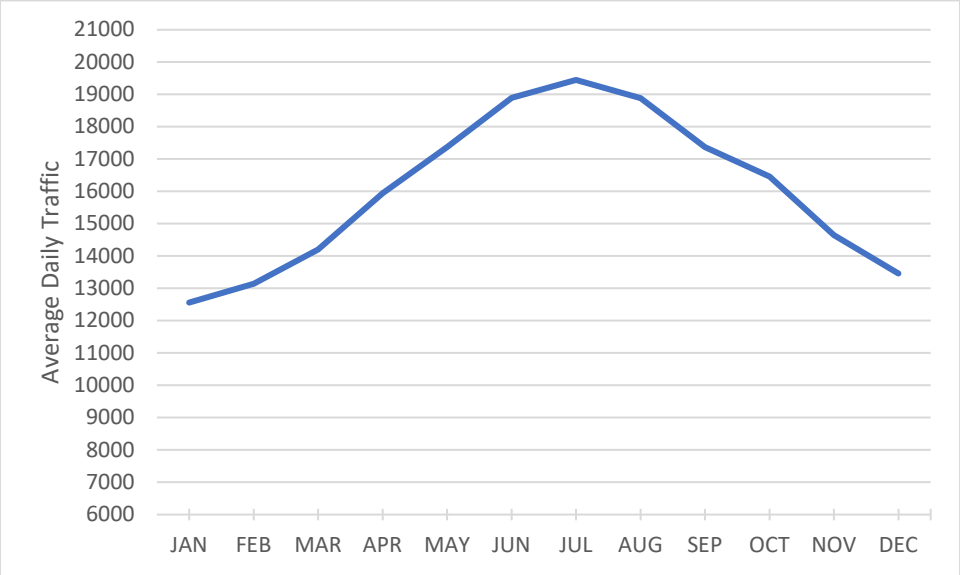


Figure 5.1.4 : US 97 2024 Traffic Volumes (Average Month) – Daily

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TEV
SW Colfax Ln	62	6,397	60	805	7,018	389	197	34	102	34	36	1,186	16,320
SW Dover Ln	117	6,138	217	33	6,727	305	151	149	142	187	133	39	14,338
SW Falcon Ln	0	6,049	11	83	6,447	0	0	0	0	11	0	69	12,670
SW Ford Ln	4	5,993	17	29	6,407	22	38	18	5	15	18	29	12,595
SW Highland Ln	10	5,954	29	23	6,340	65	42	19	13	37	19	18	12,569
SW Iris Ln	123	5,763	44	55	6,079	255	170	30	150	34	28	60	12,791
SW Jericho Ln	4	5,842	81	47	6,189	27	34	60	14	70	62	51	12,481
SW Culver Hwy	1,486	6,224	4	9	6,664	10	10	5	1,401	0	6	10	15,829
SW Monroe Ln	119	6,968	1	9	8,028	19	19	1	93	0	1	0	15,258
SW Norris Ln	6	7,084	4	0	8,118	4	6	0	5	5	0	0	15,232
SW Opal Ln	4	7,974	0	0	8,147	3	3	0	3	1	0	5	16,140
SW Park Ln	25	7,949	65	13	8,626	11	5	0	33	44	0	17	16,788

Figure 5.1.5: US 97 2024 Traffic Volumes (30th Highest Hour) – Peak Hour

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TEV
SW Colfax Ln	15	606	3	99	731	41	12	2	24	3	5	113	1,654
SW Dover Ln	14	595	31	6	705	31	14	20	11	18	12	2	1,459
SW Falcon Ln	0	586	0	8	699	0	0	0	0	2	0	8	1,303
SW Ford Ln	3	577	2	3	699	2	5	3	0	0	0	5	1,299
SW Highland Ln	2	580	5	0	693	6	0	0	2	2	0	2	1,292
SW Iris Ln	21	558	3	15	652	29	14	6	8	0	6	14	1,326
SW Jericho Ln	0	572	6	5	643	11	2	3	2	15	14	9	1,282
SW Culver Hwy	214	612	2	0	681	0	0	2	118	0	0	2	1,631
SW Monroe Ln	17	788	0	2	819	3	5	0	17	0	0	0	1,651
SW Norris Ln	3	803	0	0	834	2	2	0	2	0	0	0	1,646
SW Opal Ln	2	906	0	0	904	0	2	0	2	0	0	0	1,816
SW Park Ln	0	855	8	0	903	6	2	0	3	8	0	3	1,788

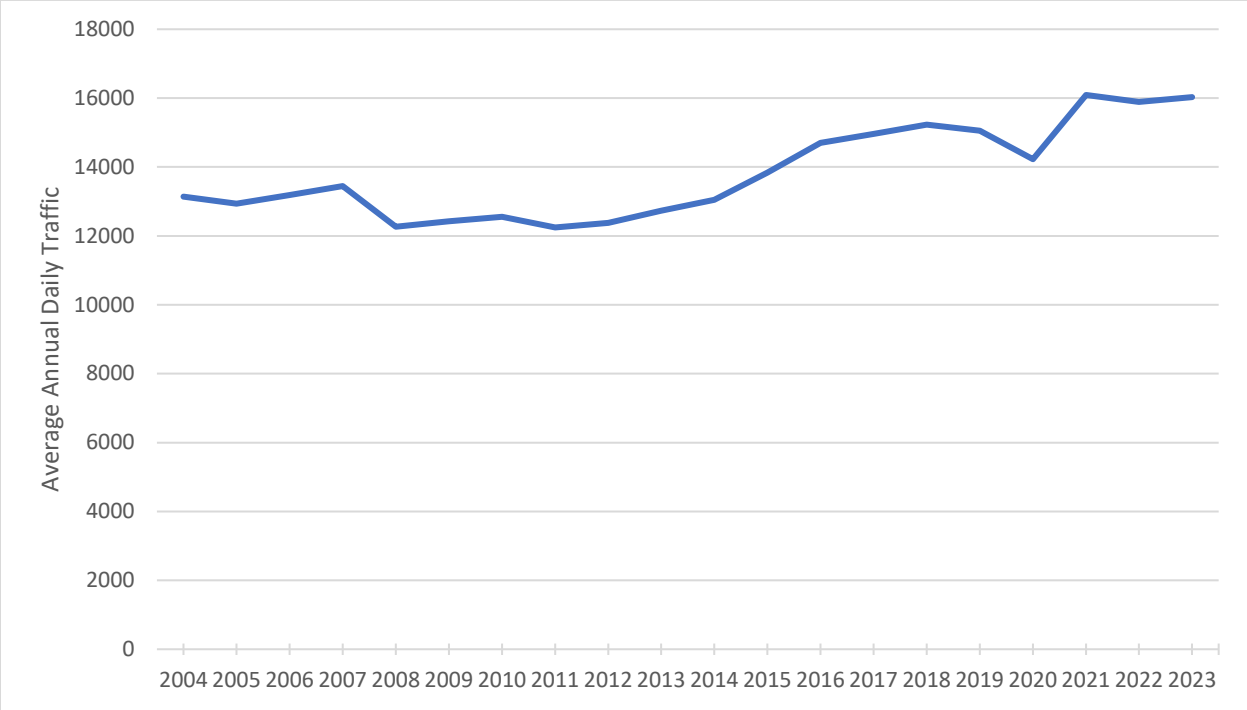
Table 5.1.6: US 97 2044 Traffic Volumes (Average Month) – Daily

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TEV
SW Colfax Ln	83	8,572	80	1079	9,404	521	264	46	137	46	48	1,589	21,869
SW Dover Ln	157	8,225	291	44	9,014	409	202	200	190	251	178	52	19,213
SW Falcon Ln	0	8,106	15	111	8,639	0	0	0	0	15	0	92	16,978
SW Ford Ln	5	8,031	23	39	8,585	29	51	24	7	20	24	39	16,877
SW Highland Ln	13	7,978	39	31	8,496	87	56	25	17	50	25	24	16,841
SW Iris Ln	165	7,722	59	74	8,146	342	228	40	201	46	38	80	17,141
SW Jericho Ln	5	7,828	109	63	8,293	36	46	80	19	94	83	68	16,724
SW Culver Hwy	1,991	8,340	5	12	8,930	13	13	7	1,877	0	8	13	21,209
SW Monroe Ln	159	9,337	1	12	10,758	25	25	1	125	0	1	0	20,444
SW Norris Ln	8	9,493	5	0	10,878	5	8	0	7	7	0	0	20,411
SW Opal Ln	5	10,685	0	0	10,917	4	4	0	4	1	0	7	21,627
SW Park Ln	34	10,652	87	17	11,559	15	7	0	44	59	0	23	22,497

Table 5.1.7: US 97 2044 Traffic Volumes (30th Highest Hour) – Peak Hour

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TEV
SW Colfax Ln	20	812	4	133	980	55	16	3	32	4	7	151	2,217
SW Dover Ln	19	797	42	8	945	42	19	27	15	24	16	3	1,957
SW Falcon Ln	0	785	0	11	937	0	0	0	0	3	0	11	1,747
SW Ford Ln	4	773	3	4	937	3	7	4	0	0	0	7	1,742
SW Highland Ln	3	777	7	0	929	8	0	0	3	3	0	3	1,733
SW Iris Ln	28	748	4	20	874	39	19	8	11	0	8	19	1,778
SW Jericho Ln	0	766	8	7	862	15	3	4	3	20	19	12	1,719
SW Culver Hwy	287	820	3	0	913	0	0	3	158	0	0	3	2,187
SW Monroe Ln	23	1,056	0	3	1,097	4	7	0	23	0	0	0	2,213
SW Norris Ln	4	1,076	0	0	1,118	3	3	0	3	0	0	0	2,207
SW Opal Ln	3	1,214	0	0	1,211	0	3	0	3	0	0	0	2,434
SW Park Ln	0	1,146	11	0	1,210	8	3	0	4	11	0	4	2,397

Figure 5.1.8: Average Annual Daily Traffic: 2004 – 2023 (ATR 16-002)



Capacity Analysis

All study intersections along the corridor are side-street stop-controlled intersections (i.e., US 97 is uncontrolled). All study intersections have a single lane per approach (i.e., no dedicated turn lanes) except for the following intersections:

- US 97/US 26/SW Colfax Lane: This intersection has exclusive left turn and right turn lanes along US 97, and exclusive right turn lanes on the side street approaches (note the eastbound approach

does not have a stripped right turn lane, but the approach width is wide enough that it operates as having an exclusive right turn lane).

- US 97/SW Dover Lane: This intersection was recently improved in 2023 to provide exclusive left turn lanes along US 97.
- US 97/SW Iris Lane: This intersection has exclusive left turn lanes along US 97 and an exclusive southbound right turn lane from US 97.
- US 97/SW Culver Highway: This intersection has exclusive left turn lanes along US 97, an exclusive southbound right turn lane from US 97, and right turn channelization for both approaches of US 97.
- US 97/SW Monroe Lane: This intersection has exclusive left turn lanes along US 97 and an exclusive southbound right turn lane from US 97.

Table 5.1.7 presents existing year PM peak hour (3:30 – 4:30 PM) intersection operations for study intersections along the corridor (see Appendix C for detailed Synchro reports). As shown, all intersections experience low v/c ratios and therefore all are well within mobility targets (mobility target for side street approaches is 0.75 along this corridor, 1999 Oregon Highway Plan, Action 1F.1). However, due to US 97 mainline volumes, side street delays are often significant, resulting in LOS E and LOS F conditions at several locations.

Table 5.1.7: Existing Year PM Peak Hour Intersection Operations (3:30 – 4:30 PM)

Intersection	Worst Movement	V/C	Delay (s/veh)	LOS
US 97/US 26/SW Colfax Ln	EBLT	0.32	113.8	F
US 97/SW Dover Ln	WBLTR	0.33	56.3	F
US 97/SW Falcon Ln	WBLTR	0.04	17.6	C
US 97/SW Ford Ln	EBLTR	0.07	35.7	E
US 97/SW Highland Ln	WBLTR	0.02	24.5	C
US 97/SW Iris Ln	EBLTR	0.21	36.0	E
US 97/SW Jericho Ln	WBLTR	0.24	32.5	D
US 97/SW Culver Hwy	EBLTR	0.34	19.3	C
US 97/SW Monroe Ln	EBLTR	0.14	29.1	D
US 97/SW Norris Ln	EBLTR	0.04	40.4	E
US 97/SW Opal Ln	EBLTR	0.04	42.5	E
US 97/SW Park Ln	WBLTR	0.16	62.4	F

Table 5.1.10 presents future year 2044 PM peak hour (3:30 – 4:30 PM) intersection operations (assuming existing intersection geometry and traffic control). As shown, US 97 intersections with US 26 and with SW Dover Lane are estimated to exceed their mobility target of 0.75 (and well exceed a V/C ratio of 1.0). All other intersections are shown to meet the 0.75 mobility target but are nearly all estimated to operate at LOS E or LOS F by 2044.

Table 5.1.10: Year 2044 PM Peak Hour Intersection Operations (3:30 – 4:30 PM)

Intersection	Worst Movement	V/C	Delay (s/veh)	LOS
US 97/US 26/SW Colfax Ln	EBLT	1.84	>200	F
US 97/SW Dover Ln	WBLTR	1.27	>200	F
US 97/SW Falcon Ln	WBLTR	0.09	29.3	D
US 97/SW Ford Ln	EBLTR	0.20	80.7	F
US 97/SW Highland Ln	WBLTR	0.07	46.1	E
US 97/SW Iris Ln	EBLTR	0.62	124.0	F
US 97/SW Jericho Ln	WBLTR	0.62	98.7	F
US 97/SW Culver Hwy	EBLTR	0.75	56.6	F
US 97/SW Monroe Ln	EBLTR	0.44	86.9	F
US 97/SW Norris Ln	EBLTR	0.16	105.9	F
US 97/SW Opal Ln	EBLTR	0.16	116.9	F
US 97/SW Park Ln	WBLTR	0.56	>200	F

Two-Lane Highway Operational Analysis

This section provides an analysis of how the two-lane sections of US 97 perform in the PM peak hour. This operational analysis is based on the metric "follower density." Follower density is the number of followers in a directional traffic stream over a length of a highway, as defined in Section 11.4.1 of the ODOT Analysis Procedures Manual. This metric accounts for the percent of the section where passing is allowed, traffic volume, opposing volume, percent of traffic that is heavy vehicles, and if rolling terrain is present. Based on follower density, a Level of Service (LOS) is provided. As shown in Table 5.1.11, all two-lane sections of US 97 in the project limits have a follower density between 3.5 and 6.0 vehicles per mile, which is defined as LOS C. LOS C is generally an acceptable level of service as jurisdictions often design their transportation systems to operate at this level (see Appendix C for Level of Service definitions). Therefore, this analysis does not suggest that additional passing opportunities are needed. A detailed two-lane highway analysis worksheet is provided in the Appendix C.

Table 5.1.11: Existing Year Two-Lane Highway PM Peak Hour Operations (3:30 – 4:30 PM)

Segment of US 97	Follower Density		Level of Service	
	NB	SB	NB	SB
SW Colfax Ln to SW Waldorf Ln	3.9	4.6	C	C
SW Waldorf Ln to SW Dover Ln	4.0	4.6	C	C
SW Dover Ln to SW Eureka Ln	4.0	4.5[1]	C	C[1]
SW Eureka Ln to SW Bear Dr (N)	3.8	4.4[1]	C	C[1]
SW Bear Dr (N) to SW Bear Dr (S)	3.8	4.4	C	C
SW Bear Dr (S) to SW Falcon Ln	3.8	4.4	C	C
SW Falcon Ln to SW Ford Ln	3.7	4.3	C	C
SW Ford Ln to SW Highland Ln	3.6	4.3	C	C
SW Highland Ln to SW Iris Ln	3.7	4.3	C	C
SW Iris Ln to SW Jericho Ln	3.6	4.0	C	C
SW Jericho Ln to SW Culver Hwy	3.6	4.2	C	C

SW Culver Hwy to SW Monroe Ln	5.2[1]	5.2[1]	C[1]	C[1]
SW Monroe Ln to SW Norris Ln	5.1	5.3	C	C
SW Norris Ln to SW Opal Ln	5.1	5.6	C	C
SW Opal Ln to SW Park Ln	5.7	5.7	C	C
SW Park Ln to High Bridge	5.4[1]	5.7[1]	C[1]	C[1]

Notes:
1. This segment of US 97 contains a multi-lane segment. The analysis results shown only apply to the section of this highway segment that contains a single lane of travel in the given direction.

Speed and Travel Time

US 97 currently has a posted speed of 55 mph through the project corridor. Prior to March 1, 2016, the posted speed of the corridor was 55 mph. In March 2016, the speed limit was raised to 65mph in accordance with Oregon House Bill 3402. A 55 mph transition speed was implemented on the south end of Madras at this time. In 2017, a 55 mph zone was implemented on the north end of Terrebonne to NW Eby Way. In 2019, the entire corridor between Madras and Terrebonne was changed to 55 mph.

The following presents a summary of travel time and travel time reliability for the corridor (US 97 between US 26 and High Bridge) across the most recent four years of data (data before 2020 was not considered due to a significant improvement to RITIS data quality mid-2019 and to reflect the final speed zone change in 2019). Data was collected using the probe-based data aggregation tool Regional Integrated Transportation Information System or RITIS., RITIS aggregates vehicle probe data provided by the data collection company INRIX into an automated data sharing, dissemination, and archiving system that provides visual analytics and performance measurement of elements such as vehicle speed and travel time. ODOT has an agreement with the University of Maryland to access RITIS with access to archived data back to 2016. Further information of what data sources are ingested into the RITIS platform can be found here.

Date ranges for RITIS data collection per day of the week (Sunday through Saturday) include the following:

- Jan 1, 2020 – December 31, 2020
- Jan 1, 2021 – December 31, 2021
- Jan 1, 2022 – December 31, 2022
- Jan 1, 2023 – December 31, 2023

Figures 5.1.12 and 5.1.13 present travel time (in minutes) for the northbound and southbound directions along the extents of the project corridor by day of week, averaged by year. Travel times were derived from free flow conditions versus posted speed. This type of travel time evaluation was chosen due to varying operational speeds captured along the corridor above and below the posted speed. As shown, travel times across this four-year period have stayed relatively consistent. The data shows that southbound travel takes on average approximately 16 seconds longer than northbound travel (about a 2% difference), with an average of 15.17 minutes for northbound travel and 15.45 minutes for southbound travel. The data also shows a general trend that travel times are on average longer during the middle of the week.

Figures 5.1.14 and 5.1.15 present planning time index for the northbound and southbound directions of the corridor by day of week, averaged by year. Planning time index is a travel time reliability metric—it is

a ratio of the planning time to the free flow travel time, where planning time is the amount of time you would need to budget to arrive on time 95% of the time (i.e., if the planning time is significantly greater than the free flow travel time, it indicates that travel time reliability is poor). A planning time index of 1.0 indicates that planning time equals free flow travel time, which represents exceptional travel time reliability. While the range of planning time index shown in Figures 5 and 6 are not alarming, the figures do demonstrate a gradual increase in planning time index over this four-year period.

RITIS captures real-time data and is therefore not a tool used to project operational performance in the future. As operational conditions continue to change, ODOT will monitor travel time and planning time index along the project limits of US 97 provided access to the RITS tool is available.

Figure 5.1.12: Travel Time (min) – Northbound

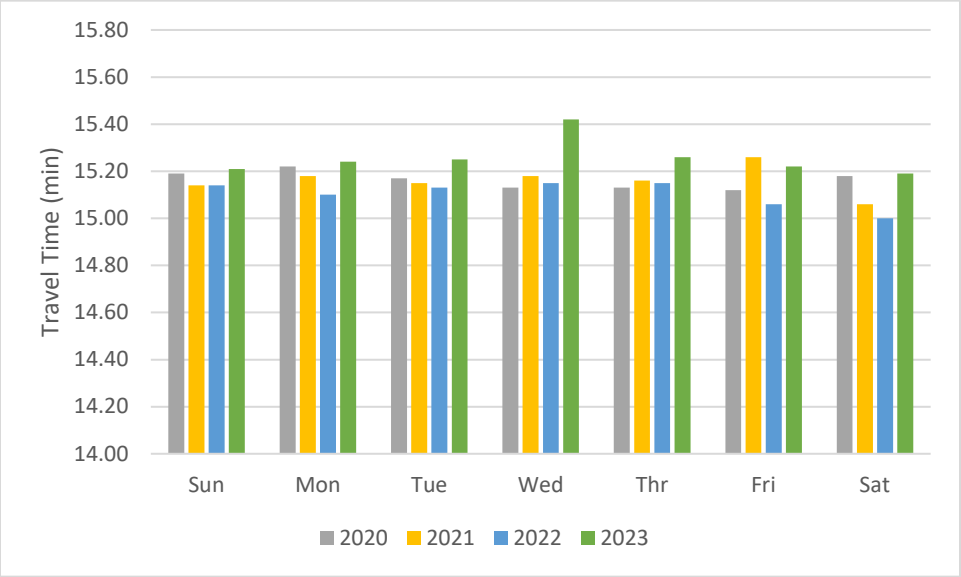


Figure 5.1.13: Travel Time (min) – Southbound

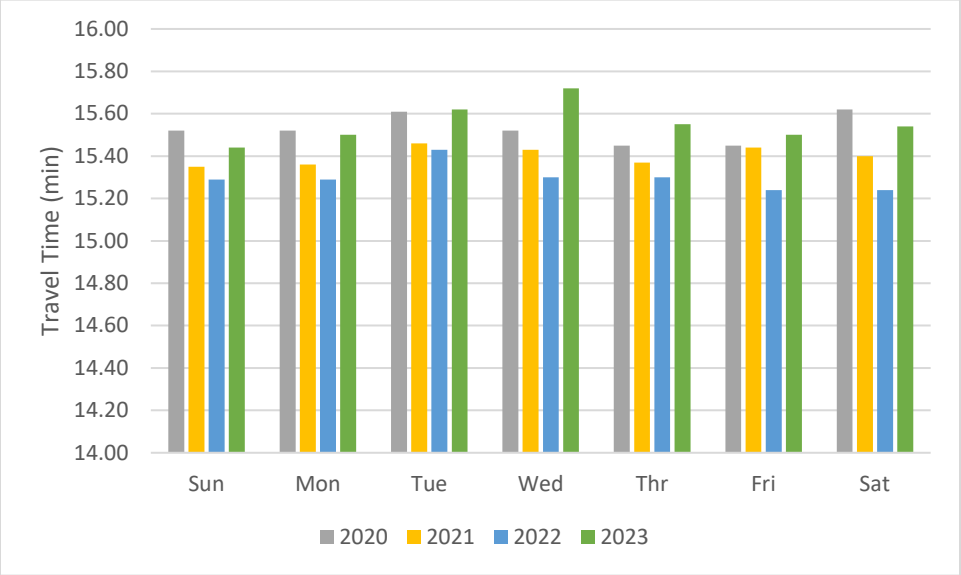


Figure 5.1.14: Planning Time Index – Northbound

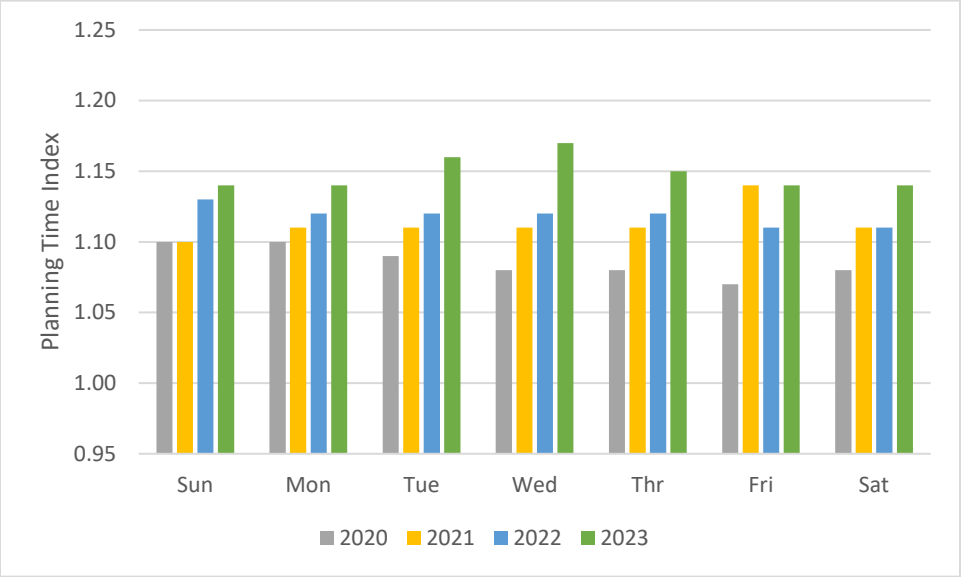
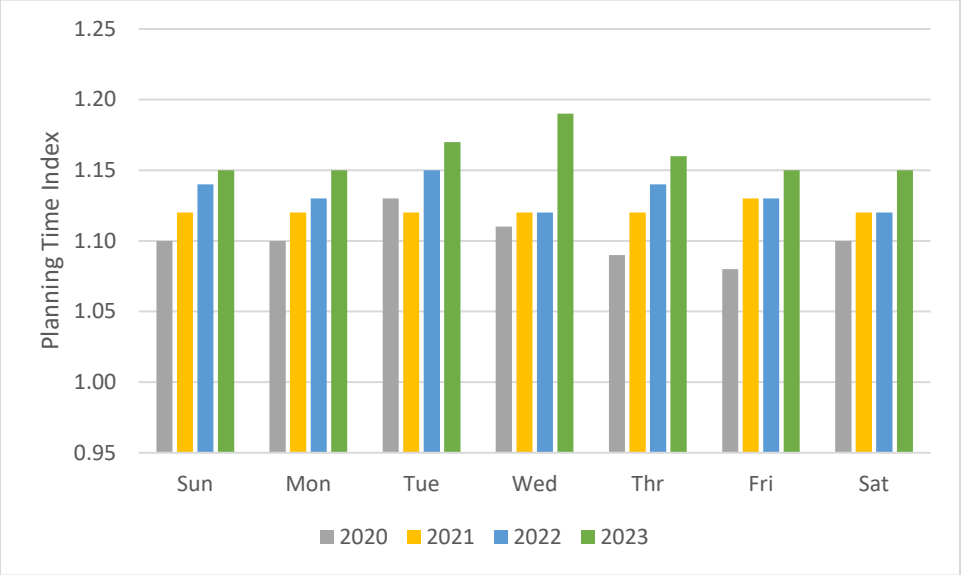


Figure 5.1.15: Planning Time Index – Southbound



Crash Data and Safety Analysis

The following presents crash data and analysis for the project corridor, including SPIS sites, corridor summary of crash data, crash type review, critical crash rate, and fatal and severe injury crash event review.

SPIS Sites

The ODOT Safety Priority Index System (SPIS) identifies top crash locations on the state highways system that are weighted by severity (i.e., these are generally locations with high concentrations of fatal and severe injury crashes). Each year, a SPIS report is generated based on the previous three years of available data. For example, the most recent 2022 SPIS report includes crash data for 2019 through 2021. SPIS sites are categorized by percentiles (a 95% site corresponds to a location that experienced more severe crashes than 95% of other state facilities). Region 4 Traffic conducts an annual review of 90% and 95% SPIS sites to identify crash trends and potential safety improvements, while 85% SPIS sites are considered for further review if the location is a repeat SPIS site, is adjacent to a 90% or 95% SPIS site, or if there are any concerns identified. The following is a list of sites identified in the most recent three SPIS reports—which corresponds to the most recent five years of crash data (2017 through 2021)—including 85%, 90%, and 95% sites:

- US 97 and SW Dover Lane: 95% (2022, 2020)
- US 97 and SW Bear Drive (South): 95% (2021), 90% (2022)
- US 97 and Culver Highway: 85% (2020)

To improve safety and reduce fatal and severe injury crashes on the corridor, ODOT and Jefferson County closed the following intersections in 2021 and 2022:

- US97 @ Eureka Lane (MP 99.46) – closed in September 2021
- US97 @ Bear Drive West (MP 99.89) – closed in September 2021
- US97 @ Bear Drive East (MP 100.07) – closed in May 2022

Due to the intersection closures above and crash history at US97 and SW Dover Lane, the *US97: Dover Ln – Bear Dr Safety Improvements Project (Key #22520)* was constructed in 2023. The project included permanent closure treatments at Bear Drive (east and west) and Eureka Lane and the construction of left turn lanes at Dover Lane.

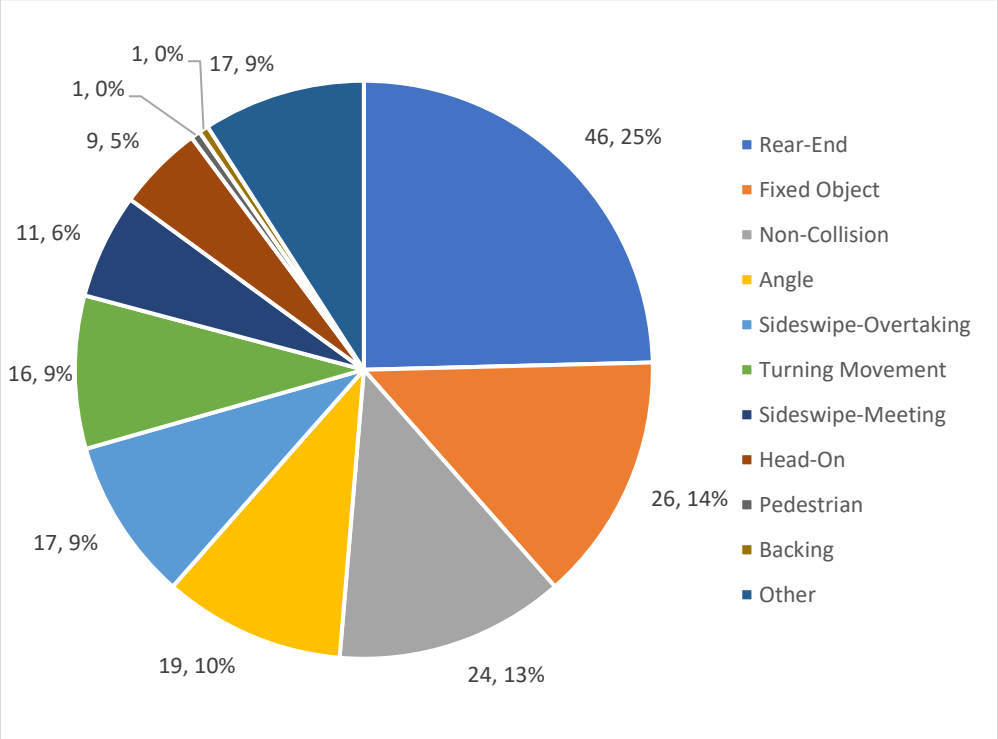
5.2 Corridor Summary of Crash Data

Crash Data was reviewed for US 97 from mile point 97.3 to mile point 112.6 for the most recent five years of available data (1/1/2017 – 12/31/2021). Note that a high-level review of crash data from mile point 112.6 to 115.0 is provided in the Appendix D. During this five-year period, there were 187 reported crashes along the corridor, including seven fatal and thirteen severe injury crashes. These 20 fatal and severe injury (FSI) crashes made up 10.7% of all crashes. The 2021 Statewide Crash Rate Tables show that 9.7% of crashes on rural other principal arterials were FSI crashes. Therefore, the makeup of crashes that result in fatalities or severe injuries is slightly higher on this corridor than the statewide average.

Figure 5.2.1 provides a summary of crashes by crash type for all crashes and for FSI crashes. As shown, rear-end crashes were the most common crash type along the corridor (25%) and were the second most

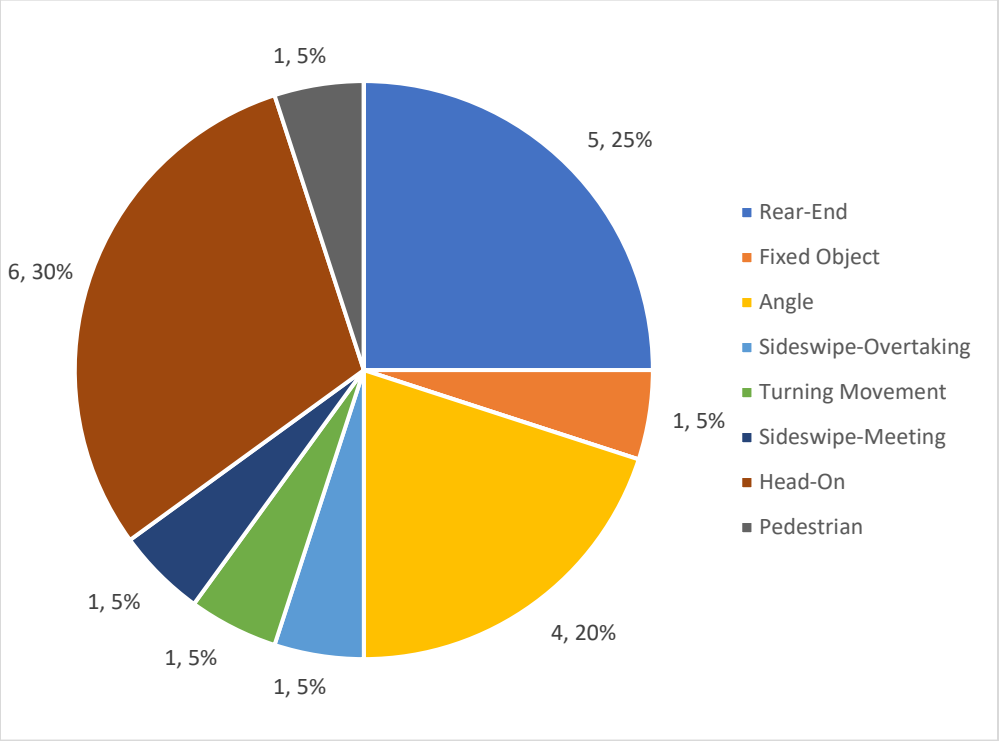
common FSI crash type along the corridor (also 25%). Head-on crashes were the most common FSI crash type (30%), with two-thirds of all head-on crashes resulting in a fatality or severe injury. While fixed-object and non-collision[1] were also common crash types along the corridor, only one of the combined 50 fixed object and non-collision crashes resulted in a fatality or severe injury. Vehicles involved in crashes resulting from entering, exiting, or crossing the highway are generally categorized as angle or turning movement crashes. Angle and turning movement crashes made up 19% of all crashes along the corridor, and 25% of all FSI crashes along the corridor. Other notable crash types include sideswipe-meeting and sideswipe-overtaking crashes. Sideswipe-meeting crashes involve vehicles traveling in opposite directions, which are similar in nature to head-on crashes; sideswipe-meeting crashes made up 6% of all crashes, including one FSI crash. Sideswipe-overtaking crashes involve vehicles traveling in the same direction (i.e., a vehicle passing another vehicle), which may include vehicles passing along two-lane sections of US 97 and along four-lane sections of US 97; sideswipe-overtaking crashes made up 9% of all crashes, including one FSI crash. A detailed review of crashes by type is provided later in the document.

Figure 5.2.1: Crashes by Crash Type (All Crashes)



[1] Non-collision crashes are generally overturned crashes resulting from a roadway departure (23 of the 24 non-collision crashes involved an overturned vehicle; the other crash was a motorcyclist that lost control and skidded on the highway). Roadway departure crashes are generally made up of fixed-object and non-collision crashes.

Figure 5.2.2: Fatal and Severe Injury Crashes by Crash Type



There was one pedestrian crash, which was a fatal crash (discussed in a further section); there were no bicycle crashes. There were three motorcycle crashes—none of which resulted in a fatality or severe injury. There was one crash involving a farm tractor and a motorcyclist, resulting in a moderate injury. There were 22 truck crashes along the corridor, which resulted in two fatal and one severe injury crashes (one fatal head-on, one fatal rear-end, and one severe injury rear-end crash). Note that the fatal rear-end crash was a four-vehicle crash, which included three northbound vehicles and one southbound vehicle; given the fatality involved the southbound motorist, the outcome is likely better described as a head-on crash resulting from a rear-end crash event. The most predominant truck-involved crash type was sideswipe-overtaking (five crashes). Of the five sideswipe-overtaking crashes, three were related to merging: one occurred at the northbound merge between SW Culver Highway and SW Monroe Lane, one occurred at the southbound merge between SW Culver Highway and SW Monroe Lane, and one occurred at the free eastbound right turn from SW Culver Highway onto southbound US 97; the remaining two sideswipe-overtaking crashes involved a passing maneuver and a motorist entering the highway from the shoulder.

There are often multiple crash causes identified for a crash event (e.g., driving too fast for conditions and driver sleepy). While reviewing the primary crash causes does not paint a full picture of crash events, it still provides some insight into some themes. The following is a summary of the most common primary crash causes by number of total crashes:

- Too Fast for Conditions: 29
- Followed Too Closely: 24
- Failed to Yield Right-of-Way: 22
- Inattention: 12

- Failed to Avoid Vehicle Ahead: 11
- Drove on Wrong Side: 10
- Driver Sleepy: 9
- Reckless/Careless Driving: 9
- Improper Overtaking: 8
- Speeding: 8

There were sixteen crashes that involved alcohol and/or drugs (9% of all crashes), which resulted in four fatal crashes and two severe injury crashes (30% of FSI crashes).

The following provides a summary of crashes by roadway characteristic:

- Intersection: 48 crashes (26%); 7 FSI crashes
- Driveway: 4 crashes (2%); no FSI crashes
- Straight: 116 crashes (62%); 12 FSI crashes
- Horizontal Curve: 4 crashes (2%); 1 FSI crash
- Vertical Curve: 15 crashes (8%); no FSI crashes

Figure 5.2.3 presents crashes by year, which show a significant drop in total crashes and FSI crashes in 2019 from 2017 and 2018. During peak COVID in 2020, total crashes were similar to 2019 values, yet FSI crashes were similar to 2017 and 2021. While total crashes in 2021 were greater than in 2019 and 2020, there were still fewer crashes that year than in 2017 and 2018; FSI crashes in 2020 were still similar to 2017 and 2020.

Figure 5.2.3: Crashes by Year

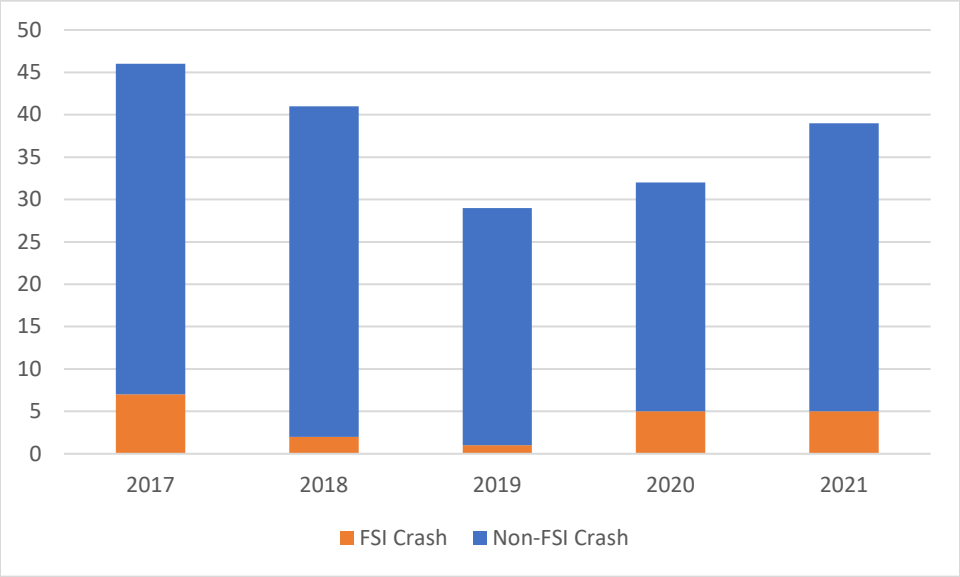


Figure 5.2.4 presents crashes by month, which shows a spike in crashes during September (including one fatal head-on crash), which does not correlate to peak travel (July). Therefore, it is unclear if there is a correlation as to why there were more crashes in September than any other month. January, which is the lowest travel month along the corridor, saw a disproportionate share of crashes. Of the 16 crashes in January, 12 included wet, snowy, or icy roadway conditions, suggesting roadway conditions played a significant role. The following presents a summary of roadway conditions across the entire five-year period:

- Wet: 8 crashes (4%); 1 FSI crash
- Snowy: 7 crashes (4%); no FSI crashes
- Icy: 22 crashes (12%); 1 FSI crash
- Dry/Unknown: 150 crashes (80%); 18 FSI crashes

Figure 5.2.4: Crashes by Month

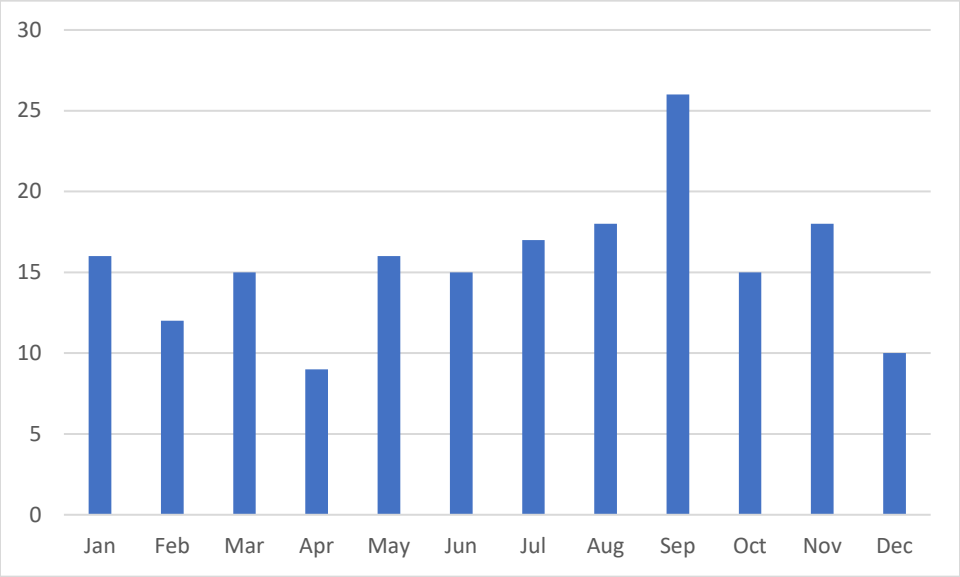
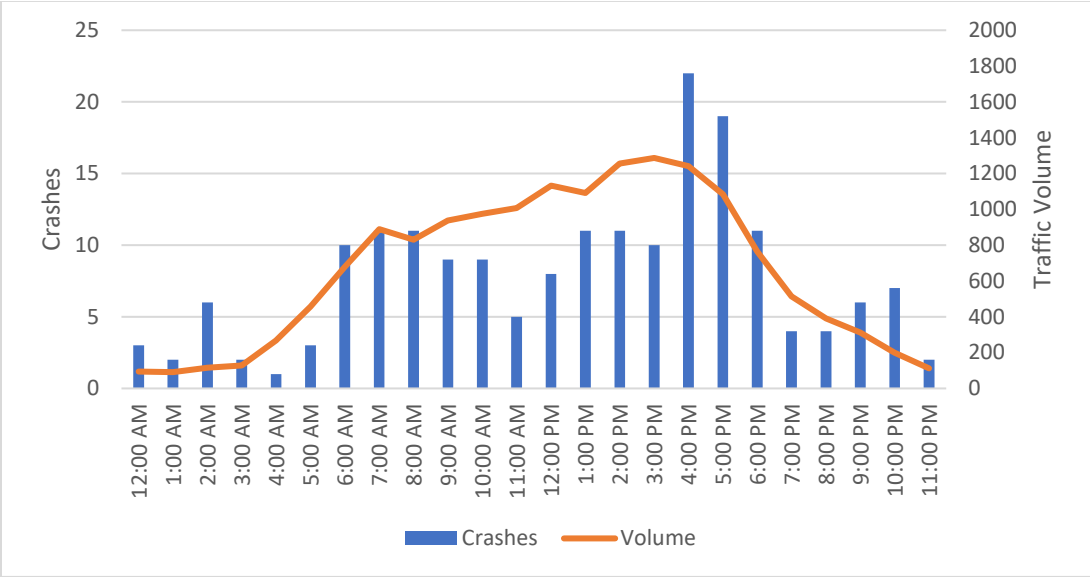


Figure 5.2.5 presents crashes by time of day, along with a sample of traffic volumes by day (traffic volumes shown reflect two-way volumes at ATR 16-002 on October 11, 2023) to provide a comparison between crashes and a typical volume profile. Based on an analysis comparing crashes and traffic volumes, the morning peak period (6:00 AM to 9:00 AM) was found to have a near 1:1 correlation between crashes and traffic volumes. Therefore, Figure 3 suggests that the mid-day period (9:00 AM to 4:00 PM) experienced fewer than expected crashes when compared with traffic volumes, and evening hours (4:00 PM to 7:00 PM, and 9:00 PM to 3:00 AM) experienced greater than expected crashes when compared with traffic volumes.

Figure 5.2.5: Crashes by Time of Day



While there were disproportionately more crashes during the late-night hours when compared to traffic volumes, 66% of all crashes occurred during daylight hours (22% of all crashes occurred when it was dark and there were no streetlights present). Seven of the 41 dark crashes were alcohol-involved crashes.

Crash Type Review

There are several crash types that are prevalent through the corridor, including rear-end, fixed-object/non-collision, angle/turning movement, sideswipe-overtaking, and head-on/sideswipe-meeting crashes. This section summarizes each crash type.

Rear-End Crashes

There were 46 rear-end crashes along the corridor, including two fatal and three severe injury crashes. While rear-end crashes are generally not an alarming crash type due to typical low-severity nature of the crash type, the fact that there were five FSI rear-end crashes (25% of all FSI crashes) is of potential concern. Interestingly, only 16 of the 46 rear-end crashes (35%) were intersection crashes, and of the 30 non-intersection rear-end crashes, only four occurred at driveways. Therefore, 26 of the 46 rear-end crashes (61%) appear to be not related to intersections or driveways. The following is a summary of those 26 crashes:

- Crash with slowed down/slower moving vehicle: 10 crashes
- Crash with stopped vehicle: 9 crashes
- Crash caused by vehicle following too closely: 3 crashes
- Crash with stopped vehicle at a work zone: 1 crash
- Crash involving animal in the road: 1 crash
- Uknown cause of crash: 2 crashes

Regarding the nine crashes involved a stopped vehicle, it is unclear as to why the vehicle is stopped. However, thirteen of these rear-end crashes involve a driver crashing into a slower moving vehicle.

Of the 16 rear-end crashes at intersections, seven occurred at the US 97/SW Bear Drive (east) intersection. Given that intersection was closed in 2022, it is reasonable to assume those crashes have been mitigated. Of the remaining 9 rear-end intersection crashes, no intersection experienced more than two rear-end crashes during this five-year period.

Fixed Object/Non-Collision Crashes

There were 26 fixed-object and 24 non-collision crashes. These crash types are evaluated together as these are generally both roadway departure crashes. Of these 50 crashes, only one was not a roadway departure crash—one fixed object crash was the result of a vehicle crashing into an object on the road. Of these 50 crashes, there was only one FSI crash (one fatal crash). While these crash types only made up 5% of FSI crashes, the total crash frequency is still high compared to other crash types and worth investigating. All reported non-collisions were overturned crashes where no fixed object was involved with the exception of one motorcycle crash resulting from the driver skidding and falling off their motorcycle. The following is a summary of objects that were struck by more than one crash in fixed-object crashes (note some crashes may have more than one object recorded):

- Fence: 10 crashes
- Cut slope or ditch embankment: 7 crashes
- Mailbox: 4 crashes
- Other sign: 3 crashes
- Utility pole: 2 crashes
- Guard rail: 2 crashes

The following is a summary of the most common crash causes for the 50 fixed-object and non-collision crashes:

- Driving too fast for conditions (not exceeding posted speed): 13 crashes
- Sleepy, inattention or distracted: 13 crashes
- Alcohol- and/or drug-involved: 8 crashes
- Driving in excess of posted speed: 3 crashes
- Reckless/careless driving: 3 crashes

Twenty-two of the 50 crashes took place with wet, snowy, or icy road conditions. Of 22 crashes that took place in wet, snowy, or icy road conditions, 11 occurred between SW Culver Highway and SW Opal Lane—a 4.01-mile section of the 15.3-mile corridor—which includes a series of horizontal and vertical curves through the Juniper Butte area.

Angle/Turning Movement Crashes

There were nineteen angle crashes and sixteen turning movement crashes. These 35 crashes generally involve a motorist turning onto of off-of the highway or crossing the highway, and therefore generally occur at intersections or driveways. Of these 35 crashes, one resulted in a fatality and four resulted in a severe injury, which made up 25% of all FSI crashes. Of the nineteen angle crashes, seventeen were crossing crashes and two were left turn crashes. Of the sixteen turning movement crashes, eleven were left turn crashes, three were right turn crashes, and two were U-turn crashes. The majority of angle and turning movement crashes occurred at intersections; only four of the 35 crashes occurred elsewhere. There was one midblock U-turn crash, two crashes at driveways, and one left turn crash at a location with no identifiable driveway. The following is a summary of angle/turning movement crashes by intersection:

- US 97/US 26/SW Colfax Ln: 2
- US 97/SW Waldorf Ln: 1
- US 97/SW Dover Ln: 13
- US 97/SW Eureka Ln: 1
- US 97/SW Bear Dr (South): 1
- US 97/SW Falcon Ln: 2
- US 97/SW Ford Ln: 1
- US 97/SW Highland Ln: 1
- US 97/SW Jericho Ln: 4
- US 97/SW Culver Hwy: 4

As shown, there were much more angle/turning movement crashes at US 97/SW Dover Lane than at any other location. The intersections of US 97/SW Jericho Lane and US 97/SW Culver Highway each experienced four angle/turning movement crashes, while every other intersection on the corridor experienced two or fewer angle/turning movement crashes.

Head-On/Sideswipe-Meeting Crashes

There were nine head-on and eleven sideswipe-meeting crashes. These twenty crashes generally involve a motorist crossing the centerline and crashing into on-coming traffic. Of these twenty crashes, two resulted in a fatality and five resulted in a severe injury, which made up 35% of all FSI crashes. The data demonstrates that crashes of this nature have a high risk of resulting in fatalities and severe injuries.

Of the twenty crashes, four were reported to have involved alcohol or drugs, and three occurred late at night. Ten of the twenty crashes occurred during peak evening commute hours (4:00 to 7:00 PM). The crash locations of these crash types occurred consistently throughout the corridor, suggesting no apparent pattern based on location. The following is a summary of the crash causes:

- Alcohol- and/or drug-involved: four crashes
- Sleepy or inattention: three crashes
- Failure to maintain lane: four crashes
- Lost control in snowy/icy conditions: four crashes
- Object or animal in road: three crashes
- Other: two crashes (one physical illness, one mechanical defect)

Only one of the twenty head-on/sideswipe-meeting crashes was a result of a passing maneuver. This passing maneuver crash was an alcohol-involved crash where passing was not allowed.

Sideswipe-Overtaking Crashes

The corridor contains a mix of passing and no-passing zones. There are both passing zones present in two-lane sections of highway, and passing lanes present in multi-lane sections of highway. There were seventeen sideswipe-overtaking crashes, including one severe injury crash. The following is a summary of sideswipe-overtaking crashes:

- One crash within passing zone of US 97 between SW Colfax Lane and SW Waldorf Lane, but driver cited as improper use of median or shoulder, suggesting passing took place on the shoulder given lack of median.
- One crash within northbound passing zone of US 97 between SW Dover Lane and SW Eureka Lane.
- One crash at US 97/SW Falcon Lane resulting from driver recklessly passing on the wrong side through the intersection.
- One crash within passing zone of US 97 between SW Ford Lane and SW Highland Lane.
- One crash at US 97/SW Highland Lane resulting from driver passing vehicle entering highway.
- One crash at US 97/SW Iris Lane resulting from driver passing vehicle slowing to turn off highway.
- Two crashes within the US 97/SW Culver Highway intersection.
- Six crashes within the multi-lane section of US 97 between SW Culver Highway and SW Monroe Lane.
- One crash within passing zone of US 97 between SW Norris Lane and SW Opal Lane.
- One crash in non-passing section between SW Park Lane and High Bridge (severe injury crash).
- One crash within the multi-lane section of US 97 between SW Park Lane and High Bridge.

As described above, there were seven sideswipe-overtaking crashes where passing lanes were present, and three crashes where passing zones were present. Five of the sideswipe-overtaking crashes occurred through intersections. One crash occurred where there was a passing zone but appeared to pass on the right side on the shoulder, and one crash occurred where passing was not legal.

Critical Crash Rate

The critical crash rate analysis method compares crash rates of a given site to an average crash rate of a reference population. This method is useful in screening a network for locations with potentially higher than expected crashes. Note that this method does not consider crash severity and should therefore only be used as a supplemental tool for network screening (in addition to a screening tool that considers

collision severity, such as the SPIS program). Table 5.2.6 presents the critical crash rate analysis for intersections and Table 5.2.7 presents the critical crash rate analysis for roadway segments.

Table 5.2.6: Intersection Critical Crash Rate

Intersection	AADT Entering Intersection	Crash Total	Intersection Crash Rate	Critical Rate	Over Critical
US 97/US 26/SW Colfax Ln	16,320	2	0.07	0.26	Under
US 97/SW Waldorf Ln[1]	N/A	2	N/A	N/A	N/A
US 97/SW Dover Ln	14,338	14	0.54	0.27	**Over**
US 97/SW Eureka Ln[2]	N/A	1	N/A	N/A	N/A
US 97/SW Bear Dr (North)[2]	N/A	0	N/A	N/A	N/A
US 97/SW Bear Dr (South)[2]	N/A	9	N/A	N/A	N/A
US 97/SW Falcon Ln	12,670	5	0.22	0.28	Under
US 97/SW Ford Ln	12,595	2	0.09	0.28	Under
US 97/SW Highland Ln	12,569	1	0.04	0.28	Under
US 97/SW Iris Ln	12,791	1	0.04	0.28	Under
US 97/SW Jericho Ln	12,481	5	0.22	0.28	Under
US 97/SW Culver Hwy	15,829	8	0.28	0.26	**Over**
US 97/SW Monroe Ln	15,258	1	0.04	0.26	Under
US 97/SW Norris Ln	15,232	1	0.04	0.26	Under
US 97/SW Opal Ln	16,140	0	0.00	0.26	Under
US 97/SW Park Ln	16,788	2	0.07	0.26	Under

Notes:

1. Intersection turning movement counts are not available at this intersection. Given there were only two crashes over a five-year period (and none of which were FSI crashes), this is not a high-priority location for safety treatments based on crash history.
2. The Eureka and both Bear Drive intersections have been closed and are no longer relevant to review as intersections.

Table 5.2.7: Roadway Segment Critical Crash Rate

US 97 Segment	AADT	Crash Total	Segment Length (mi)	Segment Crash Rate	Critical Rate	Over Critical
SW Colfax Ln to SW Waldorf Ln	13,673	4	0.69	0.23	0.59	Under
SW Waldorf Ln to SW Dover Ln	13,601	7	0.38	0.74	0.70	**Over**
SW Dover Ln to SW Eureka Ln	13,528	11	1.09	0.41	0.54	Under
SW Eureka Ln to SW Bear Dr (N)	13,023	6	0.43	0.59	0.68	Under
SW Bear Dr (N) to SW Bear Dr (S)	13,023	6	0.18	1.40	0.91	**Over**
SW Bear Dr (S) to SW Falcon Ln	13,023	5	0.70	0.30	0.60	Under
SW Falcon Ln to SW Ford Ln	12,518	6	0.52	0.51	0.65	Under
SW Ford Ln to SW Highland Ln	12,442	10	1.30	0.34	0.53	Under
SW Highland Ln to SW Iris Ln	12,382	9	1.04	0.38	0.55	Under
SW Iris Ln to SW Jericho Ln	12,193	4	1.30	0.14	0.53	Under
SW Jericho Ln to SW Culver Hwy	12,610	4	0.80	0.22	0.58	Under
SW Culver Hwy to SW Monroe Ln	15,770	16	2.02	0.28	0.47	Under
SW Monroe Ln to SW Norris Ln	15,210	11	0.99	0.40	0.53	Under
SW Norris Ln to SW Opal Ln	15,244	10	1.00	0.36	0.53	Under
SW Opal Ln to SW Park Ln	16,628	10	0.98	0.34	0.53	Under
SW Park Ln to High Bridge	16,742	14	1.88	0.24	0.47	Under

As shown in Table 5.2.1, the crash rates for the following intersections are flagged for further review:

- US 97/SW Dover Lane: There were fourteen reported crashes at this intersection, including four severe injury crashes. There were nine angle crashes, four turning movement crashes, and one rear-end crash. The angle crashes were all crossing crashes and were generally a result of a driver not yielding right-of-way; three of these crashes were severe injury crashes. The turning movement crashes involved two instances of motorists from US 97 making an improper turn and crashing into a vehicle stopped at the stop sign on the SW Dover Lane and two instances of motorists turning onto US 97 and not yielding proper right-of-way; none of the turning movement crashes resulting in a fatality or severe injury. The single rear-end crash involved a southbound travelling motorist failing to avoid a queue on the highway, resulting in a severe injury. Note that this location was improved in 2023 through the addition of left turn lanes in the northbound and southbound directions. However, it is unlikely that these improvements would address the significant amount of severe injury crossing crashes. Therefore, it is recommended that this location be considered as a crash hot spot and reviewed for further safety improvement opportunities.
- US 97/SW Culver Highway: There were eight reported crashes at this intersection, including one fatal crash. There were three turning movement crashes, two sideswipe-overtaking crashes, one angle crash, one rear-end crash, and one fixed-object crash. Two of the turning movement crashes involved motorists making a northbound left in front of oncoming traffic from US 97 onto SW Culver Highway (one of which resulting in a fatality), and one of the turning movement crashes involved a speeding motorist on Southbound US 97 crashing into a motorist turning right from SW Culver Highway onto Southbound US 97. The two sideswipe-overtaking crashes involved a northbound motorist sideswiping a stopped motorist. The other three crashes included an angle (crossing crash), a rear-end crash in the southbound direction, and a fixed-object/overturned crash resulting from a speeding motorist making a right turn from SW Culver Highway onto Southbound US 97 in snowy conditions. Given this location experiences a high volume of northbound left traffic and has experienced a few northbound left crashes, including one fatal

crash, it is recommended that this location be considered as a crash hot spot and reviewed for further safety improvement opportunities.

While the intersections of US 97/SW Falcon Lane and US 97/SW Jericho Lane were not flagged for further review, both experienced 5 crashes, while every other intersection experienced two of fewer crashes. Therefore, the following is a review of those two intersections:

- US 97/SW Falcon Lane: There were five reported crashes at this intersection, none of which were FSI crashes. Three of the crashes involved a passing maneuver (one a sideswipe-overtaking crash, and two crashes involve a motorist passing a vehicle making a left turn); note that there is skip striping present through this intersection. It is recommended that this location be considered for improvement to address passing-related crashes.
- US 97/SW Jericho Lane: There were five reported crashes at this intersection, which included one severe injury crash. Four of the crashes were angle crashes, and one of the crashes was a turning movement crash. All four angle crashes were crossing crashes, and the turning movement crash involved a motorist making an eastbound left turn onto the highway. It is recommended that this location be considered for improvement to address these types of crashes.

As shown in Table 2, the crash rates for the following roadway segments are flagged for further review:

- SW Waldorf Lane to SW Dover Lane: There were seven crashes reported within this 0.38-mile segment—none of which resulted in a fatality or severe injury. There were three fixed object crashes, one sideswipe-meeting crash, one rear-end crash, one turning movement crash, and one overturned crash. In reviewing the crash data, there are no apparent crash trends that suggest this location has more crash risk than other roadway segments along the corridor. Therefore, this location is not recommended to be considered a crash hot spot.
- SW Bear Drive (North) to SW Bear Drive (South): There were six crashes reported within this 0.18-mile segment—none of which resulted in a fatality or severe injury. There were two rear-end crashes, two sideswipe-meeting crashes, one animal crash, and one overturned crash. In reviewing the crash data, there are no apparent crash trends that suggest this location has more crash risk than other roadway segments along the corridor. Therefore, this location is not recommended to be considered a crash hot spot.

Fatal and Severe Injury Crash Event Review

There were seven fatal and thirteen severe injury crashes—20 fatal and severe injury (FSI) crashes—during this five-year period. Of the 20 FSI crashes, there were six head-on, five rear-end, four angle, one fixed object, one sideswipe-overtaking, one turning movement, one sideswipe meeting, and one pedestrian crashes. The following summarizes each of the FSI crashes by location:

- Mile point 97.66 (SW Colfax Ln to SW Waldorf Ln): There was one severe injury head-on crash at this location. This crash was reported as an alcohol-involved crash.
- Mile point 98.37 (US 97/SW Dover Ln): There were four severe injury crashes, including three angle crashes and one rear-end crash at this intersection. All three angle crashes were crossing crashes involving motorists travelling eastbound across US 97 and not yielding right-of-way to highway traffic. Two of the crossing crashes were likely a result of misjudging gaps in traffic (one of which the driver reported being blinded by the sun), and the third crossing crash was an alcohol-related crash were the driver was reported to have disregarded the stop sign. The rear-end crash took place in the southbound direction; although unclear from the crash record it is likely that the stopped motorist was waiting to make a left turn given the low chance for a conflict for southbound right turning traffic, which would likely have been mitigated from the recent project that installed left turn storage lanes.

- Mile point 100.07-100.08 (US 97/SW Bear Dr (S)): There was one fatal and one severe injury crash at this intersection. The fatal crash was a rear-end crash in the southbound direction involving a semi-truck rear ending a passenger vehicle. The severe injury crash was a head-on crash involving a distracted driver. This intersection has since been closed, which would likely have mitigated the rear-end crash. The head-on crash, however, does not seem to be related to the presence of the intersection and would not have likely been mitigated through the intersection closure project.
- Mile point 100.11 (SW Bear Dr (S) to SW Falcon Ln): There was one severe injury sideswipe-meeting crash at this location.
- Mile point 101.59 (SW Ford Ln to SW Highland Ln): There was one severe injury rear-end crash at this location. This crash took place in the southbound direction and was caused by a distracted driver who was also cited for driving too fast for conditions. There are no intersections or driveways in this area, but the crash record notes the presence of a work zone.
- Mile point 103.38 (SW Highland Ln to SW Iris Ln): There was one fatal head-on crash at this location. The crash included an alcohol- and drug-involved motorist who crashed into an on-coming semi-truck.
- Mile point 104.38 (SW Iris Ln to SW Jericho Ln): There was one fatal fixed-object crash at this location. While noted as a fixed-object crash, this crash may also be described as a head-on or sideswipe-meeting crash as the distracted, drug-involved motorist departed the roadway into a low shoulder, over-corrected and crashed into an on-coming vehicle.
- Mile point 104.93 (US 97/SW Jericho Ln): There was one severe injury angle crash at this intersection. This crossing crash involving a westbound motorist was likely the result of failing to find an appropriate gap in traffic.
- Mile point 105.73 (US 97/SW Culver Hwy): There was one fatal turning movement crash at this intersection. This alcohol-involved crash was the result of a motorist turn left from Northbound US 97 onto SW Culver Highway in front of a motorist travelling southbound on US 97.
- Mile point 108.00, 108.24, 108.61 (SW Monroe Ln to SW Norris Ln): This 0.99-mile segment experienced two fatal and one severe injury crashes, including one pedestrian crash, one rear-end crash, and one head-on crash. The crash at mile point 108.00 was a fatal pedestrian crash. The pedestrian was cited as being illegally in the roadway, crossing between intersections. This crash took place at night. The crash at mile point 108.24 was a fatal rear-end crash. This crash took place on Southbound US 97 near the truck scale on-ramp. It is unclear from the crash record why a motorist was stopped on the highway, and no trucks were involved in the crash, so it is unclear if the crash is related to the truck scale on-ramp. The crash at mile point 108.61 was a severe injury head-on crash. It appears the cause of the crash was due to a physical illness. While there were three FSI crashes along this highway segment, they are all un-related and do not indicate that this section of highway has greater crash risk than other segments within the project limits.
- Mile point 108.95 (SW Norris Ln to SW Opal Ln): There was one severe injury rear-end crash at this location. A southbound passenger vehicle rear-ended a semi-truck and was cited as following too closely. It is unclear from the crash record, but it appears that the semi-truck was not stopped when struck.
- Mile point 110.65 (SW Opal Ln to SW Park Ln): There was one fatal head-on crash at this location. This crash was an alcohol-involved crash.
- Mile point 111.91, 112.30 (SW Park Ln to High Bridge): This 1.88-mile segment experienced two severe injury crashes, including one head-on crash and one sideswipe-overtaking crash. The crash at mile point 111.91 was a head-on crash, resulting from a speeding motorist losing control of their vehicle in icy road conditions. The crash at mile point 112.30 was a sideswipe-overtaking crash, resulting from a motorist passing illegally in a no-passing zone along a horizontal curve.

ODOT Active Transportation Needs Inventory Data

The ODOT Active Transportation Needs Inventory (ATNI) utilized a set of evaluation criteria to prioritize bicycle and pedestrian need locations on ODOT highways.

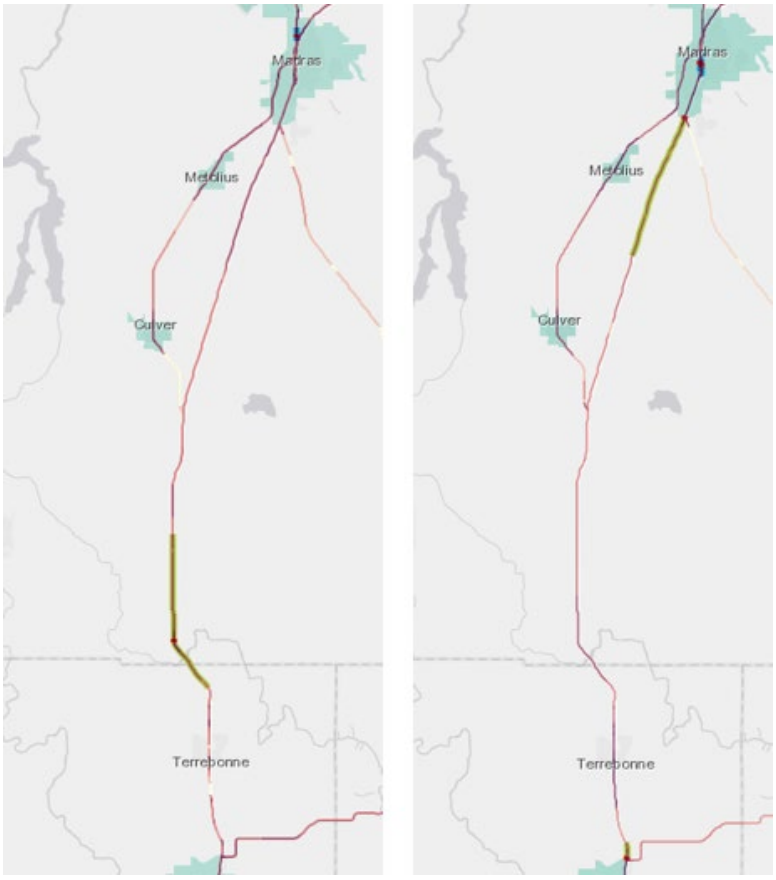
Bicycle Prioritization Results

The segment of US 97 from MP 109.14 – MP 113.74 scores a Top Rural Corridor in Region 4. There were no reported bicycle involved crashes in the study corridor during the 5-year screening period. The Bike Crash Risk Factor screening shows segments scoring at all varieties of levels, from the top 20% to the bottom 20%. This is also reflected in the Bicycle Level of Traffic Stress scores, with scores ranging from 2-4.

Pedestrian Prioritization Results

The segment of US 97 from MP 97.24 – MP 101.34 scores a Top Rural Corridor in Region 4. There was one reported pedestrian involved crash during the ATNI screening period at MP 99.34, resulting in reported minor injuries and all the study segment scores in the top 20% of all segments Pedestrian Risk Factors.

Figure 5.2.8 Active Transportation Needs Inventory Scores



6. Areas of Safety Concern

Considerations from this memo and initial feedback from the Participant Advisory Committee led to the development of the following areas of safety concern. The intent of this exercise was to identify locations based on safety data and public feedback that currently exist as safety concerns. These locations will serve as places where the project team will make possible future recommendations for safety improvements. This section includes specific locations, systemic issues, and non-engineering needs.

Specific Locations

1. US 97/Colfax Lane/US 26
    a. Safety Concerns
        i. 2 crashes
        ii. Historical SPIS site
        iii. Angle/Turning movement crashes
        iv. Crossing US 97 can be difficult
    b. Jefferson County TSP
        i. Speed treatments
        ii. Striping changes

Figure 6.1 US 97/Colfax Ln/US 26

2. US 97 Waldorf to Dover – MP 97.7 to 98.3
    a. Safety Concerns
        i. Open Accesses
        ii. Segment exceeds Critical crash Rate
    b. STIP/Planning
        i. 2023 Dover Lane turn lane project

Figure 6.2 US 97 Waldorf to Dover

3. US 97 – Dover Lane Intersection
    a. Safety Concerns
        i. Top 5% SPIS, 13 crashes
        ii. Angle crashes (9), Turning (4)
        iii. Segment exceeds Critical crash Rate
        iv. Highest crash intersection in corridor
        v. Slight intersection skew
        vi. Sight distance meets standard but is not excessive – creates challenges with steep grades
    b. Recent Projects
        i. 2023 Dover Lane turn lane project

Figure 6.3 US 97/ Dover Ln Intersection

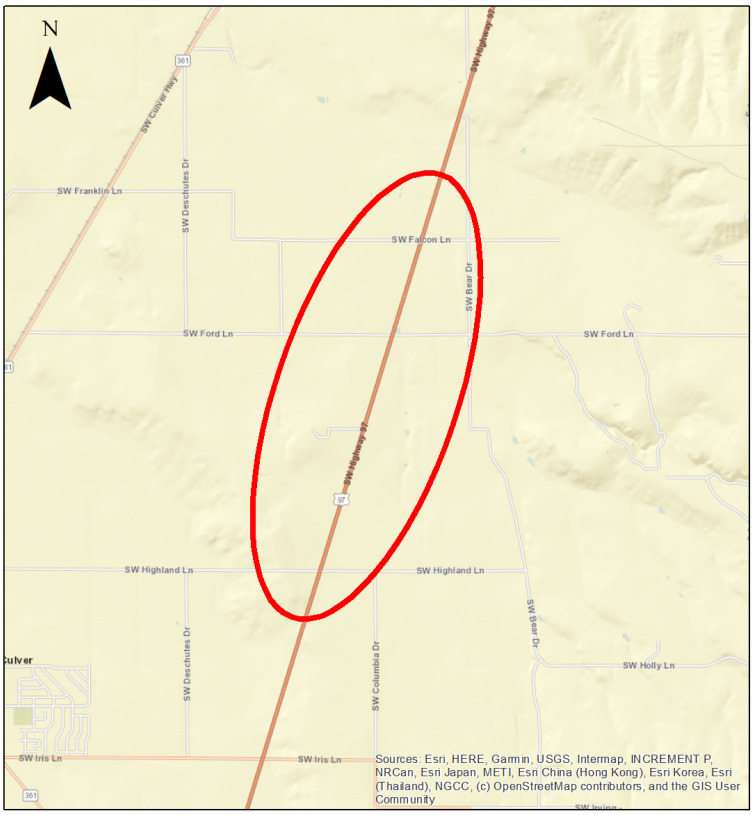
4. US 97 Passing Lanes MP 98.7 to 99.6
    a. Safety Concerns
        i. Driveway and street approach conflicts
        ii. Close to Critical Crash Rate
        iii. Livestock yard: Short passing lane with risks to SB left turning vehicles
        iv. Inconsistent rumble strips

Figure 6.4 US 97/ Dover Ln Intersection

5. US 97 – Falcon Lane to Highland
    a. Safety Concerns
        i. 16 total crashes (5 at US 97/Falcon)
        ii. Close to Critical Crash Rate
        iii. High number of approaches
        iv. Narrow roadways and tight turning radius

    b. Includes the following intersections
        i. US 97/Falcon Rd. (MP 100.76)
        ii. US 97/SW Ford Lane (MP 101.3)
        iii. US 97/SW Glide Lane (MP 101.82)
        iv. US 97/SW Highlands Lane (MP 102.6)

Figure 6.5 US 97 Falcon to Highland



US 97: High Bridge to Madras Safety Study

Jefferson County, Oregon

0 0.35 0.7 1.4 Miles

Area of Safety Concern

US 97/Falcon Rd. (MP 100.76)
US 97/SW Ford Lane (MP 101.3)
US 97/SW Glide Lane (MP 101.82)
US 97/SW Highlands Lane (MP 102.6)

6. US 97/Jericho Lane intersection
    a. Safety Concerns
        i. 5 crashes, 1 serious injury
        ii. 4 angle, 1 turning movement
        iii. Close to Critical Crash Rate
        iv. Concerns with recreational vehicles
        v. Narrow intersection turning radius

Figure 6.6 US 97/Jericho Lane Intersection

7. US 97/SW Culver Highway
    a. Safety Concerns
        i. 8 crashes, 1 Fatal
        ii. 3 turning, 2 sideswipe, 1 angle, 1 rear end, 1 fixed object
        iii. Top 3 crash locations
        iv. Over Critical Crash Rate
        v. Northbound left turn onto Culver Hwy is difficult
        vi. Crossing US 97 is challenging
        vii. Right Turn permitted without stopping allows high speeds from drivers

Figure 6.7 US 97/SW Culver Hwy

8. US 97 – Juniper Butte Area
    i. Merge lane exit northbound/Southbound
    ii. Juniper Butte (MP 106.3 to 107.2)
    iii. Juniper Butte passing lane merge
    b. Safety Concerns
        i. 16 crashes
        ii. Weather-related crashes
        iii. Truck merging

Figure 6.8 US 97 Juniper Butte

9. US 97 – Railroad Overcrossing
    a. Safety Concerns
        i. Ice

Figure 6.9 US 97 Railroad overcrossing

10. US 97/Eby Ave
    a. Safety Concerns
        i. Left-turning vehicles to Smith Rock
        ii. No indication of intersection ahead
        iii. Tight turning radius
        iv. Narrow lanes

Figure 6.10 US 97/ Eby Avenue Intersection

Systemic issues

The crash data analysis section revealed several systemic issues on this stretch of the US 97 corridor. These issues may exist in the Areas of Concern as well. Systemic issues are intended to identify broad needs in the corridor that pertain to safety.

1. Low Cost-Safety Countermeasures
    a. Signage in the corridor, both advisory and directional, is either missing, inconsistent or not up to current standards. Rumble strips are installed inconsistently.
2. Roadway Departure crashes
    a. Roadway departure crashes make up 50 total crashes (24 non collision and 26 fixed object) in the project limits. Particular attention should be given to reducing roadway departure crashes.
3. Head-on collisions

    a. Of the 20 head on crashes, 7 crashes resulted in a fatal or serious injury and subsequently made up the highest percentage (35%) of FSI crashes. Only one crash involved a passing maneuver, while the remaining crashes were related to alcohol (4), sleepy or inattentive (3), Failure to maintain lane (4), lost control in snow/ice (4), object or animal (3), or Other (2). Particular attention should be given to reducing head-on collisions systemically in the corridor.
4. Weather related crashes
    a. Weather related crashes were indicated in 20% of the 5 year crash period. Several of these crashes were concentrated on the Juniper Butte area, which is nearly 1,000ft in elevation higher than most of the corridor. Systemic solutions that address weather-related crashes should be considered in following memos.

Non-Engineering Need

Non-engineering needs were identified based on feedback from law enforcement and indicated within crash data.

1. Law enforcement funding
    a. It was indicated by the PAC that law enforcement (OSP and Jefferson County Sherriff) do not have funding to adequately staff and patrol the corridor. Additionally, full time staff at Jefferson county Sherrif's Office are already working overtime and overtime grant funding is not beneficial. Due to the high number of alcohol, speeding, and other human behavior crashes in the corridor, this lack of law enforcement funding is identified as a need.
2. Safety-related driving campaigns
    a. Some crash trends, such as the high amount of fatal and serious injury rear end crashes, can be attributed to driver inattentiveness. It was also indicated previously in the memo that alcohol/drug use(19), weather related crashes (20), and speeding/too fast for conditions (29) were all prevalent human behaviors indicated on crash reports. This memo highlights the need for safety-related driver campaigns.

7. Appendix A – Utilities

US97 High Bridge to Madras		
Utility Providers in Corridor		
High Importance*	Utility Company	Contact Information
	Bend Broadband	Chester Parker, TDS Project Coordinator 63090 Sherman Road Bend, OR 97703 541-480-8963 Chester.Parker@TDSTelecom.com
	Cascade Natural Gas	Josh Aigner, District Operations Manager 64500 OB Riley Road, Suite 2 Bend, OR 97703 541-706-6281 Joshua.Aigner@CNGC.com
	Central Electric Cooperative	Parneli Perkins, Lands Specialist PO Box 846 Redmond, OR 97756 541-312-7747 pperkins@cec.coop
★	Central Oregon Irrigation District	Kelley Hamby, Operations Manager 1055 SW Lake Court Redmond, OR 97756 541-504-7585 Khamby@coid.org
★	City of Madras	Jeff Hurd, Public Works Director 125 SW E Street Madras, OR 97741 541-475-2344 jhurd@ci.madras.or.us
★	Deschutes Valley Water District	Joel Gehrett, General Manager 881 SW Culver Highway Madras, OR 97741 541-475-3849 jgehrett@dvwd.org
	EBD Hydro LLC	administrator@earthbydesign.com
	Lumen Technologies Long Haul / National	Trevor Gilbert, Engineer II 100 NW Kearney Ave Bend, OR 97703 458-231-3146 trevor.w.gilbert@lumen.com relocations@lumen.com
	LS Networks	Craig Redelings, OSP Engineer 527 NE Elm Ave, Suite 3 Box 211 Redmond, OR 97756 541-527-1606 credelings@lsnetworks.net OSP@lsnetworks.net
★	North Unit Irrigation District	Josh Bailey, General Manager 2024 NW Beech Street Madras, OR 97741 541-475-3625 jbailey@northunitid.com
	Pacific Power	Ian Treadway, Operations Manager 328 NE Webster Avenue Bend, OR 97701 541-388-7101 Ian.Treadway@pacificorp.com
	Lumen Technologies Local	Trevor Gilbert, Engineer II 100 NW Kearney Ave Bend, OR 97703 458-231-3146 trevor.w.gilbert@lumen.com relocations@lumen.com
* A star in this column only indicates a high probability of significant facilities requiring special materials or long lead times, or reimbursable status.		
Note:		
Not all facilities are known. High probability of unknown facilities that would qualify as High Importance.		

8. Appendix B – Environmental Report

Air Quality

The Department of Environmental Quality (DEQ) has designated areas of Oregon as in non-attainment of the National Ambient Air Quality Standards (NAAQS) for the criteria pollutants carbon monoxide, ozone, and particulate matter (PM-10). Areas designated as in non-attainment of the standard for any criteria pollutant are required by the Clean Air Act (CAA) to implement a plan which demonstrates how the area will achieve attainment and maintain the standard. The Statewide Air Quality Report (SAQR) was developed to identify projects which have low enough traffic volumes that air quality violations are highly unlikely. The report basically applies to all areas that have been designated as "in attainment" of the NAAQS.

Predicted existing and future carbon monoxide levels for highway projects determined applicable under the Statewide Air Quality Report will be less than 4.5 parts per million (ppm). Since carbon monoxide serves as a representative pollutant indicator, if predicted carbon monoxide levels are low, other traffic-related pollutants are also expected to be low. Thus, highway projects addressed by the statewide report will not cause or exacerbate air quality violations and will be consistent with the Oregon State Clean Air Act Implementation Plan (SIP).

The focus area of the US97: High Bridge – Madras Safety Study is outside of designated non-attainment areas, thus assumed to be in an "attainment" area. The Statewide Air Quality Report may apply to projects selected within the corridor but will be dependent on traffic volumes and speed when compared to the NAAQS 1-hr standard of carbon monoxide levels.

The study corridor is in an area that is designated by the Environmental Protection Agency as being in attainment of the National Ambient Air Quality Standards.

The Oregon Clean Air Act Implementation Plan does not specify that transportation control measures are needed to attain the NAAQS in this area. Therefore, the project conformity procedures of the Federal Highway Administration's (FHWA) highway development regulation 23 CFR 770 do not apply.

An Indirect Source Construction Permit would not be required for projects in this area.

For projects outside of metropolitan areas, a regional conformity determination analysis is required before the projects can be added to Statewide Transportation Improvement Program (STIP). ODOT is responsible for conformity determinations in rural areas. A regional conformity determination analysis requires an extensive level of effort and may require up to 1½ to 2 years to analyze. Rural regional conformity occurs infrequently. Prior to FHWA and Federal Transit Administration (FTA) approval of the STIP, ODOT prepares a paper titled, "Current Status for Air Quality Conformity for 20XX to 20XX STIP", that includes a review of the projects in rural areas to determine if they will need an air conformity determination analysis.

ODOT is working to reduce the amount of greenhouse gases (GHG) emitted through our operation and management of the state's transportation system. ODOT is collaborating with others to develop innovative responses, minimize energy use, increase fuel efficiency and use of low carbon fuels, and support multi1modal transportation systems. ODOT is also planning for the impacts of climate change on

the transportation system (known as adaptation) and increasing transportation resilience through research, pilot studies, and strategic projects.

At this time, there are no national standards for GHGs, nor has the EPA established criteria or thresholds for ambient GHG emission pursuant to its authority to establish motor vehicle emission standards for CO2 under the CAA. Additionally, FHWA has not issued guidance addressing GHG emissions or Climate Change in NEPA reviews. In Oregon, there are many strategies, policies, initiatives, and rules in place at the state, MPO, county, and local agency level to aggressively reduce greenhouse gas emissions from various economic sectors. One GHG initiative is the 2013 Oregon Sustainable Transportation Initiative (OSTI), which is an integrated statewide effort to reduce greenhouse gas emissions from transportation while creating healthier and more livable communities. It builds on the Statewide Transportation Strategy, adopted by the Oregon Transportation Commission in 2018, which set a course for reducing GHG emissions. OSTI produced a document summarizing Oregon GHG Analysis tools that was last updated in 2018 that summarizes tools at various planning stages. The field of climate change and GHGs is evolving, and analysts should work with ODOT and FHWA to use the most recent tools and methodologies available as well as to reference the most recent legislation, polices and guidance available.

At the strategic planning stage, OSTI staff works with local communities on long-range scenario planning efforts to assess local plans' GHG emissions relative to (OAR 660-044). Outside of the Portland Metro region, these GHG reduction targets are voluntary. It is important to note that there is a difference between GHGs and other pollutants in that the impact of GHGs results from the cumulative emissions in the atmosphere and not episodic or localized concentrations as criteria pollutants that directly impact human health. As a result, VisionEval tools, with detailed household vehicles but no roadway network, are sufficient for assessing GHG emissions at a strategic planning level.

At the project level a more detailed treatment of GHG may be desired, reflecting the project roadway network changes. ODOT's approach to GHGs in the NEPA process is divided by National Environmental Policy Act (NEPA) category. Generally, for Categorical Exclusion (CE) and Programmatic Categorical Exclusion (PCE) projects, no analysis is required for GHG emissions or future climate impacts (notwithstanding what the designers/engineers may be including in their analysis and reports).

Archaeology/Historic

The study corridor is not within an area considered to be high probability for the presence of cultural materials. Archaeological surveys from previous projects within the study limits did not result in any cultural materials being present. However, all projects developed within the study limits will need to have archaeological review to determine if field surveys will be required.

Specific archaeological resource locations will be documented in the Phase 1 archaeology report following pedestrian surveys of the potential impact areas. A reconnaissance survey needs to be conducted by the archaeologist. The report containing the survey results will be sent to the SHPO. If no evidence of cultural material is found, and the archaeological research does not indicate any archaeological potential, then the project is cleared for construction, and a letter of concurrence is obtained from the State Historic Preservation Office (SHPO).

If the archaeologist finds some indication of buried cultural material, then a Phase 2 survey is scheduled. Subsurface exploration is performed using such techniques as hand auger boring and test pit excavation. If there is no indication of buried cultural material, or if the retrieval is minimal, then a report is filed with the SHPO and a clearance letter is obtained.

If the archaeologist finds significant cultural material, the site boundaries are determined, and he/she prepares a Determination of Eligibility for the National Register of Historic Places that the SHPO must approve. This document activates the federal laws on cultural resources protection and is filed with the Department of the Interior. Upon SHPO approval, options for avoiding the impact should be investigated. Such options include shifting the alignment and reducing fill slopes. If avoidance is not feasible, the archaeologist prepares a data recovery plan for salvage, and a budget for the final Phase 3 work. The recovery plan details such items as proposed mitigation, the methods to be used, the volume to be excavated, and the research questions to be answered.

In accordance with procedures established between FHWA and the U.S. Department of the Interior (DOI), if unanticipated archaeology evidence is discovered during construction, evaluation of the late discovery and implementation of appropriate mitigation measures will occur in a timely manner to avoid long construction delays.

A search of the Oregon State Historic Preservation Office Historic Sites Database resulted in several existing resources that are eligible for listing on the National Register of Historic Places. In addition to resources listed on the SHPO database, there are several resources throughout the corridor that have the potential to be considered historic/eligible. Resources within the corridor include, but not limited to, the following:

- Lateral Ditch 43-7, c.1940, eligible/contributing, crosses under US97 at ~MP 102.71
- Crooked River Canyon Bridge Landmark, eligible/contributing, located at the US97 crossing of the Crooked River at ~MP 112.62
- Crooked River High Bridge, c.1926, eligible/contributing, formally determined eligible, at ~MP 112.71
- North Unit Canal, ~MP 105.37 and ~MP 108.98
- BNSF Railroad, crosses under US97 at ~MP 113.93
- Several un-evaluated lateral canals crossing under US97 at ~MP 99.2, ~MP 99.92, ~MP 110.12, ~MP 114.44
- Several adjacent properties have structures/homes of possible historic significance

If the historian identifies a potential historic resource, he/she prepares a Determination of Eligibility for the National Register of Historic Places that the SHPO must approve. This document activates the federal laws on historic resources protection and is filed with the U.S. Department of the Interior. Upon SHPO approval, options for avoiding the impact should be investigated if the resource is determined potentially eligible/eligible. Such options include shifting the alignment and reducing fill slopes. If impacts are unavoidable, the historian will prepare a Finding of Effect to document whether the action will have an adverse effect on the resource.

If a proposed highway project may impact an archaeological or historic site that is listed in, nominated for, or has been determined to be eligible for listing in the National Register of Historic Places, then a Section 4(f) evaluation will be required. If the historic site is on land which has Land and Water Conservation Funds as its funding source, then a Section 6(f) evaluation would be required.

Section 106 of the National Historic Preservation Act applies to projects that are likely to affect properties which are listed, nominated, or determined to be eligible for the National Register. There may be additional resources in the study corridor that have not been identified. Once projects are identified, archaeological and historic surveys should be conducted throughout the potential area of project impact to determine impact to the known resources in the previous table and to identify additional sites that may be present and evaluate potential impacts to these resources as well.

Biology

Federally funded transportation projects require ODOT to comply with several federal environmental regulations regarding biological resources, most importantly the National Environmental Policy Act (NEPA), the Fish and Wildlife Coordination Act, and Section 7 of the Endangered Species Act (ESA). When projects are not federally funded, Section 7 (i.e., preparation of a biological assessment) responsibilities may be replaced by Sections 9 and 10 of the federal Endangered Species Act. State regulations including the Oregon Endangered Species Act would apply in either case. If there is a threatened species, an endangered species, designated critical habitat, or if a species has been proposed for either status, and has been in or near the project area, then impacts will need to be formally assessed.

A search of the Oregon Natural Heritage Database (ONHP) resulted in one finding of threatened, sensitive, or endangered species within the project area. The species with potential to be present within the focus area include the following:

- *Salvelinus confluentus pop. 28 (*Bull trout – Coastal Recovery Unit), Federal Status Threatened, State Status Species of Concern/Sensitive, Historical presence in the Crooked River

The database is a composite listing of species location information that has been sighted and reported. However, the ONHP list is incomplete. Therefore, surveys for rare plants need to be conducted throughout the potential area of project impacts to determine the presence and/or absence of such species.

No known potential habitat for threatened, sensitive, or endangered species is located within the focus area.

Surveys for noxious weeds need to be conducted throughout the potential area of project impact.

The project area is located within an Oregon Department of Fish and Wildlife (ODFW) wildlife management unit. Land located east and west of US97 is located within the Grizzly Wildlife Management Unit. Coordination with ODFW may be required to address concerns with impacts to wildlife habitat and migration corridors once projects are identified.

Energy

Energy will be used in the construction of the projects and for the operation of vehicles on a proposed project. For projects that significantly affect operational energy consumption, an energy analysis is required according to Oregon Transportation Planning Rule, National Environmental Protection Act (NEPA), and/or the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). However, impacts

from projects that may develop from the safety study are not anticipated to be significant enough to warrant an energy analysis.

Hazardous Materials

Hazardous materials and the problems associated with them are an important concern in the location of transportation facilities. Contaminated sites should be avoided if possible. Site investigations and cleanups have significant impacts on budgets and project schedules. Typical concerns are the history of hazardous spills in the area, known and potential hazardous material sites, etc. When hazardous sites are encountered, some level of action is required.

A search of the State Fire Marshal's website databases did not indicate any hazardous materials concerns in study corridor.

The Department of Environmental Quality website databases did not indicate any Environmental Cleanup Site Information (ESCI) sites within the project area.

One property at 4270 S Highway 97 (~MP 99.74) has structures and features that may indicate that there was previous operation of a garage or service station. This will need to be further researched should any project activities impact the property.

The main hazardous materials concern/issue through the corridor is the potential for roadside soils to be classified as unclean fill. Any future projects will need to have analysis of roadside soils to determine if the soils meet clean fill criteria or will be required to be disposed of at an appropriate facility.

Land Use/Planning

The Land Conservation and Development Commission (LCDC) have developed 19 goals, which constitute the framework for a statewide program of land use planning. Oregon law requires every city and county to have a Comprehensive Plan, which is acknowledged by the LCDC. Acknowledged plans are consistent with the statewide planning goals.

The project area is located both within and outside of the urban growth boundary. It is located both within and outside of the Madras city limits. Zoning within the project area consists of the following:

General Zone	Land Use	Description
Cg	Commercial	Commercial - General
Ag	Agriculture	EFU-40 Zone
Ag	Agriculture	EFU-80 Zone
Rng	Range	Federal Range
RR2	Rural Residential	Rural Residential Zone
Nat Res	Natural Resource	Open Space Conservation Zone

Goal exceptions may be required for work outside of the city limits and within EFU and Natural Resource/Open Space Conservation zoning. The local transportation plan and comprehensive plan may require amendments.

Noise

During the rapid expansion of the highway system and other roadways in the twentieth century, communities began to recognize highway traffic noise and construction noise had become important environmental impacts.

The Federal Highway Administration developed noise regulation that applies to highway construction projects with federal funding. The Oregon Department of Transportation is responsible for ensuring compliance with applicable regulations. Noise regulation addresses:

- Traffic noise prediction requirements
- Noise analyses
- Noise abatement criteria
- Requirements for informing local officials

There are three types of projects under FHWA Noise Rule:

- Type I Project: A Type I project can include the following projects:
    - The construction of a highway on new location
    - The physical alteration of an existing highway where there is either a substantial horizontal or vertical alteration
    - The addition of a through-traffic lane(s), including the addition of a through-traffic lane that functions as a High-Occupancy Vehicle (HOV) lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane
    - The addition of an auxiliary lane, except when the auxiliary lane is a turn lane
    - The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange
    - Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane
    - The addition of a new or substantial alteration of a weigh station, rest area, ride-share lot, or toll plaza

  If a project is determined to be a Type I project, then the entire project area as defined in the environmental document is a Type I project.

- Type II Project: Oregon does not have an FHWA-approved Type II program. State and local funding may be provided in response to noise complaints through ODOT's non-federally funded Retrofit Program. See Retrofit Program.
- A federal or federal-aid highway project that does not meet the classification of a Type I or Type II project. Type III projects do not require a noise analysis.

For Type I highway projects, the existing noise level at representative sites along the project is measured. Then, based on projected traffic, anticipated changes to topography, buildings, and other characteristics of the project, the Federal Highway Administration (FHWA) Noise Prediction Model is used to predict noise levels along the project. As part of the environmental evaluation process, we are normally

concerned with two aspects of noise--traffic noise and construction noise. These are addressed separately.

Traffic: Traffic volumes and speeds for the project area would need to be analyzed for a Type I project. The area of potential noise impacts is not the same as the general project area of potential impact (API). The area of potential noise impacts is to be determined by predictive modeling. In other words, the noise analyst must examine all noise impacts from the project, even if they are beyond the limits of construction or a general project API. The project area to be examined for noise impacts must include all areas impacted by the project, not just the areas adjacent to the project components that meet the definition of a Type I project. When determining and abating traffic noise impacts, primary consideration is to be given to outdoor activity areas of frequent human use. Mitigation will usually be necessary only where frequent human use occurs and a lowered noise level would be beneficial.

When traffic noise impacts are identified, ODOT must consider feasible and reasonable noise abatement measures. For abatement, primary consideration is given to frequently used exterior areas. When traffic noise impacts are identified, ODOT is, at a minimum, required to analyze barrier walls.

Feasibility or constructability of an abatement measure includes acoustical and engineering factors. For abatement to be feasible, The FHWA requires that noise-impacted receptors achieve at least a 5-dBA reduction in noise levels. The FHWA requires that States identify the number of impacted receptors that must get a 5-dBA reduction. For abatement to be feasible, ODOT requires that a simple majority of impacted receptors achieve at least a 5-dBA reduction in noise levels. ODOT also considers engineering factors such as barrier height, safety, topography, drainage, utilities, and access issues when determining feasibility. Abatement must be able to be constructed using the American Association of State Highway Transportation Officials (AASHTO) Green Book

In assessing reasonable noise abatement, to meet minimum federal requirements, ODOT must consider the viewpoints of the residents and property owners that benefit from the proposed abatement, the cost-effectiveness of the abatement measure, and the ODOT noise reduction design goal for abatement. All three criteria must be met to satisfy the reasonableness requirement. Assessing reasonable criteria will be done only after the proposed abatement has been determined to be feasible.

In Oregon, federal funding is only available for feasible and reasonable abatement proposed for Type I projects. ODOT's non-federally funded Retrofit Program is not a Type II program and, therefore, is not eligible to receive federal funds. For abatement activities that are federally funded, the federal share will be the same as for the facility where the project is located. Federal funding is available for:

- Construction of noise barriers, including acquisition of ROW
- Traffic management measures such as traffic control devices
- Signage for prohibition of certain vehicle types
- Time-use restriction for certain vehicle types
- Modified speed limits • lane use restrictions
- Alteration of the horizontal or vertical alignment
- Acquisition of property for buffer zones to pre-empt development that would adversely be impacted by traffic noise, and
- Noise insulation of certain land use facilities. Post-installation maintenance and operational costs are not eligible for federal funding.

Landscaping is not considered abatement; therefore, federal funding is not available for landscaping related to noise abatement purposes.

Federal funding is also available for noise abatement on privately held land. The preferred location of barriers is on the ODOT ROW; however, locating barriers on the ODOT ROW may not always be possible. Federal funds can be used for abatement for certain facilities on private land. Federal funds for noise insulation of privately owned structures are limited.

Construction: Construction noise is going to occur with every project. Generally, the same boilerplate discussion used with traffic noise impacts applies here as well. Typically, no effort is made to predict the specific level of construction noise. Land use activities that may be affected by construction noise should be noted in the noise technical report. Identifying such land use activities can aid in consideration of construction noise abatement strategies. If there is anything particularly unique anticipated, like a large amount of blasting, pile driving or similar noise, discuss with the engineering unit prior to a noise study being conducted. There would be a possibility of timing restrictions on construction activities relating to noise impacts.

Local ordinances may restrict nighttime construction noise levels or high noise levels on the weekend or holidays. Where such restrictions exist or where public concerns are known, special construction noise studies may be used to quantify the anticipated noise levels and to recommend measures to reduce construction noise. Such studies can be used to obtain special permits or a regulatory variance where needed. Local noise ordinances for night work must be determined; permits and variances are needed before construction begins.

One key to effectively dealing with construction noise is communication with the residents adjacent to the construction and notification of unusual activities that may temporarily generate high noise levels. For example, neighbors should be advised in advance of pile driving or blasting operations. Public involvement can often eliminate or lessen the frequency of noise complaints.

Section 4(f) Potential

Section 4(f) of the Department of Transportation Act of 1966 refers to any effect on a historic property, historic bridge, part, wildlife and waterfowl refuge, or public recreation area, if the project includes federal funds. There is the potential for 4(f) on the project. There are eligible historic resources present within the study corridor. There are parks and areas of special interest within the potential area of project impact. Peter Skene Ogden State Scenic Viewpoint property is located on both sides of US97 between ~MP 112.53 and MP 112.95. Section 4(f) requires projects consider avoidance first, minimization of impacts second, and mitigation third.

If there are any impacts to these resources, a 4(f) evaluation will have to be prepared. There are several Section 4(f) documentation options depending on impacts. Options to address impacts include:

- Temporary Occupancy Section 4(f)
- *de Minimis* Section 4(f)
- Programmatic Evaluation Section 4(f)
- Constructive Use Section 4(f)

- Individual Evaluation Section 4(f) (Note: Individual Section 4(f) is usually prepared for adverse effects. When this occurs, the project also requires the preparation of a Memorandum of Agreement between the FHWA, SHPO, and the Advisory Council on Historic Preservation.

Mitigation for impacts may not be required depending on the significance of the impact to the Section 4(f) resource.

Socioeconomics/Environmental Justice

Socioeconomics refers to the social and economic impacts of a proposed project. A socioeconomic report may need to be prepared and should include a discussion of beneficial and adverse social, relocation, and economic impacts of a proposed project. Indirect and cumulative effects should be discussed. Measures to avoid or minimize adverse socioeconomic impacts should be identified.

For each project identified in the study corridor, benefits of the project once constructed will need to be summarized. Determinations that traffic patterns will not be substantially affected either temporarily or permanently will need to be documented. Also, description of all anticipated closures, including estimated closure duration and potential impacts will need to be documented. When the potential for impacts from a closure exist, the public involvement portion of the project record and NEPA document would need to describe outreach efforts to those potentially impacted.

No minority or low-income populations have been identified that would be adversely impacted by projects. Therefore, the determination is that projects identified in the safety study will not cause disproportionately high and adverse effects on any minority or low-income populations in accordance with the provisions of E.O. 12898. No further EJ analysis is anticipated.

Visual

The project is not located on a tour route, a scenic highway, goes through U.S. Forest Service property, or is in the vicinity of any known visually protected areas. There are no state or federal scenic waterways or wild and scenic rivers within the study corridor. The Peter Skene Ogden State Scenic Viewpoint is located within the study corridor. Any projects that occur within the proximity of the Viewpoint will need to be evaluated via a Visual Impact Assessment scoping questionnaire. There is no anticipation that a full Visual Impact Assessment would be required for projects identified within the study corridor.

Waterways/Water Quality

There are no lakes or delineated wetlands in the project area. There are irrigation canals that run adjacent and under US97, and US97 crosses the Crooked River. Irrigation canals are not jurisdictional under the Oregon Department of State Lands. Main canals are jurisdictional under the U.S. Army Corps of Engineers. Laterals may be jurisdictional if there is a direct connection (ingress or egress) to a jurisdictional waterway. If there are project impacts that result in fill material being placed in canals, jurisdictional determinations will need to be made and a determination made as to whether the project will be exempt from permitting requirements.

There are concerns with impacts to canal systems and groundwater from roadway/stormwater runoff. Water quality regulations are under development by Department of Environmental Quality to protect groundwater resources. One objective of these regulations is the protection of sole source aquifers. These groundwater regulations will also include wellhead protection areas. All projects in the

construction phase require water quality mitigation. These mitigation measures are described in the Standard Specifications for Construction. Any projects that will be adding >1000m^2 of new impervious surface will trigger the requirement for water quality report consideration. Stormwater from the project should be collected and managed to avoid significant adverse impacts to surface and groundwater quality. Projects should be evaluated by a Water Quality Resource Specialist to determine whether the project requires a water quality report.

Construction activities will expose soils, which could cause erosion and sedimentation. Slopes and roadside areas will need to be graded and re-vegetated to restore soils and erosion during construction. Best Management Practices (BMPs) will need to be implemented. The construction contract should also limit the amount of open excavation allowed at any one time. Spill controls will need to be implemented to prevent an uncontrolled release of equipment fuel and other equipment-related substances or construction materials.

The contractor (as ODOT's agent) will be required to meet or exceed the Department of Environmental Quality (DEQ) requirements for the National Pollution Discharge Elimination System (NPDES) 1200-CA permit. No toxicants, including "green" (plastic) concrete will be allowed to enter any aquatic resource. In addition, dust control measures, such as watering, will be used as needed during construction.

An Erosion Control Plan (ECP) will be prepared and implemented during construction. If soil erosion and sediment resulting from construction activities is not effectively controlled, the amount of disturbed area will be limited to that which can be adequately controlled.

Wetlands

National Wetlands Inventory maps indicated no wetland resources within the immediate project area. There may be potential wetland areas associated with canals within the project area. Surveys will need to be conducted to address the presence/absence of wetlands along canals.

No soils in the study corridor contain hydric capabilities.

Permits/Clearances

There are several permits and/or clearances required from various agencies prior to construction projects identified from the safety study:

- Public Utility Commission (PUC) for railroad permit issues (for crossings)
- Department of Geology and Mineral Industries (DOGAMI) for material sources
- Local Jurisdiction national Pollutant Discharge Elimination System (NPDES) Permit (for determination, contact the Department of Environmental Quality)
- State Historic Preservation Office (SHPO), Historic
- State Historic Preservation Office (SHPO), Archaeological
- Noise Clearance (FHWA)
- Department of Environmental Quality (DEQ) Commercial/Industrial Noise Regulation
- Department of Environmental Quality (DEQ) Hazmat Clearance
- ODOT Erosion Control Plan
- Threatened and Endangered Species Clearance
- Goal Exceptions for Zoning Impacts
- U.S. Army Corps of Engineers Nationwide Permit

NEPA

Three basic "classes of action" are allowed and determine how compliance with NEPA is carried out and documented:

- Environmental Impact Statements (EIS) are required for major Federal actions that significantly affect the quality of the human environment and are full disclosure documents.
- Environmental Assessments (EA) are concise public documents that briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a finding of no significant impact (FONSI).
- Categorical Exclusions (CE)/Programmatic Categorical Exclusions (PCE) are categories of actions which do not individually or cumulatively have a significant effect on the human environment and for which, therefore, neither an EA or EIS is required.

Prior safety projects that have been completed within the study corridor have been classified as CEs or PCEs. It is expected that projects developed out of the safety study will be classified the same as prior projects. However, there is always a chance that a project could require preparation of an EA or EIS, depending on the significance of impacts. Each project will be individually evaluated to determine NEPA classification once they are identified and scope is being determined.

9. Appendix C – Level of Service Definitions

The following describes Level of Service per the Highway Capacity Manual and AASHTO Geometric Design of Highways and Streets.

A: free flow. Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes. Motorists have a high level of physical and psychological comfort. The effects of incidents or point breakdowns are easily absorbed. LOS A generally occurs late at night in urban areas and frequently in rural areas.

B: reasonably free flow. LOS A speeds are maintained, maneuverability within the traffic stream is slightly restricted. Motorists still have a high level of physical and psychological comfort.

C: stable flow, at or near free flow. The ability to maneuver through lanes is noticeably restricted and lane changes require more driver awareness. Most experienced drivers are comfortable, roads remain safely below but efficiently close to capacity, and posted speed is maintained. Minor incidents may still have no effect, but localized service will have noticeable effects and traffic delays will form behind the incident. This is the target LOS for some urban and most rural highways.

D: approaching unstable flow. Speeds slightly decrease as traffic volume slightly increases. Freedom to maneuver within the traffic stream is much more limited and driver comfort levels decrease. Minor incidents are expected to create delays. Examples are a busy shopping corridor in the middle of a weekday, or a functional urban highway during commuting hours. It is a common goal for urban streets during peak hours, as attaining LOS C would require prohibitive cost and societal impact in bypass roads and lane additions.

E: unstable flow, operating at capacity. Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to maneuver in the traffic stream and speeds rarely reach the posted limit. Any disruption to traffic flow, such as merging ramp traffic or lane changes, will create a shock wave affecting traffic upstream. Any incident will create serious delays. Drivers' level of comfort becomes poor. This is a common standard in larger urban areas, where some roadway congestion is inevitable.

F: forced or breakdown flow. Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Demand is generally higher than capacity.

10. Appendix D – Crash Data Review from High Bridge to Terrebonne

While the focus of this study is from Madras to High Bridge (mile point 97.3 to 112.6), there have been some safety concerns voiced for the section between High Bridge and Terrebonne (mile point 112.6 to 115.0). In particular there have been concerns regarding icy road conditions at curved section of US 97 at the rail overpass and of intersection crashes at NW Eby Avenue. Therefore, this Appendix provides a high-level review of crash data for this section.

During this same five-year period (1/1/2017 – 12/31/2021), there were 38 crashes including one fatal crash and two severe injury crashes. The fatal crash was a sideswipe-overtaking crash at mile point 114.59 (south of NW Eby Avenue) resulting from a motorist passing on the shoulder and creating a crash resulting in a motorist in the opposite direction being struck and killed. One of the severe injury crashes was a sideswipe-meeting crash at mile point 113.81 (north of NW Eby Avenue) resulting from a motorist losing control in icy conditions at the curved section of US 97 that passes over the rail tracks. The second severe injury crash was documented as a turning movement crash at NW Eby Avenue involving a southbound motorist striking a southbound left turning motorist (while documented as a turning movement crash, it might be better categorized as a rear-end crash).

In addition to the icy conditions sideswipe-meeting crash at the curved section of US 97, there were three other crashes within that section (mile point 113.70 to 114.03). These three crashes all occurred in dry road conditions. One crash was an animal crash, one crash was a rear-end crash in the northbound direction due to a slowing motorist (possibly someone slowing to turn onto NW 10th Street), and one crash was a head-on crash resulting from a sleepy driver.

In addition to the severe injury crash at NW Eby Avenue, there were two other rear-end crashes in the southbound direction, both resulting from someone waiting to make the southbound left turn onto NW Eby Avenue.