

U.S. 97 High Bridge to Madras Safety Study

Oregon Department of Transportation

Oregon Department of Transportation

April 2025

Acknowledgements

We would like to thank the representatives of the following groups who served on the advisory committee for the project:

- Jefferson County Commissioners
- Jefferson County Public Works
- Jefferson County Fire and EMS
- Jefferson County Sherriff
- Jefferson County Public Health
- City of Madras Community Development
- City of Madras Police Department
- Deschutes County Community Development
- Oregon State Police
- City of Culver
- Oregon Parks and Recreation
- Department of Land Conservation and Development
- Confederated Tribes of Warm Springs
- Love's Truck Stop

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Contents

Project Summary 1

The Safety Study 2

Crash Countermeasure Toolbox: 5

Public Engagement 6

Solutions 8

Funding Context 9

Recommendations 11

Corridor-Wide Solutions 11

Non-Engineering Solutions 19

Location Specific Concepts 23

US 97/US 26/Colfax Lane Intersection 23

US 97 Waldorf to Dover and US 97/Dover Lane Intersection 26

US 97 Passing Lanes 30

US 97 – Falcon to Jericho 33

US 97/ SW Culver Highway Intersection 36

US 97 – Juniper Butte Area 40

US 97 – Railroad Overcrossing 45

Project Goals 47

Appendices

Appendix A: Public Involvement Summaries

Appendix B: Technical Memorandum #4 Crash Countermeasure Toolbox

Appendix C: Technical Memorandum #3 Roadway Characteristics and Safety Analysis

Project Summary

US 97, also known as the Dalles-California Highway, is the primary north-south transportation facility in Jefferson County, Oregon. US 97 is a statewide facility, connecting communities in Central Oregon to routes and destinations across the region. US 97 is used by local farmers, statewide freight, residents that live along US 97, and regional travelers who come to visit destinations in Central Oregon.

Figure 1 Project Area Map



In the past ten years, safety on US 97 has become an increased concern amongst residents, local jurisdictions, and ODOT; crash rates and crash trends have shown that sections of the US 97 corridor need improvement.

The U.S. 97 High Bridge to Madras Safety Study ("safety study") primarily focused on US 97 from the City of Madras border to the Jefferson County and Deschutes County line (milepoint 97.3 to 112.6) in Figure 1. The safety study also reviewed the corridor for potential crash areas to the unincorporated community of Terrebonne (milepoint 115.0).

The Safety Study

This study was a collaborative effort between ODOT staff, transportation professionals, local governments, experienced emergency service personnel, and people who live and work in Jefferson County. To understand needs along the corridor, the team:

- Gathered community feedback on safety issues in the corridor
- Looked at issues related to safety on US 97
- Evaluated proven safety countermeasures with public input
- Created potential solutions and a list of potential projects.

Figure 2: Safety Study Overview



This process allowed for a data-driven and organized approach to identify problems and mitigate crash patterns, severity, and frequency along US 97.

Crash Data:

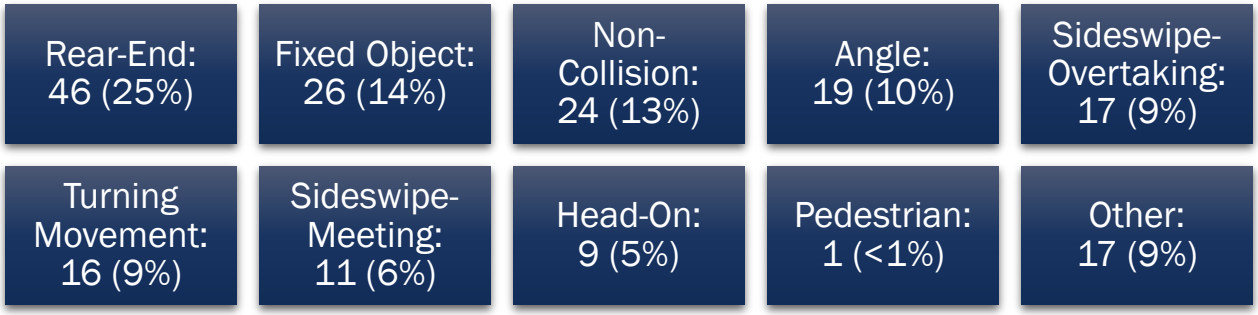
The safety study utilized the most recent five years of crash data (2017-2021) to highlight and analyze crash trends. These include:

- 187 Total crashes
- 13 Severe injury crashes
- 7 Fatal crashes

Rear-end collisions were the most prevalent crash type occurrence, followed by fixed object crashes, non-collision crashes (primarily overturned vehicles),

and angle crashes. Head-on crashes resulted in the most frequent fatal and serious injury crashes (30% of all FSI), and angle crashes were the second most frequent crash type to result in a fatal or serious injury crash (20% of all FSI). Information on crash history can be referenced in Appendix A.

Figure 3: Crash Type Summary



Areas of Safety Concern:

This corridor of US 97 has an above-average rate of fatal and serious injury crashes when compared to the statewide average. The top three crash locations in the corridor included US 97/Dover Lane[1], US 97/Bear Drive[2], and US 97/SW Culver Highway. Along the corridor, SW Waldorf to Dover Lane and SW Bear Drive (N) to SW Bear Drive (S) had crash rates above the statewide average.

The project utilized crash data, feedback from the Participant Advisory Committee, and comments from the open house to develop areas in need of safety improvement. These areas of safety concern were used to evaluate safety countermeasures, apply appropriate safety strategies, and develop concepts.

Areas of safety concern in the safety study include:

[1] US 97/Dover had recent safety improvements in 2022 that added a left turn lane on mainline US 97.
[2] US 97/Bear Drive had recent improvements and was closed in 2021.

- US 97/Colfax Lane/US 26
- US 97 – Waldorf to Dover Lane (MP 97.7 to 98.3)
- US 97/Dover Lane
- US 97 Passing Lanes (MP 98.7 to 99.6)
- US 97 – Falcon Lane to Highland Lane (MP 100.8 to 102.6)
- US 97/Jericho Lane
- US 97/SW Culver Highway
- US 97 – Juniper Butte (MP 106.3 to 107.2)
- US 97 – Railroad Overcrossing

Figure 4: US 97 at Dover Lane



Crash Countermeasure Toolbox:

The project team developed a Crash Countermeasure Toolbox to serve as a summary of all possible safety countermeasures that may be considered in the project. The Toolbox included countermeasures from proven safety manuals from ODOT and FHWA, as well as Intelligent Transportation Systems solutions.

The Toolbox summarized potential solutions that would apply to the type of corridor, specific crash types, and possible countermeasures for each of the Areas of Safety Concern. Appendix B includes the Crash Countermeasure Toolbox.

Figure 5: Safety Countermeasure Toolbox



Public Engagement

The project team reached out to US 97 road users to better understand the challenges in the corridor. We connected with the community through a project website, two open houses, tabling events at the Central Oregon Farm Fair and Jefferson County Fair, an online survey, advisory committee meetings, and Jefferson County commissioner briefings. Public involvement activities were advertised via radio and newspaper interviews, social media posts, Gov Delivery and Media announcements, and resident mailers. Project feedback was incorporated into the decision-making process and reviewed by the PAC[3].

Figure 6: Jefferson County Fair Booth



Top Issues

The following key safety issues arose in conversations with the public:

- Driver speeds
- Lack of turn lanes
- Safety at intersections such as US 97/Dover Lane
- Lack of law enforcement presence
- Difficulty turning left onto US 97
- Concern about head on collisions and passing

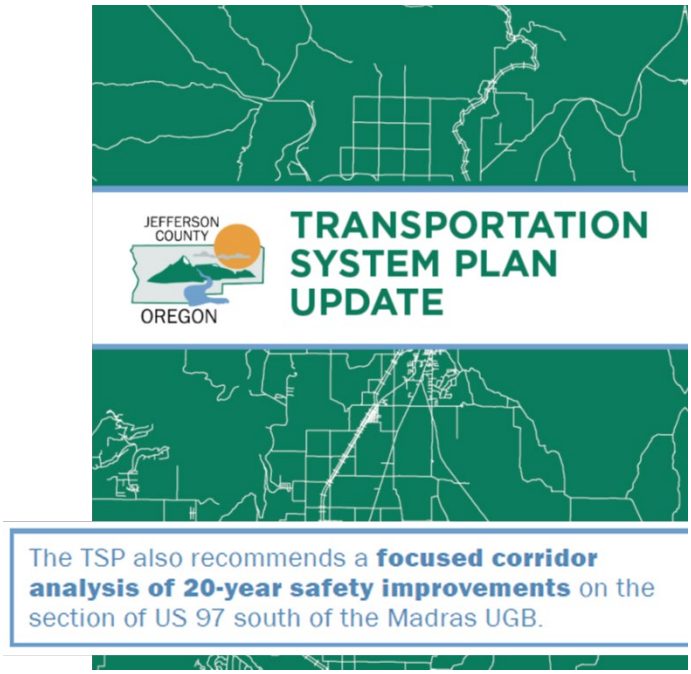
[3] While increasing capacity would not enhance safety on US 97, some participants did express a desire for more passing lanes and four lane cross sections. A four-lane cross section would not improve safety based on the recent five years of crash history.

Participant Advisory Committee

The success in the project lies in the collaborative approach between the project team and the Participant Advisory Committee (PAC). The PAC implemented direction from the Jefferson County TSP and assisted the ODOT team to develop strategies and solutions that enhance safety on US 97.

The PAC was made up of local government representatives, emergency services, law enforcement, health professionals, residents, tribal representatives, and other groups interested in improving safety on US 97.

Figure 7: Jefferson County TSP



PAC Goals

The PAC developed project-specific goals for the safety study. These goals were used to direct the actions of the safety study and evaluate solutions in the concept development phase. Project goals focused on improving safety on US 97, balancing access with safety and through movements, and protecting the natural and built environment with practical design solutions. Practical solutions that are feasible in the near term (5-15 years) were the focus of the advisory committee efforts.

Figure 8: US 97 High Bridge to Madras Safety Study Goals



Solutions

Solutions from the crash countermeasure toolbox were developed for each of the areas of safety concern. Each location includes proven safety countermeasures that reduce the frequency and severity of crashes based on crash history at that location. Planning-level cost estimates were created for each location-specific solution to support future implementation efforts. Corridor-wide solutions and non-engineering solutions can be reviewed under the Recommendations section.

Table 1: Location Specific Solutions Summary

LOCATION	COUNTERMEASURES	PLANNING LEVEL COST
US 97/US 26/Colfax Lane	Roundabout, Illumination	$7.9 M
US 97: Waldorf to Dover	Median treatments, shoulder widening, remove roadside obstacles, consider restricted crossing U-turns	$8.8 to $12 M
US 97: Passing Lanes	Median barrier, access improvements	$9.5 M
US 97: Falcon to Jericho	Short term: striping improvements. Mid term: traversable median. Long term: intersection improvements at US 97/Iris	Short term: $200k Mid term: $20.3M Long term: $7M
US 97/SW Culver Highway	Intersection realignment	$8 M
US 97: Juniper Butte Area	Median barrier, ITS improvements, shoulder widening, merge lane improvements	$14.7 M
US 97: Railroad Overcrossing	ITS Improvements	$2 M
	Location-Specific Improvements Identified:	**$81..6 M**

Funding Context

A thorough planning document increases the ability for ODOT and local jurisdictions to implement solutions. There are a number of potential funding sources that could be pursued to fund solutions within the safety study. Safety projects on US 97 will have to compete regionally, statewide, or nationally depending on the funding type or grant project.

- In Oregon, the State Highway Fund covers both projects and operating costs, including maintenance and operations, revenue collection and shared services.
- The All Roads Transportation Safety (ARTS) Program addresses safety needs on all public roads in the state, promoting best practices for infrastructure safety and reducing fatal and serious-injury crashes. Collaboration with local road jurisdictions is key to the program's success. This program is funded through the federal Highway Safety Improvement Program and is highly competitive.
- The Statewide Transportation Improvement Program (STIP) is ODOT's capital improvement plan for state- and federally-funded projects. Most STIP funding is dedicated by state or federal law to projects and cannot be used for agency operational costs.
- The Oregon Legislature can provide funding allocations to specific projects or needs, especially those identified in adopted planning studies.
- The Federal Lands Access Program improves transportation facilities that provide access to, are adjacent to or are located within federal lands. The Access Program supplements state and local resources for public roads, transit systems and other transportation facilities, with an emphasis on high-use recreation sites and economic generators.



Recommendations

Corridor-Wide Solutions

Solution ID	
01	Shoulder and Centerline Rumble Strips

Description: Install rumble strips along the outside of the trave lane and centerline to inform drivers if they leave the travel lane.

Implementation Suggestion: Near-term

Considerations:

Rumble strips currently exist for the shoulder and centerline in sections of the corridor but are missing in some areas. This project would revisit locations and design.

No anticipated right-of-way, geotechnical, or environmental impacts.

Road noise and proximity to residents should be considered.

Benefits: CRF for run-off-the-road crashes (22%) and head on crashes (12%) (RD16, RD17, RD18 from ODOT CRF list).



Photo/Image Credit: safety.fhwa.dot.gov

Cost: $12k per mile (both sides of the road).

Assumptions: Does not include any required paving with installation.

Solution ID 02	Widen Shoulders by 3 feet

Description: Widen shoulder by and up to 3 feet throughout the corridor.

Implementation Suggestion: Mid-term

Considerations:

Shoulder width varies throughout the corridor and needed improvements may vary by 1 to 3 feet. Shoulder widening has previously been scoped by ODOT.

Right-of-way impacts are possible and environmental impacts are minimal.

Benefits: CRF for all crashes 6-18% (RD20 from ODOT CRF list).



Photo/Image Credit: Google

Cost: $12,240,000.00

Assumptions: $816k per mile from MP 97.32 to 112.57. Drainage will need to be adjusted.

Solution ID 03	Increase Distance to Rural Roadside Obstacle

Description: Increase distance to roadside obstacle by 3 to 16 feet by improving the clear zone.

Implementation Suggestion: Mid-term

Considerations:

Obstacles could include fences, trees, utility poles, and any other fixed object that would increase likelihood of injury in a roadway departure crash.

Removing objects can be costly and easements may be needed to remove objects outside of the right-of-way.

Right-of-way impacts are likely.

Benefits: CRF for all crashes is 22-44% (RD1, RD2).



Photo/Image Credit: Google

Cost: $1,750,000

Assumptions: $350k per mile, assumes 5 mile segments to start.

Solution ID	Median Treatments
04	

Description: Install a traversable median or median barrier throughout section of the corridor.

Implementation Suggestion: Mid- to long-term

Considerations:

Median barrier can address head-on crashes which result in the largest portion of fatal and serious injury crashes in the corridor.

A traversable median may be installed as a first phasing effort to reduce crashes in the corridor.

Median barrier requires widening of roadway and can affect out of direction travel. RCUTs and roundabouts can aid corridor directional access.

Right-of-way impacts are likely.

Emergency services and incident management should be involved in future project design.

Potential Reduction in Vehicle Carrying Capacity (ORS 366.215).

Benefits: CRF for all crash types and all injury crashes 12% (H40) for a traversable median. CRF for all crash types and all injury crashes of 30% (RD25) for median barrier.



Photo/Image Credit: ODOT

Cost: $1.5M per mile.

Assumptions: Cost varies heavily, this would cover portions of corridor not included in Area of Safety Concern. RCUTs would aid out of direction travel in rural sections of corridor.

Solution ID	
05	Restricted Crossing U-Turn

Description: Install Restricted Crossing U Turn (RCUT) when barrier or turn restrictions are installed.

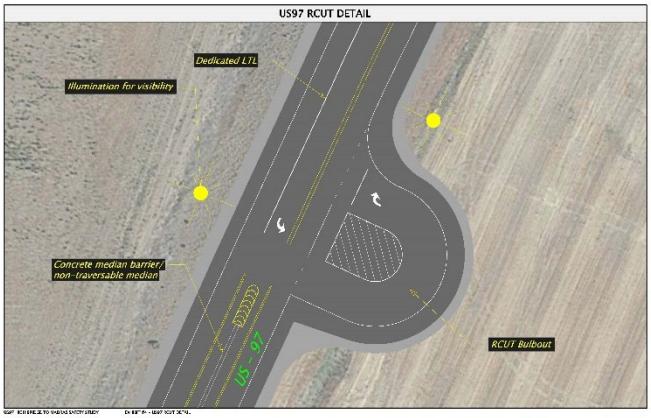
Implementation Suggestion: Long-term

Considerations:

RCUTs, also known as J-turns, are a useful tool to limit out of direction travel when combined with median barrier or turning restrictions.

Right-of-way and environmental impacts are likely, as well as drainage modifications.

Benefits: No CRF but aids in implementation of median barrier (RD 25).



Cost: $1.7M per location.

Assumptions: RCUT designed to accommodate freight and farm equipment.

Solution ID	Close Passing Across Intersections
06	

Description: Close passing opportunities across intersections with striping changes.

Implementation Suggestion: Near-term

Considerations:

Recommendation would change striping and close passing across the following intersections:

- MP 100.81 SW Glide Ln (Private)
- MP 102.59 SW Highland Ln (passing allowed NB)
- MP 104.93 SW Jericho Ln
- MP 108.74 SW Norris Ln
- MP 109.74 SW Opal Ln
- MP110.73 SW Park Ln
- MP 111.72 SW Quincy Ln (Private)

Right-of-way and environmental impacts are not likely.

Benefits: No CRF but is consistent with state law.



Photo Credit: Google, US 97 at Park Lane

Cost: $63,0000 - $63k? $630k? to remove and re-install no passing striping at intersections.

Assumptions: Assumes re-stripe and remove cost at $3k per mile.

Solution ID 07	**Consistent Signage:** Advance Intersection Warning Signs

Description: Install advance intersection warning signage to notify drivers of upcoming locations and potential for vehicle slowdowns or turning movements.

Implementation Suggestion: Near-term

Considerations:

- No anticipated right-of-way, geotechnical, or environmental impacts.
- Additional maintenance costs will be incurred as signs are added to the corridor.
- Future project should evaluate where existing signs are missing or substandard.



Photo/Image Credit: FHWA Manual on Uniform Traffic Control Devices (W2-1)

Benefits: CRF of 20% for all crashes (I21 from ODOT CRF list). If setup includes flashing beacons (not coordinated with signal timing): CRF of 13% for all crashes (I15 from ODOT CRF list).

Cost: $20k per sign.
Assumptions: Included with larger project, either systemic or in corridor specific locations.

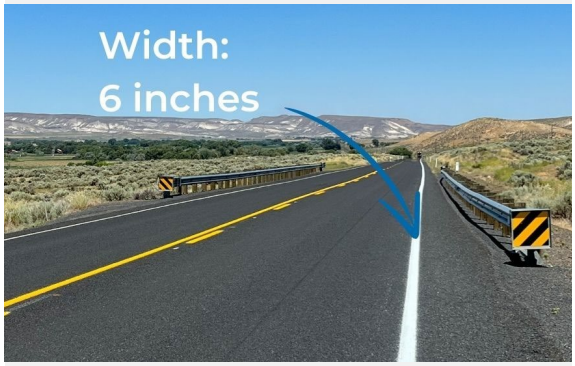
Solution ID 08	Install Wider Edge lines

Description: Install wider edge lines to better delineate the travel lane from the shoulder. Increase from 4" to 6"

Implementation Suggestion: Near-term

Considerations:

- No anticipated right-of-way, geotechnical, or environmental impacts.
- Additional maintenance costs will be incurred as edge lines are wider than current.



Photo/Image Credit: SWARCO engineering

Benefits: CRF of 14% for all crashes (RD24 from ODOT CRF list).

Cost: $825k
Assumptions: $55k per mile, included with larger project.

Solution ID 09	Driver Feedback Signs

Description: Install driver feedback signs to indicate to drivers that they are entering communities and encourage slower speeds. When possible, consider opportunities to re-evaluate speed limits in conjunction with engineering treatments.

Implementation Suggestion: Near-term

Considerations:

No anticipated right-of-way, geotechnical, or environmental impacts. Additional maintenance costs will be incurred as signs are added to the corridor.

Existing speed feedback signs exist in Terrebonne and Madras. Sign locations should be re-evaluated in future projects.



Photo/Image Credit: FHWA

Benefits: CRF of 20% for all crashes (I21 from ODOT CRF list).

Cost: $75k per sign.

Assumptions: Included with larger project, either systemic or in corridor specific locations.

Non-Engineering Solutions

Solution ID	Safe Driving Media Campaign
10	

Description: Develop a media campaign for safe driving. Topics covered could include speeding, impaired driving, passing opportunities and behavior, setting expectations for travel time in varying conditions, and winter weather driving. Consider using humor in messages to attract attention.

Implementation Suggestion: Near-term

Considerations:
No anticipated right-of-way, geotechnical, or environmental impacts.

Benefits: No CRF available. The benefits include increasing driver awareness of their impacts on other drivers and setting appropriate expectations when using the corridor.



Photo/Image Credit: Oregon Department of Transportation

Cost: Varies based on scope and longevity of the campaign.

Solution ID	Evaluate Funding Opportunities for Increased Enforcement
11	

Description: Evaluate funding opportunities to support increased state, county, and local enforcement. Jefferson County Sherriff office is supportive and included funding costs for additional patrol deputies.

Implementation Suggestion: Near-term

Considerations:
No anticipated right-of-way, geotechnical, or environmental impacts.

Benefits: No CRF available. The benefits include encouraging drivers to travel the speed limit and pass others appropriately. A secondary benefit is that responders are in the proximity if there is an incident.



Photo/Image Credit: Jefferson County Sherrif

Cost: Jefferson County Sherrif has included a $1.25M annual ask to patrol the corridor.
Assumption: Could vary based on scope and longevity.

Solution ID	Evaluate Funding Opportunities for Increased Fire & EMS
12	

Description: Evaluate funding opportunities to support increased funding for Jefferson County Fire and EMS.

Implementation Suggestion: Near-term

Considerations:
No anticipated right-of-way, geotechnical, or environmental impacts.

Benefits: No CRF available. The benefits include a reduced response time to crashes and incidents, as well as better equipment for rescue operations.

Photo/Image Credit: Jefferson County Fire and EMS

Cost: Jefferson County Fire & EMS has included the following funding needs:

- Medium duty rescue unit: $400k to $600k
- Medic Crash Unit: $375k
- Additional Staffing: $360k annually
- Extrication Tool Upgrade: $35k
- Ambulance extrication tool: $54k

Solution ID	
13	Increase ODOT Maintenance funding

Description: Increase ODOT Maintenance funding so that corridor assets and conditions are maintained at optimal levels. This could include sign/delineator replacements, guardrail repair, frequency of winter maintenance, and improved crew response times.

Implementation Suggestion: Near-term

Considerations:
No anticipated right-of-way, geotechnical, or environmental impacts.



Benefits: No CRF available. The primary benefit is that the corridor would be maintained to an appropriate level and depending on funding, a higher level of maintenance response.

Cost: Cost varies, likely a repeating cost in staff time annually or every few years depending on the maintenance activity.

Location Specific Concepts

US 97/US 26/Colfax Lane Intersection

The project team and the PAC identified the US 97/US 26/Colfax Lane intersection as an area of safety concern. The location has been a historical Safety Priority Index System (SPIS) location and presents several risks to drivers on the US 26 or Colfax Lane approach that turn left, right, or continue across US 97. The US 97 South Madras Facility Plan has a long-term preferred alternative which includes median barrier and intersection improvements. Future implementation of this project would require an Intersection Control Evaluation (ICE) and would determine the final intersection configuration. The preferred alternative to reduce crashes and crash risk are presented below.

Solution ID #14: Install Roundabout and Illumination

The preferred alternative would install a roundabout at US 97/US 26/Colfax Lane. Figure 9 shows an example layout of the roundabout configuration. A roundabout would improve safety by reducing conflicts from left turning and through movements. This project would improve access to US 97, US 26, and Colfax Lane, as well as improve overall circulation in the north part of the corridor. Turning movement and angle crashes were noted in TM#3 and the PAC feedback indicated that turning movements were difficult at the US 26 and Colfax Lane approaches on the intersection. The roundabout would include updated illumination which was also identified as a countermeasure in TM#4.

Implementation Suggestion: Mid- to long-term, depending on local development and safety performance.

Considerations

Roundabouts have shown to be effective at accommodating all modes of traffic safely, including freight. This intersection has frequent heavy dimension use from the north of US 97 to US 26. Installation of roundabout with medians will require outreach with the Mobility Advisory Committee per ORS 366.215 Reduction of Vehicle Carrying Capacity and Highway Directive DES-02 that the roundabout is properly sized.

Project will have minor right-of-way impacts and minor environmental impacts.

The roundabout would have a secondary benefit of improving overall corridor access in the north portion of the corridor. The roundabout would also accommodate out of direction travel if median barrier is installed north or south of the roundabout. The roundabout would also decrease side street delay which was shown to be significant in TM#3.

A speed zone evaluation, a possible countermeasure to reduce corridor speeds in TM#4, could be implemented post construction to evaluate speeds and determine if a reduction in corridor posted speed is appropriate.

This location may have reimbursable utilities which would need to be captured in the cost.

Safety Benefits

Converting a stop-controlled intersection to a roundabout is estimated to reduce injury crashes by 82% (H18 from ODOT CRF list). Roundabouts also help to slow speeds, which may create additional safety benefits along the highway. Illumination is expected to reduce nighttime injury crashes by 38% (H29 from ODOT CRF List).

Cost Estimate

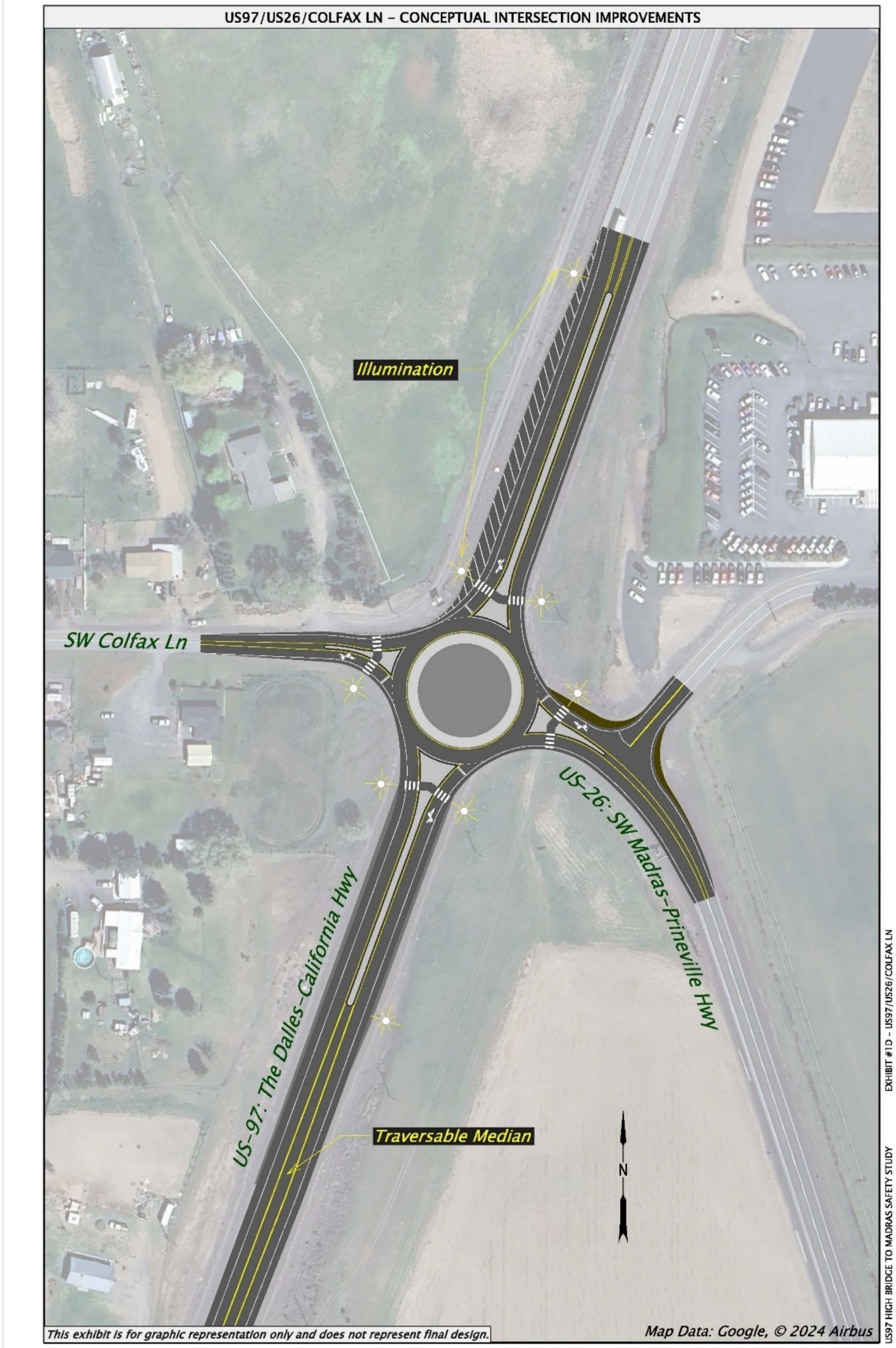
This project is estimated to cost $7.9M.

Countermeasures not recommended

This section lists solutions that were included in brainstorming sessions or suggested by the public but are not recommended by the project team:

- Simplify and reduce size of intersection – While this improvement could have positive safety benefits, the benefits are likely minimal and the cost to adjust pavement, signage, and drainage would be significant.

Figure 9: US 97/US 26/Colfax Lane



US 97 Waldorf to Dover and US 97/Dover Lane Intersection

Solution ID #15:

This solution combines two areas of safety concern: The Waldorf to Dover section of US 97 (MP 97.7 to 98.3) and the US 97/Dover Lane intersection. The project team and the PAC identified these locations as areas of safety concern in the project. The proposed solution would install a traversable median from the terminus of the proposed roundabout project to the intersection of US 97/Dover Lane. Left turn and through movement restrictions on the Dover approach are proposed as well. Restricted Crossing U-Turns may be considered to aid out of direction travel.

Implementation Suggestion: Mid-term.

Considerations

The project would have considerable right-of-way impacts. Drainage would need to be addressed as well. Environmental impacts would need to be assessed and mitigated as part of the project, although no known extensive impacts exist.

The US 97/Dover Lane intersection improvement project was completed in 2022 and may mitigate some issues at the intersection. However, the crash types at the intersection indicate that additional improvements are needed to improve safety at US 97/Dover Lane.

Additional median treatments from the Crash Countermeasure Toolbox may be considered should crash types continue or change.

A farm-vehicle only access road may be considered to aid farm vehicles that cross US 97 at Dover.

The US 97/US 26/Colfax Lane intersection is included in the graphic to demonstrate how the proposed roundabout would accommodate left turning movements if left turns were restricted at Dover Lane. Phasing options for implementation include prioritizing improvements at US 97/US 26/Colfax first and then evaluating turn restrictions at US 97/Dover.

Safety Benefits

A traversable median (H40 in ODOT CRF manual) provides separation between opposing flows of traffic. It is estimated to reduce all crashes at all severities by 12%. Turn restrictions at Dover do not have a CRF but would eliminate the left turning movement and through movement crashes from the minor (Dover) approach. Rural roadside obstacles may be addressed in this potential project or in a systemic project; if so, this countermeasure (RD1, RD2) would reduce all crashes by 22-44%. The Waldorf to Dover section of US 97 is above the critical crash rate and the US 97/Dover intersection is one of the top three crash locations in the corridor. Roadway departure, angle crashes, and head-on crashes were the primary crash types in this section.

Cost Estimate: This project is estimated to cost $8.8M.

Countermeasures not recommended

- An access road was originally considered but was not supported by residents or Jefferson County.
- Median barrier was proposed as a long-term concept. Should crash patterns change, projects may evaluate if median barrier would be an effective tool. RCUTS would be used to aid out-of-direction travel. Installation of median barrier would require outreach with the Mobility Advisory Committee per ORS 366.215 Reduction of Vehicle Carrying Capacity.

Figure 10: Example US 97 Cross Section with Traversable Median



Figure 11: US 97 Waldorf to Dover and US 97/Dover Lane



US 97 Passing Lanes MP 98.7 to 99.6

Solution ID #16:

The proposed solution for US 97 MP 98.7 to 99.6 is to add median barrier and eliminate the conflict with the existing passing lane at the Auction Yard approach. This section of the corridor had both observed safety issues and was supported by public feedback from the PAC and open house.

Implementation Suggestion: Mid- to long-term.

Considerations

PAC feedback indicated a strong preference to retain the passing lane in this section. Additional right-of-way would be needed to widen US 97 and install median barrier. Drainage would need to be re-designed for the wider pavement width. Environmental impacts would be assessed at project development but are expected to be minimal.

Installation of median barrier will require outreach with the Mobility Advisory Committee per ORS 366.215 Reduction of Vehicle Carrying Capacity.

The existing passing lane is sufficiently long enough to meet ODOT Highway Design Manual standards. A shorter passing lane would not be sub-standard in length and is not expected to impact corridor travel time.

Left turn lane warrants would need to be evaluated to support the overall intersection configuration at the Auction Yard access.

This project could be phased to only include a traversable median and reduce cost of a median barrier. A median barrier could be installed at a later date if safety issues persist. However, the median barrier provides greater separation from oncoming vehicles and better addresses the crash types in this section.

Safety Benefits

Median barrier (RD25 and H31 in the ODOT CRF Manual) are used to separate opposing directions of traffic on divided highways with high speeds or on divided highways with a high frequency of fatal or serious injury crossover crashes. Median barrier has a 30% reduction in all crashes at all injury severities. This section of the corridor has a history of high-speed rear end crashes, sideswipe/passing crashes, and head-on collisions.

Cost Estimate

This project is estimated to cost $9.5M.

Countermeasures not recommended

The following countermeasures from TM#4 were not recommended for the following reasons:

- Remove passing lane, install median: The PAC feedback strongly indicated that the passing lane should remain.

Figure 12 US 97 Passing Lanes



US 97 – Falcon to Jericho

Solution ID #17:
US 97 from Falcon Lane to Jericho presents unique challenges in concept development: high frequency of public and private approaches, a history of sideswipe/passing crashes, and an adjacent farm industry that utilizes US 97. Near-term solutions include striping changes and mid-term solutions include a traversable median, turn restrictions at US 97/Jericho, county road access consolidation, and long-term intersection improvements at US 97/Iris Lane.

Implementation Suggestion: Near-term/long-term.

Considerations

The near-term improvements are relatively inexpensive and low impact. Striping changes could be coupled with other corridor wide improvements. Striping changes would evaluate passing at intersections/accesses.

Long-term improvements are expected to have significant right-of-way impacts. The traversable median would require widening and would impact adjacent drainage facilities, as well as intersections and private approaches.

Access consolidation at key locations will provide improved traffic control. The recommendation to consolidate two accesses in the corridor has been left vague to retain flexibility in the future. Accesses are very frequent in this section and while consolidating county road approaches would be an improvement, it still would not make the corridor meet access spacing standards.

An Intersection Control Evaluation (ICE) would need to occur at US 97/Iris Lane for any future intersection improvements. A roundabout, which would be subject to approval from the Mobility Advisory Committee in accordance with ORS366.215 Reduction of Vehicle Carrying Capacity and Highway Directive DES-02, should be considered in the future at this intersection.

Median barrier installation could be considered in the long-term should farm ownership change in the corridor. Currently, large agricultural machinery crosses the highway and median barrier would present challenges with directing that machinery onto the highway. In addition, installation of median barrier will require outreach with the Mobility Advisory Committee per ORS 366.215 Reduction of Vehicle Carrying Capacity.

ODOT should work with Jefferson County to re-evaluate emergency/detour routes at implementation.

Safety Benefits

Striping adjustments do not have an ODOT CRF but would make the passing zones consistent with state law (no passing across intersections).

A traversable median (H40 in ODOT CRF manual) provides separation between opposing flows of traffic. It is estimated to reduce all crashes at all severities by 12%. Sections of this corridor are close to the critical crash rate and increased travel lane separation would address the crash types.

Turn restrictions at Jericho do not have a CRF but would eliminate the left turning movement and through movement crashes from the minor (Jericho) approach. Future intersection improvements at US 97/Iris Lane could better accommodate left turns at the intersection.

Cost Estimate

Short-term improvements would cost less than $200k.

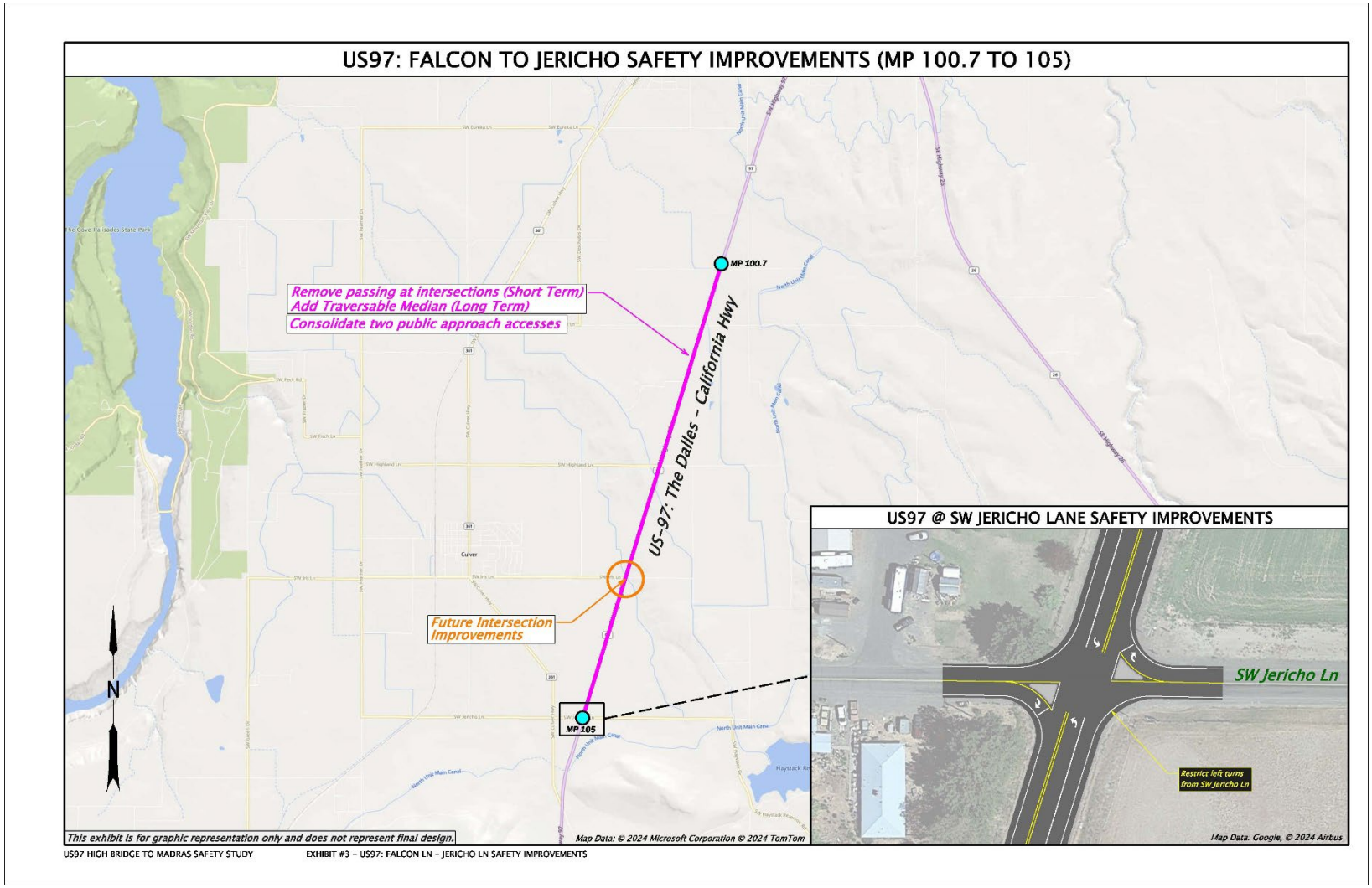
Mid-term costs for installing a 10' wide traversable median are expected to be $20.3M.

Long-term costs for a rural roundabout at US 97/Iris Lane are estimated at $7M.

Countermeasures not recommended

- Median Barrier: Median barrier could be recommended in the future but a review of private farm approaches and access needs with the agricultural community would need to occur.

Figure 13: US 97 Falcon to Jericho



US 97/ SW Culver Highway Intersection

Solution ID #18:
Solutions for the US 97/SW Culver Highway intersection include an intersection realignment that reduces existing sight distance, intersection skew, and operations issues. A review of the most recent five years of crash data showed this intersection to be one of the top three crash locations in the corridor. Safety concerns from the PAC and public feedback showed that this intersection was also a concern to the public. The intersection realignment would provide better sight distance and appropriate turn lane capacity while also reducing confusion and conflicts in the current alignment.

The Jefferson County TSP identifies a need to provide safe bicycle travel parallel to Juniper Butte on US 97. A concept for bicycle and pedestrian connections across the US 97/Culver Highway intersection and a concept to connect to the Peter Skene Ogden State Scenic Viewpoint is included.

Implementation Suggestion: Long term

Considerations:
The project would have significant right-of-way impacts.

The existing Culver Highway approach could be used as an acceleration lane to southbound US 97. The existing acceleration lane does not meet ODOT design standards. The proposed changes would bring the existing acceleration lane to standard.

The graphic shows a realignment of the eastern leg of Culver Highway. A future project should evaluate if this leg of Culver Highway is still needed, Support from local farmers indicated a strong desire to keep the eastern leg of SW Culver Highway open at the time of the study, but changes in farming practices and agricultural travel patterns may change in the future. Closing the eastern leg of Culver Highway at the intersection would provide considerable cost savings and increased safety by reducing the number of conflicts at the intersection. A future project may consider an access road or wider shoulder for farm vehicle access to SW Culver Highway as a cost-effective solution as well.

The shared-use path connects under US 97. This would be best accomplished if the canal is piped, but a design exception for path vertical clearance under US 97 could also be evaluated. Additional coordination with the Central Oregon Irrigation District would need to occur for the project to be successful. Additional improvements to the US 97/Iris Lane intersection are proposed in Solution #17. There is the potential to phase out the eastbound to northbound connection if improved access is made to the north on US 97.
The shared-use path connection to Peter Skene Ogden State Scenic Viewpoint would require coordination with Oregon Parks and Recreation Department. The concept assumes minimal impacts to the existing US 97 bridge structure.

Illumination may be considered if utility hookups are present.

Safety Benefits

A reduction of intersection skew angle (H601 from ODOT CRF) would have expected safety benefits at the intersection. If determined that the east leg of Culver Highway could be closed at time of construction, closure of the east approach would have a 100% reduction in crashes that involve the eastern approach.

Cost Estimate

This project is estimated to cost $8 M.

Countermeasures not recommended

- Install Roundabout: A roundabout was not a preferred intersection treatment due to the high speeds from Juniper Butte and concerns about truck acceleration/deceleration.
- Offset T intersection: This intersection configuration would not address all of the crash types that are currently occurring.
- Closure of eastern leg of Culver Highway: This concept was not supported by the Jefferson County at the time of the study. Future projects should conduct outreach to evaluate if the eastern leg of Culver Highway is still necessary. Closing the eastern leg would simplify the intersection, improve safety, and provide cost-savings to a future project.

Figure 14: US 97 at Culver Highway

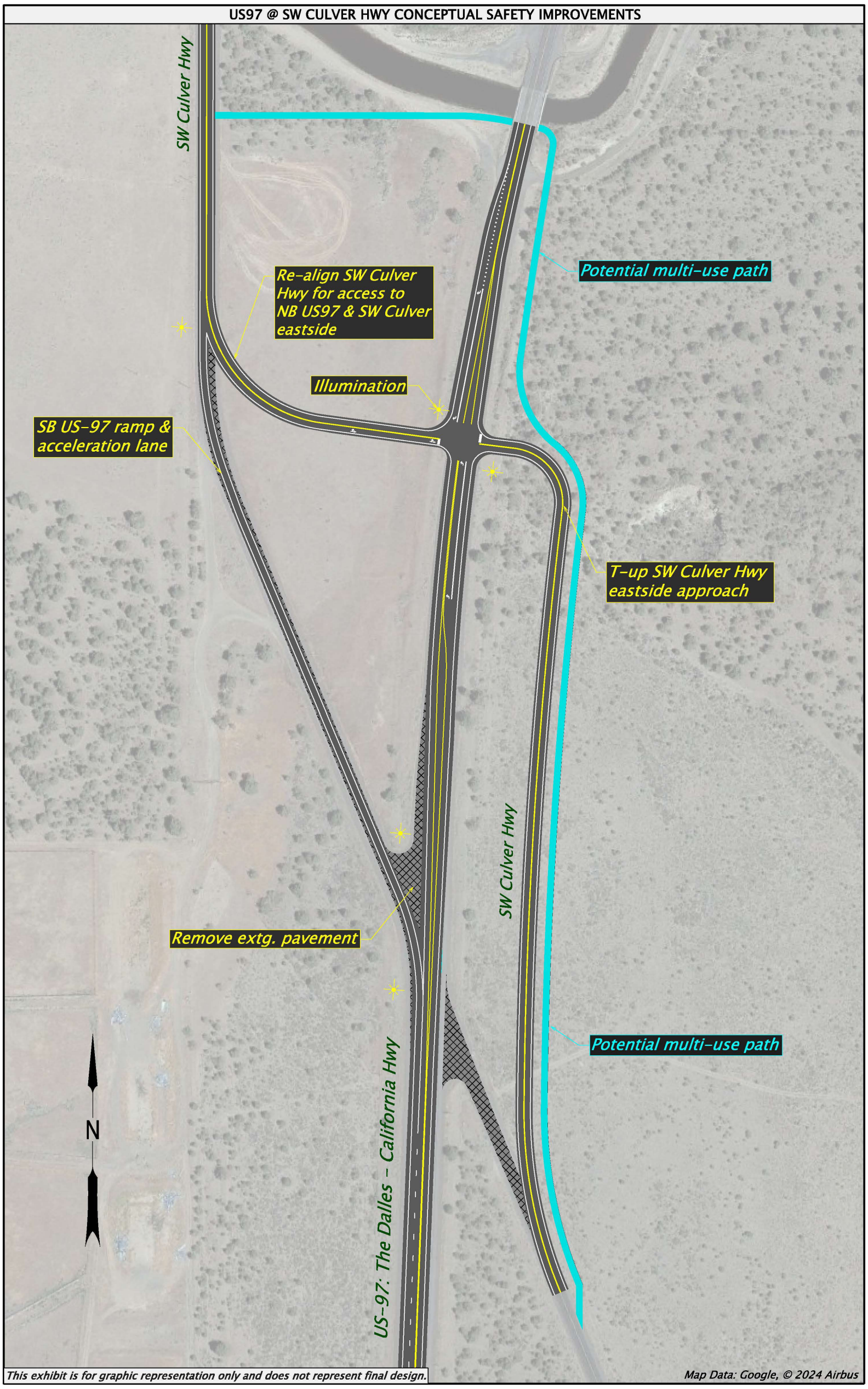


Figure 15: US 97 at Peter Skene Ogden Path Concept



US 97 – Juniper Butte Area

Solution ID #19:

The Juniper Butte section of US 97 includes recommendations for ITS solutions, median treatments, and shoulder/merge lane improvements. US 97 over Juniper butte presents unique corridor issues: the elevation change can lead to snow/ice accumulation before other parts of the corridor, the four-lane cross section allows for excessive driver speeds, and crossover crashes force closures on the corridor where existing parallel routes are not ideal. Public feedback, PAC comments, and discussions with ODOT maintenance helped determine appropriate corridor treatments. The following treatments are recommended:

- Median barrier installation
- ITS improvements: Advisory speed signs and variable message boards, Road Weather Information Stations (RWIS)
- Shoulder widening
- Lengthen merge lane for truck scales on northbound/southbound merges

Implementation Suggestion: Mid- to long-term, depending on solution.

Considerations

Right-of-way and environmental impacts are to be expected. Widening to support median barrier installation and shoulder width would have impacts to adjacent properties. Most of the land use surrounding Juniper Butte is federal range land so the impact to private property is expected to be minimal.

ITS improvements would need to be coordinated and supported by a Concept of Operations study, which would include regional US 97 ITS equipment and proposed solution ID#20. The proposal would also need to be consistent with statewide ITS documents.

Installation of median barrier and ITS devices over US 97 will require coordination with the Mobility Advisory Committee per ORS 366.215 Reduction of Vehicle Carrying Capacity. Median barrier should also consider access for fire and emergency services, possibly in the form of a break in the barrier at the top of Juniper Butte.

Wildlife crossing of median barrier should be considered in the design phase. Additional coordination with ODFW and ODOT's Wildlife Passage program should occur.

Shoulder widening cost is included in a Systemic package, solution ID 02.

When constructed, updated emergency route and detour route planning should occur post project between ODOT and Jefferson County.

Safety Benefits

This section of US 97 has historically had weather-related, sideswipe, and crossover (head-on) crashes that have resulted in fatalities and occasional roadway closures. The following countermeasures are meant to reduce both the frequency and severity of these instances.

- Median barrier (RD25 and H31 in the ODOT CRF Manual) are used to separate opposing directions of traffic on divided highways with high speeds or on divided highways with a high frequency of fatal or serious injury crossover crashes. Median barrier has a 30% reduction in all crashes at all injury severities.
- ITS Improvements: Rural variable speed limit signs (H52 in ODOT CRF Manual) have a reduction in crash type and severity of 20%. Road Weather Information Stations (RWIS) do not have a countermeasure but can aid ODOT in communicating road conditions to drivers.
- Shoulder widening: CRF for all crashes 6-18% (RD20 from ODOT CRF list)
- Merge Lane improvements: While there is not a CRF for improved merge lanes, operational benefits are to be expected. A longer merge lane will improve visibility from mainline vehicles and merging trucks, and give drivers increased response and reaction times to merging trucks.

Cost Estimate

This project is estimated to cost $14.7M.

Countermeasures not recommended

Below are the countermeasures from TM#4 that are not recommended:

- Roadside clearing: Roadside clearing is included in a systemic project and may be included in a project when funded. The majority of the historical crashes are better supported by the countermeasures above in this location.
- Traversable Median: Median barrier would be more effective at addressing the crash types and severity of crashes.

Figure 16: US 97 at Juniper Butte Median Barrier



Figure 17: US 97 ITS Improvements - Northbound



Figure 18: US 97 ITS Improvements - Southbound



US 97 – Railroad Overcrossing

Solution ID #20:

Installation of intelligent transportation systems (ITS) technology increases driver awareness and expectations of driver conditions on the corridor. Variable message signs are proposed at the US 97 overcrossing. A Road Weather Information System (RWIS) would support message signs and provide information through TripCheck. General benefits of installing ITS equipment are the coordinated operations of the system, allowing ODOT staff to efficiently monitor the corridor, manage and change messaging to drivers as needed, and remotely manage equipment. Feedback from the PAC and the public indicated that issues arise on the railroad overpass primarily in winter.

Implementation Suggestion: Mid-term.

Considerations

A Concept of Operations study is needed so that the seamless installation of ITS equipment can occur on the corridor. There are options for ice warning systems that could be implemented. Final determination is based on State Traffic Engineer approval of the design requirements identified by ODOT.

Right-of-way impacts and environmental impacts are minimal.

Any ITS devices installed over US 97 will require coordination with the Mobility Advisory Committee per ORS 366.215 Reduction of Vehicle Carrying Capacity.

Safety Benefits

A driver feedback sign is not a listed countermeasure in the ODOT CRF Manual; however, ITS equipment can have positive safety benefits by alerting drivers of road conditions and upcoming changes in traffic or weather patterns.

Cost Estimate

This project is estimated to cost $2M for both reader boards and installation.

Countermeasures not recommended

The following countermeasures from TM#4 were not considered:

- Consider guardrail extension: Guardrail may be installed if found deficient in the future. The primary countermeasure at this location based on public feedback, feedback from ODOT maintenance, and crash review led the team to pursue the variable message signs over the guardrail.

Figure 19: US 97 Railroad Overcrossing ITS Improvements



Project Goals

Project goals were developed by the participant advisory committee at the start of the project and reflect goals from the Jefferson County TSP (2021) for US 97. Project goal criteria were then scored for each of the location-specific concepts and are included below the scoring table. Corridor-wide solutions and non-engineering solutions were not compared to the project goals.

Each project was evaluated and the results are indicated using the following symbols in the table below:

- ● Project meets or fully addresses the criterion.
- ◦ Project partially meets or addresses the criterion.
- ○ Project does not meet or has negative impacts with respect to the criterion.
- N/A Not applicable.

Project ID	Project Location	Project Description	Multi-modal safety	Safety – Reduces Fatal/Injury	Safety - Practical Design	TSP Consistency	Prioritizes access consolidation	Considers Private Property Impact	Notes
14	US 97/ US 26/ Colfax	Install Roundabout and illumination	●	●	○	●	N/A	●	Roundabouts can have significant design challenges but perform better from a safety and operational standpoint than a signal
15A	US 97 Waldorf to Dover	Install traversable median, restrict turning movements	●	○	●	●	○	●	Traversable median provides adequate CRF but median barrier more greatly reduces crashes.
15B	US 97 Waldorf to Dover	Install median barrier, restrict turning movements	●	●	○	●	●	○	Access road has significant private impacts and would not be funded with safety funds.
16	US 97 Passing lanes	Install median barrier	●	●	○	●	○	○	A more practical design would be to eliminate the passing lane and utilize the roadway space available for median barrier. Accesses largely remain in current configuration
17	US 97 Falcon to Jericho	Adjust striping, consider traversable median.	●	○	●	○	○	●	Project weighed impacts to farm access heavily and prioritized a more mid-term solution that balanced safety benefits with access.
18	US 97 Culver Highway	Realign intersection, include bike/ped connection	●	●	○	●	●	●	Solution complies with all goals in the project and the Jefferson Co. TSP. Project will be costly and does not have CRFs for all aspects.
19	US 97 Juniper Butte	Median barrier, ITS, shoulder widening, merge lane improvements	●	●	●	●	○	○	The solutions address crash types but will have significant private property impacts.

20	US 97 Railroad Crossing	ITS improvements	°	°	●	●	○	N/A	ITS improvements provide valuable information to motorists but are limited in their safety effectiveness