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Technical Memorandum #4: Corridor Issues Summary

January 24, 2023 Project# 270030.007

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RE: OR 6: Wilson River Highway Corridor Study (HB 4053)

OR 6: Wilson River Highway Corridor Study (HB 4053)

This memorandum summarizes the issues identified for the OR 6: Wilson River Highway Corridor Study (HB 4053) (refer to as OR 6 Corridor Study). The issues were identified by the Project Team based on a comprehensive review of the following items together:

- Existing conditions, as summarized in Technical Memorandum #3
- Public and stakeholder input

The team summarized the issues in two categories to facilitate the development of solutions in the next step of the project:

- Location-specific issues
- Corridor-wide issues

These issues will form the basis for project development and recommendations of the OR 6 Corridor Study.

Contents

LOCATION-SPECIFIC ISSUES

The locations identified in this section are those where specific projects may be further evaluated and recommended as part of the OR 6 Corridor Study. This section provides a brief summary of key facts from the inventory, operations, and safety analyses, as well as public input received, to indicate why a location was identified and provide a description of the issue. For more details on each location, the reader should refer to *Technical Memorandum #3: Existing and Future Conditions* and the *Outreach Summary Memorandum*.

The team reviewed the public and stakeholder input received to date in addition to the analyses and inventory work completed to identify the locations presented in this section. The primary purpose of the OR 6 Corridor Study is to reduce fatal and severe injuries. Therefore, the safety analysis was used as a primary factor in reviewing locations. Several of the locations flagged from the safety analysis are presented in this section, with several short segments flagged through the equivalent property damage only (EPDO) analysis grouped into one larger segment near Mile Point (MP) 31 to 35. The remainder of the locations flagged from the safety analysis are well captured in the corridor-wide issues and will be addressed through systemic recommendations.

MP 2.0 - 2.1 (Wilson River Loop [East] Intersection)

This location was identified due to safety issues with the OR 6/Wilson River Loop (East) intersection, which was flagged through the safety analyses.

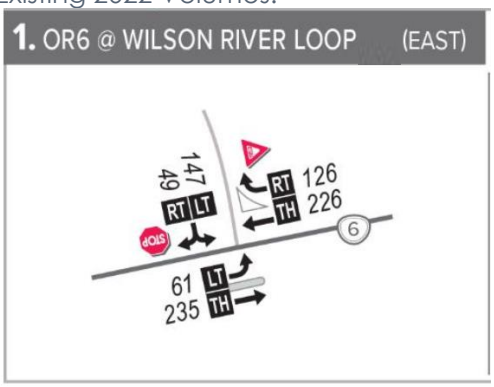
MP 2.0 – 2.1 (Wilson River Loop [East] Intersection) Description
Reported Crash Data (2016 – 2020)

- Location was flagged due to:
  - Exceeding 95th percentile EPDO score (MP 2.0 – 2.1 has the 2nd highest EPDO score in the corridor)
  - Intersection crash rate (0.903) exceeds expected rate (0.475) for rural 3-leg stop-controlled intersections
  - Identified as an Oregon Department of Transportation (ODOT) Safety Priority Index System (SPIS) site: MP 2.02 – 2.11 was identified in Top 10% 2020 SPIS list and Top 15% 2019 SPIS list
- Between 2016 and 2020 (at MP 2.0 – 2.1), 15 crashes were reported, including:
  - 1 severe injury crash
  - 14 turning crashes, 1 fixed object
  - 5 crashes on wet roads
  - 2 crashes in the dark
  - 8 crashes involving southbound left-turning vehicles
  - 3 crashes involving westbound right-turning vehicles
- MP 2.0 – 2.1 received the 2nd highest EPDO score on the corridor

Intersection crash rate is 0.903 and exceeds the statewide 90th percentile comparison rate for rural 3-leg stop-controlled intersections (0.475).

Traffic Volume and Operations

Existing 2022 Volumes:



- Intersection operates acceptably under existing and future (2044) conditions.

Site Observations and Characteristics

- The East intersection was created when the north leg was realigned to the east, offset from the south leg. A dedicated westbound right-turn lane is provided for the north leg.
- The East intersection is located near a weigh station that creates a short distance between the westbound trucks' merge area and the right-turn lane for Wilson River Loop, resulting in a relatively short weave section.
- Geotechnical and environmental issues are unlikely as long as projects stay within existing road prism.
- Wetlands are present nearby.

(Image from Google Earth)

Public Input Received
■ *Vehicles in westbound right-turn deceleration lane block sight distance of vehicles waiting to make a southbound turn.* ■ *MP 2 (Wilson River Loop [East]): Needs improvement, there are visibility issues.*

MP 31 – 35 (Horizontal Curves and Pull-outs)

The segment from approximately MP 31 to 35 contained several 0.1-mile segments that were flagged through the safety analyses. When considering safety scores EPDO on a rolling basis, this segment had the highest scores of the corridor. In addition, several other conditions are present along this segment including poor pavement conditions and unstable slopes.

MP 31 – 35 Description
Reported Crash Data (2016 – 2020)
■ Highest concentration of severe crashes in corridor (highest EPDO scores of the corridor) – Particularly between MP 33 – 34 ■ Between MP 31 and 35: – 65 reported crashes (2016 – 2020) o 7 fatal/severe injury, including 2 head-on, 2 non-collision (overturn), 2 fixed object, and 1 sideswipe meeting o 28 other injury crashes, including 12 fixed object, 3 head-on, 5 non-collision, 4 rear-end, and 4 sideswipe meeting o 30 property damage only crashes, including 1 backing, 16 fixed object, 1 head-on, 4 non-collision, 4 other, 2 rear-end, 1 sideswipe meeting, and 1 turning movement – 12 head-on or sideswipe-meeting crashes in this segment – 45% occurred on snow or ice – 18% occurred on wet pavement – 37 % occurred in diminished natural light conditions (dark, dawn, or dusk)
Traffic Volume and Operations
■ ODOT's TransGIS reports an average annual daily traffic volume of approximately 5,050 for the roadway segment from MP 22.65 to MP 36.7, based off the automatic traffic recorder site 2209 located at MP 32.88.
Site Observations and Characteristics
■ Series of horizontal curves ■ Several short passing lanes are located within the curves, including some with passing lane lengths and/or taper lengths that do not meet current standard

  - Curve between MP 33 – 34 contains a short passing lane and has crashes on both ends of the passing lane

- This segment is located at the peak of the summit

  - Snow and ice crashes were reported

- Unstable slopes

  - Active slide at MP 34.8 that ODOT is currently working on
  - Numerous landslides and rockfalls in the area
  - Any projects that involve cut/fill will be challenging
  - For example, projects that stay within existing road prism may be able to use temporary solutions (i.e., Deep Patch) to help stabilize roadway for shorter time frames, but those that extend outside road prism will be much more costly and involve additional permitting processes

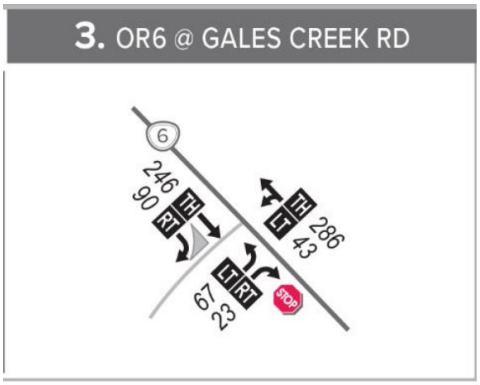
- Poor pavement conditions from MP 33 – 35 ("fair" on other segments)

Public Input Received

- *MP 31-32.5: Passing lanes need to be repainted.*
- *MP 32.5: Turning traffic has limited visibility due to curve and can cause dangerous maneuvers. The end of a passing lane here adds additional concerns. (Note: Although the commenter cited MP 32.5, there is no turn opportunity at this location. The commenter may have intended to reference a nearby location, such as Beaver Dam Road.)*
- *MP 33.5 (Summit, east to South Fork Gales Creek Road): Poor road condition and uneven surface causing vehicles to leave lane of travel. The commenter suggested a longer passing lane in this location.*
- *MP 33.5 (Summit, east to South Fork Gales Creek Road): Poor road condition and uneven surface causing vehicles to leave lane of travel.*
- *MP 34.5: Unsafe passing experienced in this area.*
- *MP 31 ("Devils' Corner" near Drift Creek Road): Area is problematic, road condition is poor, motorists often cannot maintain lanes.*
- *MP 32-36: The roadway condition is poor in this major slide area.*

MP 42.2 (Gales Creek Intersection)

The OR 6/Gales Creek intersection was identified based on the safety analyses and operational analyses. This intersection has a skew intersection angle and exceeds the expected crash rate for similar intersections statewide and meets volume criteria for a westbound left-turn lane on OR 6.

MP 42.2 (Gales Creek Intersection) Description
Reported Crash Data (2016 – 2020)
■ Intersection crash rate (0.548) exceeds expected rate (0.475) for rural 3-leg stop-controlled intersections ■ 8 reported crashes between 2016 – 2020, no fatal or serious injury. – 4 turning, 2 fixed object, 1 rear-end, 1 angle – 4 on wet roads – 2 in dark ■ 5 involved left turns (4 northbound left, 1 eastbound left)
Traffic Volume and Operations
Existing 2022 Volumes at OR 6/Gales Creek Road:  ■ Intersection operates acceptably under existing and future (2044) conditions. However, the intersection meets volume criteria and crash justification for a westbound left-turn lane based on existing and future peak hour volumes.

Site Observations and Characteristics

- Construction of a northbound left-turn lane will be challenging and costly due to bridge (approximately 200 feet long) over Gales Creek, located approximately 350 feet east of the intersection
- Sight distance for movements from the side street appears constrained in Google Earth
- Projects at this location are unlikely to trigger geotechnical issues unless fill is needed near Dorman Pond.
- Environmental review may be triggered if the bridge is modified (fish passage) or if any removal/fill were to occur in Gales Creek as it is Essential Salmonid Habitat.

(Image from Google Earth)

Public Input Received

- None

CORRIDOR-WIDE ISSUES

The issues summarized in this section are prevalent through much of the corridor. Many of these issues may be best addressed through systemic recommendations, which would proactively address the issue at all locations where the conditions of risk are present rather than waiting for a crash pattern to occur. The Project Team will work to develop systemic or programmatic recommendations to address these issues as part of the OR 6 Corridor Study. For some of the issues listed, specific locations are noted. These locations may be further reviewed during project development.

Roadway departure crashes accounted for 52 percent of crashes within the study corridor. These are common crash types along rural two-way lane highways in Oregon. This study will look to identify issues contributing to the crash patterns on this corridor and ultimately identify opportunities to reduce crash frequency and severity.

Several crash characteristics or patterns were identified as higher than expected for rural minor arterials in Oregon[1]:

- Turning movement crashes (13.1 percent of reported crashes between 2016 and 2020),
- Crashes on icy roadways (13.1 percent of reported crashes),
- Crashes on Saturday or Sunday (19.2 and 17.8 percent, respectively),
- Crashes involving wildlife (12.1 percent),
- Crashes in July and August (12.9 and 11.7 percent, respectively), and
- Crashes between 9 am – noon and noon - 3 pm (15.2 and 19.9 percent, respectively).

Recreational Destinations (Including Informal Destinations)

The OR 6 Study Corridor provides access to many destinations along the corridor including campgrounds, hiking trails, residences, and small stores. While some of these destinations are marked, others are not well signed. The Project Team identified a correlation between crash patterns at some of these recreational destinations, including several unmarked trail heads that are used informally for hiking. Risk is present due to vehicles slowing to look for their destination, as well as vehicles unexpectedly pulling out of these locations. Several of these

[1] This comparison is based on 2015 – 2019 Oregon crash data averages (using the *Highway Safety Manual* overrepresentation methodology) for rural minor arterials.

locations are also located near bridges or culverts, which restricts the roadway width and recovery area for vehicles that may leave their lane or need to swerve to avoid another vehicle.

Specific locations the Project Team reviewed include:

- MP 5.8 vicinity: The area from MP 5.8 to 5.9 (Rush Road intersection) was flagged through the safety analyses. This area has narrow shoulders, poor pavement conditions, and is scored within the 90th percentile for bicycle statewide prioritization results.
- Approximately MP 23.7 near Lee's Camp Store, with an open driveway and a transit stop. There is a slight curve in the road and the road narrows.
- Approximately MP 25.2 trailhead access, which was also flagged through the safety analyses. This area has a transit stop and small unimproved parking lot.
- Near MP 42.1, just north of Gales Creek intersection, an informal parking area is located on the southwest side of the road near Dorman Pond.

Public input received that is relevant to this issue includes the following comments. Several of these are comments regarding specific intersections or destinations along the corridor:

- *It is difficult to make left-turns along the corridor.*
- *MP 30.5 (Drift Creek Road): Drift Creek Road is only wide enough for one vehicle which causes traffic to back up on the westbound OR 6 travel lane. Considered a very problematic intersection with a lot of recreational traffic.*
- *MP 32.5: Turning traffic has limited visibility due to curve and can cause dangerous maneuvers. The end of a passing lane here adds additional concerns.*
- *MP 38-42: Speed concerns.*
- *MP 39 (Timber Road): The sharp right turn from westbound OR 6 requires slowing down and causes traffic to back up. There is no shoulder here.*
- *MP 41 (Shell Station): There is no turnoff area at the gas station. When the station is full, vehicles block traffic while they wait to turn. Parked trucks block views and make it difficult to merge back onto the highway.*
- *MP 42 (OR 8/Gales Creek Road and OR 6) (3): It is difficult for westbound vehicles to turn left onto OR 8. There is limited visibility for other traffic to see turning vehicles and have time to slow down.*
- *MP 44 (Timmerman Road): Concerns with the intersection.*
- *MP 47 (Stafford Road): It is difficult to make a left turn across traffic on OR 6.*
- *MP 48 (Hartmann Drive): Turning onto or off OR 6 is difficult and drivers pass on the left when vehicles are waiting to turn.*

Curves (Including Curves with Snow/Ice)

Horizontal curves are common throughout the corridor. A review of the crash data shows that several sites with high crash frequency and severity are located within horizontal curves. Roadway departure crashes were most commonly observed within horizontal curves. In addition to the presence of curves, several other factors are also present in many of these locations including:

- Vertical grade
- Snow, ice, and wet pavement
- Passing lanes located within curves
- Pull-outs located within curves with limited sight distance

The team reviewed the existing and future conditions analyses, ODOT's curve signage inventory, and noted the following:

- Curves at the following general areas with relatively high safety analyses scores:
  - MP 10.5
  - MP 17.8
  - MP 30.9 – 31.5: this area has average calculated speeds under 55 mph and does not have curve warning signs. It is also partially located along a passing lane.
  - MP 33-34: this location (33.3 – 33.4, and 33.8 – 34.0) also has poor pavement conditions and a pull-out located on the curve.
  - MP 37.0 -38.0
  - MP 41.0

Public input received that is relevant to this issue includes the following comments or locations where concerns regarding curves were noted:

- *Are there enough chain-up areas? There are not many on the Tillamook side, just around MP 16-17. There are plenty on the east side, although they are not great for re-entry on curves.*
- *MP 8-10 (Siskeyville): Concern about blind curves and speed.*
- *MP 13.5: Poor visibility at this corner.*
- *MP 18.5: Limited visibility at corner.*
- *MP 26.5: There is a blind corner here.*

Passing Lanes

Passing lanes are located throughout the corridor, with the majority of the eastbound (EB) passing lanes located west of milepost 33, and the majority of the westbound (WB) passing lanes located east of milepost 33, traveling in uphill directions. The Project Team noted that many of these are located within a series of curves where crashes have been reported. In addition, roadway conditions are noted as factors in many of the crashes in these locations. The total length was measured based on the start and end points of the travel lane widening. For the entry taper, the measurement was taken from the start point of the travel lane widening to the start point of the passing lane skip striping. For the exiting taper, the measurement was taken from the end point of the passing lane skip striping to the end point of the travel lane widening. The Project Team measured the lengths in Google Earth via aerial imagery and then adjusted based on pavement marking plan documents provided by ODOT where skip striping was removed and/or signage was adjusted at the existing tapers for nine of the ten passing lanes along the OR 6 study corridor. The pavement marking plans are dated June 29, 2022 and assumed to have been installed prior to January 2023. Several passing lanes were noted to have lengths and/or taper lengths that do not meet ODOT's 2023 Highway Design Manual (HDM) guidance.[2] Most notable include:

- MP 16.29 – 16.47 (eastbound [EB] passing lane):
  - Total length measured (entry taper, passing lane, and existing taper): 950 feet (compared to guidance of 2,240 feet)
  - Exiting taper length measured: 230 feet (compared to guidance of 660 feet)
  - Passing lane length measured: 400 feet (compared to guidance of 1,250 feet)
- MP 30.88 – 31.85 (EB passing lane)
  - Entry taper length measured: 130 feet (compared to guidance of 330 feet)

[2] The team checked passing lanes against the following minimums for the purpose of flagging inadequate locations: minimum entry taper length: 330 feet, minimum passing lane length: 1,250 feet, minimum exiting taper length: 660 feet, resulting in a minimum total length: 2,240 feet.
The minimums were taken from or calculated based on HDM Section 328 (Passing Lanes).
- The minimum length of a passing lane should be 1,250 feet, plus tapers.
- Exiting taper length: L=WS (L=length in feet, W=width in feet, S=posted speed in MPH). 12 feet * 55 MPH = 660 feet
- The recommended length for the lane addition taper (entry taper) is half to two-thirds of the lane drop length: 0.5 * 660 feet = 330 feet

HDM Section 328 also notes that "if at all possible, passing lanes should be located where there are no approaches".

- MP 33.53 – 33.78 (westbound [WB] passing lane)
  - Total length measured (entry taper, passing lane, and existing taper): 1,940 feet (compared to guidance of 2,240 feet)
  - Entry taper length measured: 270 feet (compared to guidance of 330 feet)
  - Exiting taper length measured: 430 feet (compared to guidance of 660 feet)
- MP 34.4 – 34.66 (WB passing lane):
  - Passing lane length measured: 850 feet (compared to guidance of 1,250 feet)
  - Also has parking along part of the passing lane
- MP 35.45 – 35.7 (WB passing lane):
  - Total length measured (entry taper, passing lane, and existing taper): 1,970 feet (compared to guidance of 2,240 feet)
  - Passing lane length measured: 760 feet (compared to guidance of 1,250 feet)
- MP 43.2 to 43.9 (EB passing lane)
  - Entry taper length measured: 290 feet (compared to guidance of 330 feet)
  - Intersections of NW Parson Road and NW Timmerman Road are also located within the exit taper

Public input received that is relevant to this issue includes the following comments or locations where concerns regarding passing or passing lanes were noted:

- *Speed differential concerns throughout the corridor.*
- *Drivers get impatient and pass.*
- *There are insufficient passing lanes and slow vehicle pullouts, and some passing lanes are too short. Some center lines switch passing direction when they should not. Some pullouts are not paved and sometimes there is not enough warning to be able to use turnouts safely.*
- *Drivers who are driving at 55 mph get passed in areas with double-yellow.*
- *Where are the passing lanes? Need to have better messaging to drivers.*
- *MP 5 (Wilson River RV Park): Short eastbound passing lanes near steep driveways and RV park turnoff.*
- *MP 6-8 (Mills Bridge to Siskeyville Boat Launch)*
- *MP 16-17: Eastbound passing lane is too short.*
- *MP 19-20: Concern about the direction of passing lanes.*
- *MP 22-23 (North Fork Road): Concern about passing lanes being too short.*
- *MP 25 (King's Mountain Trailhead): There is a blind corner at this pull off.*
- *MP 26-37: Drivers often pass despite solid yellow lines in this segment.*

- *MP 31-32.5: Passing lanes need to be repainted.*
- *MP 32.5: Turning traffic has limited visibility due to curve and can cause dangerous maneuvers. The end of a passing lane here adds additional concerns.*
- *MP 33.5 (Summit, east to South Fork Gales Creek Road): Poor road condition and uneven surface causing vehicles to leave lane of travel. The commenter suggested a longer passing lane in this location.*
- *MP 34.5: Unsafe passing experienced in this area.*
- *MP 35.5 (Rogers Road): Request for three lanes with new eastbound passing lane.*
- *MP 37 (2): There are inadequate passing lanes and no shoulder here.*
- *MP 39 (Glenwood Food Mart): Concern about short passing lanes near this popular turnoff.*
- *MP 41-42: Concern about passing lanes in this high-merge segment.*

Roadway Conditions (Wet, Snow, Ice)

Some segments of the corridor have concentrations of crashes occurring on snow/ice conditions or wet pavement conditions. In particular, a pattern of snow/ice crashes is observed between approximately MP 31 and MP 38, which correlates with the peak elevation and grades of the corridor as shown by the approximate roadway profile from Google Earth below. Between MP 31 and 38, snow and ice conditions were present in 38 percent of crashes.

Thirty-one percent of fatal and serious injury crashes occurred on wet pavement. According to the Federal Highway Administration (FHWA), "Poor pavement conditions, especially wet pavement, have been identified as one of the major contributing factors in roadway departure crashes. When a pavement surface is wet, the level of friction is reduced, and this may lead to skidding or hydroplaning."[3]

Public input received that is relevant to the weather/roadway conditions issue included the following:

- *Ice is an issue early in the morning, particularly at on-ramps in Banks.*
- *Snow is sometimes an issue, as is fog.*
- *Landslides and rocks on the road can cause vehicle damage or loss of control.*
- *MP 12-13 (The Narrows): This area ices over easily.*
- *MP 33.5 (Summit, east to South Fork Gales Creek Road): Poor road condition and uneven surface causing vehicles to leave lane of travel.*

[3] https://safety.fhwa.dot.gov/roadway_dept/pavement_friction/

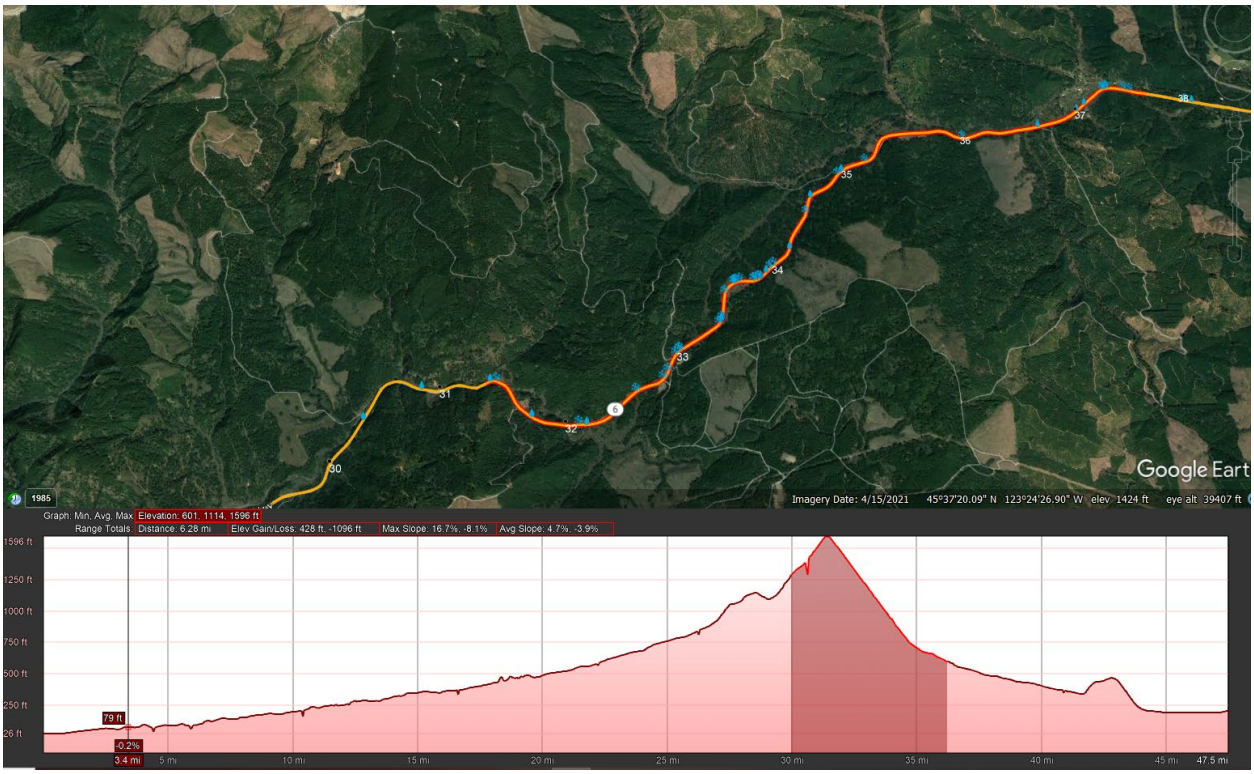


Exhibit 1: OR 6 Study Corridor Profile from Google Earth, with MP 31 to 38 highlighted

Pavement / Slope Stability Conditions

Public input suggested pavement conditions as one of the primary concerns for the corridor. In addition, there are numerous areas of unstable slopes throughout the OR 6 study corridor and areas where unstable slopes have led to pavement condition issues and roadway cross slopes that appear to be in the wrong direction within a curve. Where these unstable slopes overlap with safety concerns, there may be an opportunity to address both issues with potential projects or strategies. In addition, understanding areas of unstable slopes will be an important consideration in implementing other projects or recommendations throughout the corridor. Areas with unstable ground will require more complex and generally more expensive treatments.

Based on ODOT's geotechnical report and the inventory analyses completed for this project, MP 28-37 is the primary segment of the corridor with unstable slopes. ODOT's geotechnical report identifies MP 32 to 37 as the segment with the most slides. ODOT is working on an active slide at MP 34.8.

A review of the pavement conditions against the safety analyses revealed the following conclusions:

- 15 of the fatal or serious injury crashes (between 2016 and 2021) (36%) occurred on roadway segments with poor pavement conditions. Three of the fatal crashes occurred between MP 4.47 and MP 8.50 (all three of these involved drugs and were roadway departure crashes), and three fatal crashes occurred between MP 33.36 and MP 34.97 (two involved drugs; two involved aging drivers; one involved speed).
- The flagged safety location at MP 10.5 to MP 10.6 (horizontal curve) has poor pavement conditions.
- The flagged safety location at MP 33.3 to MP 33.4 (horizontal curve and pull-out) has poor pavement conditions and is within an area of landslide topography highlighted in the Advanced Investigation Geotechnical Report for OR6: 34.9 Landslide (Figure 5).
- The flagged safety location at MP 33.8 to MP 34.0 (horizontal curve) has poor pavement conditions and is within an area of landslide topography highlighted in the Advanced Investigation Geotechnical Report for OR6: 34.9 Landslide (Figure 5).

Public comments received related to pavement conditions or unstable slopes included the following:

- *Roads are windy and some slope at the opposite angle to what drivers expect.*
- *Poor pavement conditions can make semis move out of their lane. And in some locations, the superelevation is going in the wrong direction.*
- *Debris in roadway (trees, rocks, etc.) have been contributing factors to crashes.*
- *MP 23 (Jones Creek Road): Segment has a sunken grade and shoulders are falling off.*
- *MP 28 (Elk Creek Road): There is a water ponding issue here. Road condition is poor.*
- *MP 31 ("Devils' Corner" near Drift Creek Road): Area is problematic, road condition is poor, motorists often cannot maintain lanes.*
- *MP 32-36: The roadway condition is poor in this major slide area. (3)*
- *MP 33.5 (Summit, east to South Fork Gales Creek Road): Poor road condition and uneven surface causing vehicles to leave lane of travel.*

Communications

Input from the public and stakeholders revealed that the lack of wireless and optical/wired communications available along the corridor creates additional challenges with reporting and responding to crashes when they occur. Drivers have indicated that they do not know where they are along the corridor after crashes. Drivers also have to travel to obtain service to call for help. This creates delays in responding to crashes and additional challenges for emergency vehicles to access crashes with traffic queues and unknown crash locations.

In addition to the lack of cell phone service throughout the corridor, there is also limited communications infrastructure in place. Some of the issues with installing fiber in long segments of rural highways are limited right-of-way with multiple utilities competing for the same space, lack of power to regenerate the communications over a long distance, and challenging terrain with possibilities of rock impeding boring or trenching. The limited number of customers being served along the corridor makes the cost/benefit calculations for fiber installation lower than other areas.

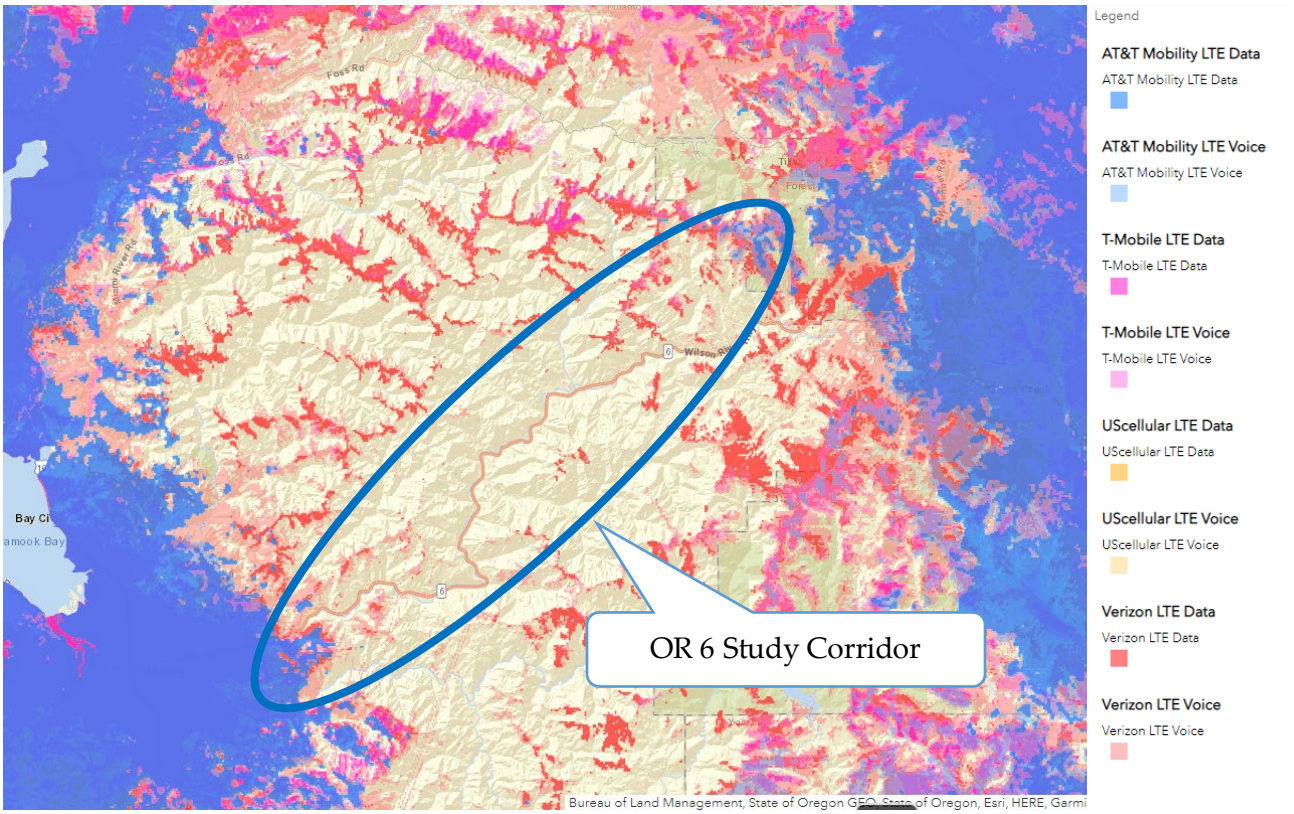


Exhibit 2: Illustration of OR 6 Corridor without AT&T, T-Mobile, US Cellular, or Verizon Coverage
Source: [4G LTE Coverage as of May 15, 2021 (AT&T Mobility, T-Mobile, UScellular, Verizon) (arcgis.com)]

Public comments received related to the communications issue on the corridor included the following:

- *There is almost no cell phone coverage and no indication where coverage is available. This makes it difficult to communicate in emergencies.*
- *There are no weather monitors or cameras that share road conditions at the summit.*
- *MP 7-29: There is poor cell service in this segment.*

Risky Driving Behaviors

Input from the public and stakeholders indicated that driving behaviors are also a concern along the corridor. Concerns voiced included: driving too fast, unsafe passing behaviors, and impaired driving. The safety analysis revealed the following:

- Alcohol or drugs impairment was reported in 6 percent of all reported crashes (27 crashes) and 16 percent (5 crashes) of fatal or serious injury crashes.
- Speed "too fast for conditions" was reported in 27.5 percent of all reported crashes. Project team members driving the corridor observed some of the behaviors. Team members experienced traveling within a queue at around 50 mph or more while observing others trying to pass where there is not enough room to pass, since the speed differential was not necessarily large enough.
- Overall, 49 percent of fatal or serious injury crashes within the study corridor involved at least one of the following risky driving behaviors: impaired driving, speed, unsafe passing, careless or reckless driving, and/or driver inattention.

NEXT STEPS

The Project Team requests confirmation of these issues from the Project Management Team and Stakeholders. These issues will be used to develop solutions for the study in the next step of the project.

The next memorandum will further explore potential impacts and considerations of the recommendations. In particular, this corridor contains larger areas of unstable ground and sensitive environmental contexts. The project will further explore and summarize these in the next memorandum.

For unstable slope areas where projects stay within the existing roadway prism (i.e., no cut or fill or change to drainage regime), lower cost temporary solutions may include geosynthetic-reinforced roadway sections (Deep Patch) or surface drainage improvements. These solutions would not provide long-term mitigation for the unstable slopes however when implemented with a larger project to address safety concerns, they may provide a low-cost benefit to extend the life of the new roadway surface. For unstable slope areas where projects would worsen the existing condition of the unstable slope by adding fill, removing soil, or changing the surface/subsurface drainage regime, a geotechnical investigation and higher cost mitigation solutions may be required to provide a sufficient factor of safety against slope failure. These mitigation solutions for landslides may include retaining walls, subsurface drainage (horizontal

drains or trench drains), or rock-fill buttresses/shear keys. Mitigation solutions for rockfall areas along the corridor may include removal of the hazard (i.e., excavation), reinforcement of the slope face (i.e., draped or pinned mesh), barriers to catch the rockfall (i.e. K-rails or rock fall fence), or increasing the catchment width so the rockfall does not reach the roadway.

Each proposed area of impact will need to be reviewed to assess permitting requirements for biological resources and wetlands/waters resources. If wetland and waters impacts are proposed, the impacts can likely be permitted using the Oregon Department of State Land's General Permit for Transportation-Related Structures and the United States Army Corps of Engineers' (USACE) Nationwide Permit 14 for Linear Transportation Projects (NWP-14). In most cases, modifications or replacements of water crossings will trigger fish passage review by the Oregon Department of Fish and Wildlife. Crossing replacements and increases in impervious surface will trigger Endangered Species Act (ESA) compliance and review by the National Marine Fisheries Service (NMFS). Impacts to ESA-listed terrestrial species will trigger review by the United States Fish and Wildlife Service (USFWS). If the project is funded by FHWA, this ESA consultation process can be achieved via the Federal-Aid Highway Program (FAHP) programmatic Biological Opinion (BO). If the project does not receive funding from FHWA, and it has a USACE removal-fill permit such as the NWP-14, then the Standard Local Operating Procedures for Endangered Species (SLOPES V) programmatic BO can be used to demonstrate compliance with the ESA. If impacts exceed programmatic thresholds, or impacts are proposed to species that were not considered during the programmatic consultation, then the project would need to consult individually with NMFS and/or USFWS.

Lastly, there may be areas where the unstable ground, geometry, or other constraints are impacting roadway design. There may be locations where these constraints are impacting the ability to meet minimum dimensions, such as passing lane lengths and taper lengths. Based on the planning-level review of aerial imagery presented in this memorandum, the Project Team will consider these locations with known design constraints and consider options such as removal of a passing lane if locations are not meeting minimums and cannot be remedied.