

MT HOOD HIGHWAY ROAD SAFETY AUDIT

Timberline Rd to Nottingham

Mile Point 54.20 – 70.20

Audit Dates: November 16-18, 2011 and February 17, 2012



Road Safety Audit (RSA)

Mt Hood Highway (US-26 and OR-35)
Mile Point 54.20 – 70.20

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Introduction

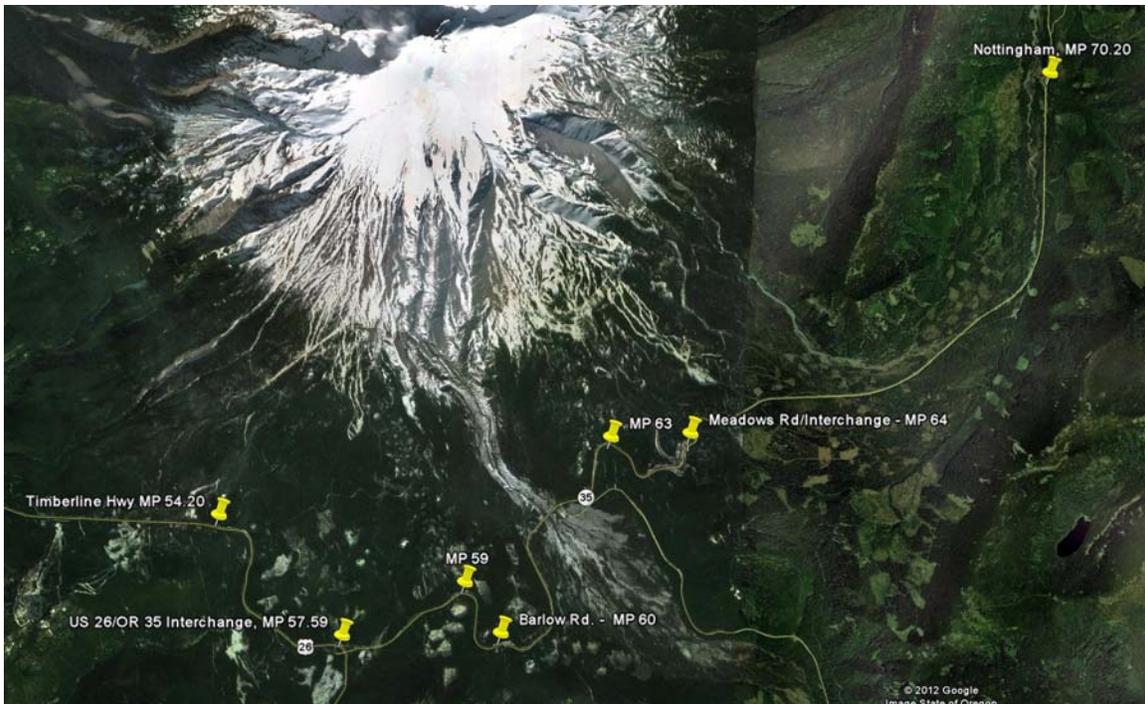
A Road Safety Audit (RSA) was conducted for Mt Hood Highway (US-26 and OR-35) from mile points 54.20 to 70.20 in Clackamas and Hood River Counties. The purpose of the RSA is to conduct a safety evaluation of the corridor, considering the safety of all road users. The objective is to identify potential safety issues contributing to crashes, to qualitatively assess the safety risk and recommend a variety of treatments to eliminate or help mitigate those risks.

Background

This Road Safety Audit (RSA) was prompted by ODOT staff safety concerns around Mt Hood particularly during winter snow/ice conditions that include the high mountain passes elevations and heavy peak period winter recreation traffic volumes. The general objective is for the audit team, as selected by ODOT, to do a Road Safety Audit. The RSA team includes members with diverse backgrounds, different areas of expertise and levels of experience to insure that all aspects related to safety are covered. This RSA is intended to provide for mitigation measures to eliminate and minimize the safety concerns. The Hood River-Mount Hood (OR 35) Corridor Plan adopted by the OTC on August 13, 1999 and the Oregon State Highway 35 Feasibility Study by Western Federal Lands Highway Division of the Federal Highway Administration dated July 2003 were reviewed. This was both to obtain information for this RSA and ensure compatibility. This RSA also will provide the road safety analyses and safety mitigation measures needed for a new OR 35 planning effort scheduled for March.

Elements of this RSA included safety of roadway infrastructure, signing, pavement markings, traffic operations/congestion, intelligent transportation systems (ITS), winter maintenance operations, traffic enforcement and all necessary incidental items for a complete audit. Human (driver) safety factors were also primary factors considered along with the roadway infrastructure safety factors.

Figure 1 that follows shows the section of the Mt Hood Highway (US 26 and OR 35) covered by the audit. The total RSA section length is approximately 15 miles from Timberline Rd (MP 54.2) to Nottingham (MP 70.2). There is a mile point equation in the US 26 section. The US 26 section (Timberline Rd to OR 35) had a much lower 5-year crash rate, much higher traffic volumes and is much wider with mild horizontal curvature. The elevation of this section is also generally lower than much of the OR 35 section. The OR 35 section from US 26 to the Robin Hood Campground has a much higher 5-year crash rate than the US 26 section, much lower traffic volumes, is much narrower with relatively sharp horizontal curves and generally at a higher elevation. These differences will be discussed in more detail later in this report. As a result of these very substantial differences the US 26 and OR 35 sections were analyzed and discussed as separate sections for this RSA.



Audit Vicinity Map

RSA Process:

A start up meeting to gather input from some of the key resources not participating was held on November 16, 2011 in the ODOT Region 1 office. After the meeting, the RSA team travelled to Government Camp. A RSA start-up meeting was held with the RSA team and some of the key resources at the ODOT Government Camp maintenance station to gather known information on safety issues and needs. After the meeting, day time and night time field reviews of the RSA sections were made by the team.

On November 17, 2011 another brief field review was made by part of the RSA team in the snow that occurred overnight. Another RSA team meeting was held to finish identifying safety issues and needs based on the field reviews and all available safety data. The focus of the meeting shifted to identifying and documenting all of the mitigation measures needed to address all of the safety issues.

An RSA presentation was prepared with assistance from the team and some of the key resources. The presentation of the RSA study results and team findings was made in the ODOT Region 1 office on December 13, 2011 to key ODOT staff including key resource persons. Not all of the RSA team members and key resource people were able to attend. The RSA results were discussed and questions answered as needed. The PowerPoint presentation is included as Appendix A of this report.

RSA team members were as follows:

- Dan Serpico - Region 4 Traffic
- Gerry Juster - Region 2 Planning and Development
- Taisei Imamura - Region 2 Traffic
- Eric Ford - Dist. 2C Sandy

- Ian Amweg - Washington County
- Sgt. Duane Larson - Oregon State Police
- Dwayne Hofstetter - Sr. Trans. Eng.

In addition to the RSA team key resources for the RSA are listed as follows:

- Sue D'Agnese - Region 1 Traffic Manager
- Jim McNamee - TMM Gov. Camp
- Robert Hopewell - Region 1 Traffic Investigations
- Katherine Carlos - Region 1 Traffic Analysis
- KC Humphrey - Region 1 Traffic Safety
- Larry Olson - District 2C Manager
- Kirsten Pennington - Region 1 Planning Manager
- Sonya Kazen - Region 1 Senior Planner
- George Fekaris - FHWA-WFL

RSA Findings

This report is organized to describe existing conditions, crash analysis, RSA team safety issues and the mitigations for each route with US 26 first and OR 35 in the next section of the report. The safety issues and mitigations are further organized by discussions in the order of how quickly the mitigations can be implemented. The mitigation measures follow the issues discussions with the short term-high priority and lower cost safety improvements listed first.

US-26 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)

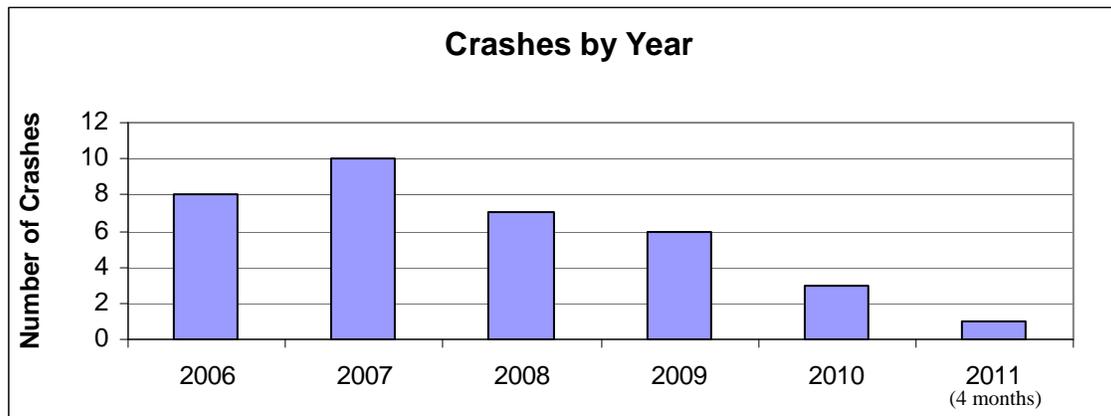
US-26 RSA Analysis

Existing Conditions

The US 26 section of the RSA was from Timberline Rd at MP 54.2 to OR 35 at MP 57.59. As previously mentioned this section of highway generally has good pavement widths with adequate shoulders (approximately 8 feet wide) with wider areas to pull off the road and a WB uphill climbing lane ending at the Timberline Rd Jct. There was a construction project completed in 2008 that made some significant changes east from and including Timberline Jct. It included some new pavement and some shoulder widening. US 26 has good pavement conditions including the paved shoulders, good striping with recessed pavement markers and good striping for the intersections/ ramp connections. The signing is also generally good along US 26 with VMS signs. The average daily traffic (ADT) volume on US 26 is approximately 8,000 vehicles per day (vpd). However there is peak period traffic congestion both during peak winter recreation periods at Mt. Hood and during peak summer traffic periods. The higher winter peak traffic periods contribute to safety concerns as discussed in the following crash analysis.

Crash Analysis

The numbers of crashes per year on US 26 from Timberline Rd to OR 35 for the last 5 years are illustrated in the figure that follows. This figure also shows the number of crashes for the first 4 months of 2011 to include all of the 2010-2011 winter recreation periods. There were 34 reported crashes for the 5 full years (2006-2010) time period with an average crash rate of approximately 0.95 crashes per million vehicle miles travelled. This is slightly higher than the statewide average for rural principal arterial highways of 0.70 crashes per million vehicle miles. There were no fatalities and only one injury A (severe injury) crash. There were no safety priority index (top 10%) locations. The average crash rate is relatively low for a higher elevation mountain pass highway with severe weather conditions in the winter. However 21 of the 34 reported crashes (62%) occurred with ice or snow pavement conditions. Fourteen of the 21 ice or snow crashes occurred on Friday, Saturday or Sunday mostly during high traffic volume/congestion periods on Friday or from 9AM to 6PM on Saturday or Sunday. The most common crash type with 11 crashes was fixed object/run off the road. As can be seen in the following bar chart the numbers of crashes per year appear to be decreasing.



Seven of the 34 crashes were at the Timberline Road intersection. This intersection was at the east end of the 2009 RSA. Concern was expressed about the limited sight distance for right turn drivers from Timberline Highway when there was a vehicle with the driver stopped waiting to

US-26 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

make a left turn on to US 26. Recent observations have shown that some drivers making right turns on to US 26 are using the right shoulder area like an extra westbound lane to accelerate and merge with westbound traffic.

Short Term Findings/Safety Issues

Speed is an issue with the most common driver error (“speed too fast for conditions”). Traffic congestion/delay during peak traffic periods in the winter contributes to safety concerns per the previous crash analyses. This is particularly applicable for the RSA team driver behavior issues listed as follows:

- Risk Taking
- Lack of Patience
- Lack of Driver Education
- Lack of Experience
- Overconfidence
- Lack of Knowledge Regarding Winter Driving
- Drivers are not prepared for winter weather.

Another issue/finding discussed by the RSA team was the need for additional OSP assistance/coverage needed for traffic incidents and enforcement.

Safety Risk:

- Exposure - High
- Probability - High
- Consequence - High
- Resulting Road Safety Risk - High

Short Term Mitigation Measures

Driver education was a key mitigation identified by the RSA team. Specific mitigation measures are listed as follows:

- Consider PSA’s for winter driver preparedness that reference and provide internet links to the real time information sources available.
- Consider including question(s) about winter driving requirements in the driver’s license exam.

Another key mitigation was to provide driver information measures as follows:

- Consider more publicity to use Trip Check for real time road conditions information at Mt Hood
- Consider providing Bluetooth travel times and transit alternatives information.
- Consider using VMS signs to provide drivers traffic information such as incidents and routing in addition to traction device requirements.

The other short term high priority mitigation identified was to make police support more available during winter conditions. This is needed to help clear incidents quicker to minimize congestion and secondary crashes during peak traffic periods:

- Consider applying for an additional police winter funding grant for incident and enforcement coverage.

US-26 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)

Mid-Term Findings/Safety Issues

An existing Timberline Rd condition/issue is the restricted sight distance for right turns from Timberline Rd (2009 RSA finding). A related finding was that some drivers making right turns from Timberline Rd are using the US 26 right shoulder area like an extra WB lane. There is no striping or signing showing this traffic movement that is being made as mitigation for the sight distance restriction for right turning drivers. The picture that follows illustrates stopped vehicles waiting to turn on to US 26 from Timberline Highway with a stopped vehicle waiting to turn left and oncoming WB traffic on US 26.



There is no WB wide area for chain on/off close to the US 26/OR 35 interchange and a widened area is needed east of OR 35 for both WB US 26 and OR 35 NB traffic.

US-26 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

The EB ramp connection to OR 35 NB is difficult to see especially during the winter. The NB OR 35 connection alignment is not normally expected because it veers off to the right and then crosses back across/under US 26 (grade separated) to go north on OR 35 on the left side of US 26. This ramp with the conventional overhead sign is shown on the picture that follows.



Safety Risk:

- Exposure - Medium
- Probability - High
- Consequence - High
- Resulting Road Safety Risk - Medium

Mid-Term Mitigation Measures

- Consider installing a Variable Speed Limits (VSL) system adjusted to the traffic/weather/road conditions to help mitigate the speeds too fast for conditions safety issue.
- Consider applying for additional funding for better OSP coverage and enforcement by making available additional personnel during the winter. This is to make up for a recent OSP staffing decrease.
- Investigate the feasibility of US 26 widening and signing/striping to add a short additional WB traffic lane/merge area west from Timberline Rd. This is to mitigate the restricted sight distance issue for drivers making right turns from Timberline Road on to US 26 WB.

US-26 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

- Consider an additional chain on/off area WB near OR 35. This is needed for both WB traffic on US 26 and NB traffic on OR 35 to install tire chains to safely travel over the high elevation summits.
- Prepare an up to date communications plan with the ski areas and other stakeholders. This is needed to provide real time routing (at ski areas, internet & VMS signs) and travel information to the winter recreation area users.
- Consider installing an overhead EB Diagrammatic sign for the ramp connection to OR 35 NB showing the alignment for the US 26 EB connection to OR 35. This will help drivers follow the alignment particularly when it is more difficult to see during winter road and weather conditions.

OR-35 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)

OR-35 RSA Analysis

Existing Conditions

The OR 35 section of the RSA was from US 26 (MP 57.59) to Nottingham at MP 70.20. There are many sharp horizontal and vertical curves. Towards the north end of the section the highway is straighter and flatter. Both Barlow Pass (MP 59.78/elevation 4161) and Bennett Pass (MP 63.76/elevation 4647) are higher than Government Camp on US 26 (elevation 3995). The OR 35 horizontal curves don't have spiral transitions and have super elevations that are steeper than desirable when the road is covered with ice and or snow. As previously mentioned this section of highway generally has narrow pavement widths with narrow paved shoulders. The wider areas for installation of tire chains are very limited. There is a NB climbing lane ending at the Barlow Road intersection and a short SB climbing lane (Bennett Pass) ending close to the Mt Hood Meadows SB on-ramp connection. Sight distance is restricted at the Barlow Trail/intersection SB due to the topography and both the horizontal and vertical alignment on OR 35. The SB climbing lane at Mt Hood Meadows interchange is mostly within the interchange area and is on curved roadway alignment. Most of OR 35 has poor pavement conditions. The guard rails are all metal except for some in the areas under construction. The metal guardrails have been hit and damaged by vehicles in many places.

However there is good striping with some recessed centerline pavement markers. Snow poles that are in place during the winter provide for good road side delineation both day and night. The signing is generally fair with good reflectivity except for damaged signs along OR 35 with no existing VMS signs. However some of the signing is often difficult to see particularly in the winter when there are large amounts of snow. The average daily traffic (ADT) volume on OR 35 is approximately 1,700 (1500-2100) vehicles per day (vpd). Even though the traffic volumes are relatively low there is peak period traffic congestion during peak winter recreation periods at Mt. Hood Meadows. It was reported that there may be as many as 25,000 vpd in a peak Mt Hood Meadows winter recreation day. These peak periods traffic conditions also contribute to safety concerns on OR 35 particularly on Friday, Saturday and Sundays during the winter with snow and or ice on the roadway as discussed in the crash analysis that follows. The peak traffic periods occur between the hours of 6AM and 6PM when most of the crashes also occur.

OR-35 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

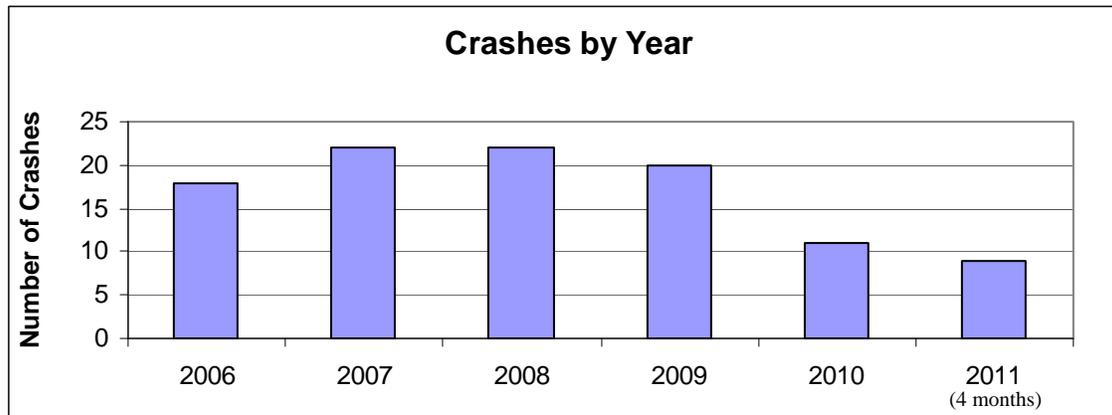
There are two FHWA projects on OR 35 that currently under construction that will result in horizontal curves with spiral transitions and paved shoulders that will be 8 feet wide. These will be major improvements from MP 61.1 to MP 62.14 (White River) and MP 65.32 to MP 68.23 (Clark Creek). There is also a left turn lane installation project (MP 64.81 to 65.07) planned for construction at Sahalie Falls Loop Road to Mt. Hood Meadows shown on the following photo.



OR-35 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)

Crash Analysis

The numbers of crashes per year on OR 35 from US 26 to Nottingham for the last 5 years are illustrated in the figure (bar chart) that follows. This figure also shows the number of crashes for the first 4 months of 2011 to include all of the 2010-2011 winter recreation periods. There were 93 reported crashes for the 5 full years (2006-2010) time period with an average crash rate of approximately 2.57 crashes per million vehicle miles travelled. This is substantially higher than the comparable statewide average for rural principal arterial highways of 0.70 crashes per million vehicle miles. There were 2 fatalities in one crash and 9 injury A's (severe injuries) in 4 crashes. The average crash rate is similar to the high elevation mountain pass (2.65 in 2010) on the Santiam Highway (US 20) that also has severe weather conditions in the winter. Seventy three of the 93 reported crashes (78%) occurred with ice or snow pavement conditions. Fifty-six of the 73 winter crashes were on Friday, Saturday or Sunday and 45 were from 6AM to 6PM. Forty of these involved failure to maintain traffic lane or run off the road. Speed too fast for conditions was listed as the most common causative factor in 67 of the 93 crashes. As can be seen in the following bar chart a trend for the number of crashes per year isn't readily apparent. The trend appeared to be downward in 2010 but was up in 2011 based on the 4 months of available crash data.



Fatal and Injury A Crashes

There were 2 fatalities and 5 injury A's in one head on crash on ice at MP 69.66. Two of the injury A crashes were separate motorcycles on different curves with dry pavement in July. There also was a SB injury A with snow on the road involving Fixed Object. The other injury A crash involved a left turn on snow from Mt. Hood Meadows (Sahalie Falls Lp). The majority of the severe crashes were also located at the 4 high safety priority index (SPIS) sites on OR 35.

OR-35 RSA Analysis *(Existing Conditions, Crash Analysis, Findings and Mitigations)*

SPIS

The 4 SPIS sites all had winter related crashes during the day. The first location from MP 58.92 to 59.09 was in a long horizontal curve. The second site was from MP 63.91 to 64.09 in the curves at the Mt. Hood Meadows Interchange. The third site was from MP 64.90 to 65.08 involving left turning and Fixed Object crashes at the Sahalie Falls Loop Mt Hood Meadows access road. The fourth site was from MP 69.57 to 69.75 in a straight section of road with a mild vertical grade in a no passing zone. The 2009 severe crash with 2 fatalities and 5 injury A's involved a SB 16 year old driver that had apparently just completed passing another vehicle then lost control on ice and struck a NB vehicle in the NB travel lane head on at MP 69.66. The 16 year old had a restricted drivers license not allowing the two young passengers in his vehicle. A picture of this location follows.



Short Term Findings/Issues

Speed is an issue with the most common driver error (“speed too fast for conditions”) in 72 % of the crashes. Traffic congestion/delay during peak traffic periods to and from Mt Hood Meadows in the winter contributes to safety concerns and issues. As previously discussed the majority of the crashes are during the winter with snow and or ice. Traffic congestion may prompt driver behavior issues that result in more drivers speeding. The RSA team identified driver behavior issues are listed as follows:

- Risk Taking
- Lack of Patience
- Lack of Experience
- Overconfidence

OR-35 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

- Lack of Knowledge Regarding Winter Driving
- Drivers are not prepared for winter weather (driver education).

Additional police assistance/coverage is needed during winter weather for incidents, additional police presence and enforcement. Based on past research police presence has reduced speed and had safety benefits as a result of less risky driver behavior.

Safety Risk:

- Exposure - High
- Probability - High
- Consequence - High
- Resulting Road Safety Risk - High

Short Term Mitigation Measures

Several driver education high-priority short-term projects were identified: Driver Education:

- Consider preparing PSA's for winter driver preparedness that reference and provide internet links to the real time information sources available.
- Consider including question(s) about winter driving requirements in the driver's license exam.

Several driver information high-priority short-term projects were also identified: Information:

- Consider providing more publicity (PSA's) to use Trip Check for real time road conditions information at Mt Hood.
- Consider providing real time Bluetooth travel times and transit alternatives information on the internet.
- Consider using VMS signs to provide driver routing, road and incident information in addition to traction device requirements.
- Consider installing larger curve signs with distance riders and steel sign supports. (MP 64-65) as warranted for the series of curves in the Mt Hood Meadows interchange area.
- Consider installing chevrons for additional delineation for sharp curves and at the end of widened areas (MP 64 -65) as warranted.
- Consider removing the SB Passing lane at Mt Hood Meadows Interchange.

The other high-priority short-term project identified was to consider obtaining additional winter time short term police coverage (Funding Grant).

Mid-Term Findings/Safety Issues

A medium term issue is the existing OSP coverage starting at the Hood River/Clackamas county line to the north through the Mt Hood Meadows interchange is supposed to be covered from The Dalles OSP office. This is far enough away from Mt Hood Meadows that it makes it somewhat impractical to respond to any incidents on OR 35 in a timely manner particularly in the winter. As a result OSP coverage is quicker and more practical from Government Camp that has recently had an OSP staff reduction.

Traffic Congestion/Delay/Safety in peak winter periods is a concern particularly with the relatively narrow sections of road (need wider shoulders and additional chain up areas). These winter safety issues are discussed in the previous crash analysis. Trees close to the road are also a safety concern for ice spots (shaded areas) and restricted sight distance. Drivers frequently lose control on sharp curves with no spiral transitions and steep cross slopes (super elevations). This

OR-35 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

issue is especially a concern with the winter ice and or snow conditions when vehicles slide on the curves. The sharp curves at MP 59(SPIS), 60, 63 & 64(SPIS) are particular concern locations in the winter with passing lanes, trees and steep supers. Three of these curves are shown in the following pictures. The other one near MP 64 is shown later in the Mt Hood Meadows Interchange area issues discussion.



OR-35 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)



OR-35 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

Some of the traffic signs may be too small and too low for good winter visibility (also need steel supports that don't break off in the winter). There are no snow banks and snow poles close to the roadway in widened sections and additional delineation (chevron signs) at the ends may make it easier for drivers to follow the road in the winter.

The curves at MP 64 are in the Mt Hood Meadows Interchange and also in a short SB climbing lane. This climbing lane likely encourages some higher speeds with passing on the curves. All of the guardrails except in the construction projects are metal and are less effective for vehicle redirection. The metal guardrails require a lot of maintenance to repair damage from vehicle impacts particularly in the curve sections.

The Barlow Road/Trail intersection area has safety concern issues mostly related to the restricted sight distance as follows:

- The cut bank/trees in the NE quadrant of the side street approach restrict sight distance to the north. This makes drivers pull forward beyond the stop bar to see SB approaching vehicles as illustrated in the 2 pictures on the next page. The first picture is looking NB at the intersection. The second picture illustrates the restricted sight distance looking north for a driver stopped on Barlow Road. This picture was taken on November 16 after the snow overnight. With heavier snow and larger snow banks the sight distance would be more restricted.



OR-35 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)



- The restricted sight distance is also a safety concern for drivers and hikers crossing OR 35 on the trail.
- The crossing/intersection is located in a curve that also contributes to the restricted sight distance with the cut bank in the NE quadrant.
- The trail crossing and road intersection are located close to the Barlow Pass Summit (4160) with lower winter temperatures.
- The SB pedestrian crossing warning sign was down (missing).

There were several safety concern issues identified by the RSA team for the Mt. Hood Meadows Interchange area that also is SPIS site:

- The short passing lane combined with sharp horizontal curves, winter peak traffic congestion and high elevation for Bennett pass (4650) in the Mt Hood Meadows Interchange are issues.
- Some drivers are making a sharp U-turn type maneuver across the gore area from NB to SB on to the Meadows off-ramp.
- The curve signing needs to be upgraded and have distance riders.
- An additional VMS sign is needed facing traffic leaving Mt Hood Meadows directing drivers to go NB or SB on OR 35.
- The delineation at the ends of widened/taper sections may be easier to follow with chevron signs.

OR-35 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)

Typical views of the interchange area from the air and on OR 35 SB are shown in the following pictures:



OR-35 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)



OR-35 RSA Analysis
(Existing Conditions, Crash Analysis, Findings and Mitigations)



Safety Risk:

- Exposure - Medium
- Probability - High
- Consequence - High
- Resulting Road Safety Risk - High

Mid-Term Mitigation Measures

The medium-priority mid-term projects for consideration are as follows:

- Remove Trees that shade and contribute to ice on the highway at selected locations.
- Propose new OSP boundary north of Mt Hood Meadows to have closer traffic patrols available.
- Additional funding for better OSP coverage and enforcement.
- Install a Variable Speed Limits (VSL) system.
- Minor OR 35 maintenance widening and wedge paving to reduce super elevations on sharp curves as appropriate (near MP 59, 60, 63 & 64).
- Minor widening to install a right turn deceleration lane for the SB Mt Hood Meadows off-ramp and extend the NB on-ramp.
- Install CCTV and an additional VMS sign at the interchange to inform & direct exiting Meadows traffic of conditions on OR 35/US 26/I-84 and whether to go north or south on OR 35.
- Prepare an alternate route communications plan for Mt Hood Meadows and OR 35 detour routing.
- Install centerline rumble strips.

OR-35 RSA Analysis

(Existing Conditions, Crash Analysis, Findings and Mitigations)

- Review no passing zones (crash history, signing, merging on OR 35) and make adjustments as appropriate.
- Ball bank the curves to determine curve signing needed to comply with the 2009 MUTCD
- Install new larger curve signs on steel supports per the 2009 MUTCD requirements.

Long Term Findings/Safety Issues

As previously discussed, traffic Congestion/Delay/Safety in peak winter periods is a concern particularly with the relatively narrow sections of road (need wider shoulders and additional chain up areas). Winter safety issues are demonstrated in the previous crash analysis. Trees close to the road are also a safety concern for ice spots (shaded areas) and restricted sight distance. Drivers frequently lose control on sharp curves with no spiral transitions and steep cross slopes (super elevations). This issue is especially a concern with the winter ice and or snow conditions when vehicles slide on the curves. The sharp curves at MP 59(SPIS), 60, 63 & 64(SPIS) are particular concern locations in the winter with passing lanes, trees and steep supers.

Safety Risk:

- Exposure - Medium
- Probability - High
- Consequence - High
- Resulting Road Safety Risk - High

Long Term Mitigation Measures

Long term safety issues that need additional study were identified:

- Review feasible future mitigation options to reduce crashes for the sections of OR 35 with sharp curves near MP 59 (SPIS), MP 60 (Barlow Rd/trail), MP 63 and MP 64 (Mt Hood Meadows, SPIS).
- Review potential future locations for shoulder widening and replacing the metal guardrail with aesthetic concrete barrier at crash locations where the guardrail is frequently hit.
- Review potential future selected locations for additional chain up areas that could also be used for enforcement.

General Background

This Road Safety Audit (RSA) addendum was prompted by ODOT staff as a result of winter snow condition safety concerns around Mt Hood. The winter driving conditions with more snow are significantly different than conditions during the initial RSA field review last November when there were minimal amounts of roadside snow. As a result a winter RSA field review was conducted on February 17, 2012. The road surfaces generally were well sanded with mostly bare pavement. Conditions on Timberline Road and the roads to Mt Hood Meadows were also briefly reviewed. The persons participating in this review were Larry Olson ODOT District 2C Manager, Sue D'Agnese ODOT Region 1 Traffic Manager, Dan Serpico, ODOT Region 4 Traffic and Dwayne Hofstetter Sr. Transportation Engineer. Larry pointed out winter safety concerns as part of the winter field review.

During the winter, drivers often don't have striping and signing visible for guidance and warning. The painted striping is not even visible on bare pavement in the winter. Without guidance and warning driving aids, safely travelling on the road is mostly dependent on the driver's abilities and experience. As a result significant differences in speeds between different drivers were observed during the winter field review. This may contribute to the impatience and aggressive driving actions.

The Level of winter Maintenance Service for US 26 is level A requiring plowing and keeping bare pavement. The OR 35 section is level B requiring plowing/sanding but not keeping the pavement bare at all times and applying as much liquid deicer. As a result there may be some additional times that there will be snow pack on the road on OR 35 as a result of the lower level of maintenance service standard and the unavailability of the manpower/equipment to keep the pavement bare at all times. Due to the higher elevations winter temperatures are often lower on the OR 35 mountain pass summits (Barlow and Bennett) than at Government Camp on US 26. This can result in ice conditions requiring sanding sooner on OR 35 than on US 26. As a result there generally isn't much difference on the two routes except that there may be snowpack longer on OR 35. When there is ice on both routes at the same time US 26 will receive the road maintenance mitigation treatments first. This could be a safety concern on OR 35.

Dan Serpico also observed peak winter traffic conditions on US 26 just before 5PM on Monday February 20. WB traffic on US 26 was backed up (stopped) from the OR 35 Interchange for a distance of over 6 miles to the west past Ski Bowl and Government Camp Loop. Jim McNamee stated that this is typical of weekend days during peak traffic periods in the ski season and also that there is similar traffic congestion during some peak periods in the summer but not as severe as in the winter. Larry Olson also confirmed the winter peak period conditions. On Sunday February 19 he said it took 2 hours to go 10 miles west bound from Frog Lake on US 26. He also observed some of the impatience with vehicles passing traffic in the oncoming traffic (EB) lane and drivers being unprepared (ran out of gas). As a result the peak period traffic demands are over capacity for the single US 26 WB lane from Still Creek Road to the west. This addendum to the previous RSA report is supplemental to it and documents the winter driving conditions on US 26 and OR 35 during peak winter periods with significant roadside snow banks/depths present.

Winter Conditions Safety Issues/Concerns:

Many of the issues identified in the previous RSA report were more severe during this winter review as a result of the winter conditions. An example of this is the pavement condition on OR 35 last November appeared to be closer to fair with pavement cracking and some smaller

Winter Conditions Addendum

pavement deformation areas. Based on this February review the pavement condition definitely is poor showing a number of pop out areas (holes in the surface). As a result the pavement condition rating has been revised in the final RSA report to poor. Sight distance is significantly more restricted in the winter due to the snow banks along the road.



Pavement markings that were described as good during the November, 2011 review were for the most part not visible throughout the RSA section during this winter review. The recessed marker pavement slots were mostly filled with sanding material and the painted pavement lines were either worn out (mostly gone) or covered with sanding material. The signing was in much worse condition with numerous broken off sign supports close to the road and signs further from the road buried in the snow with the signs not visible at all. In addition there were many sheet aluminum signs observed in this winter review, that were bent back and not legible to drivers. These winter signing visibility issues were particularly evident on OR 35. This illustrates the need for additional winter mitigation curve warning sign mitigation on OR 35.



Winter Conditions Addendum

Winter operations were observed at the west end of the RSA section at Timberline Road. In addition to the November safety concerns, it was found that there are a number of pedestrians crossing US 26 and hitchhiking on Timberline Road to the ski areas. Another observation was fast moving traffic eastbound on US 26 turning north on Timberline Road across the worn off painted island on the Timberline Road approach. It was also found that Timberline Road from US 26 to Timberline Lodge has some of the same winter condition safety concerns as the RSA section with no pavement markings visible and many signs also not visible.



Winter Conditions Addendum

The winter conditions at the US 26 EB to OR 35 NB off-ramp further emphasized the need for diagrammatic signing as proposed in the RSA report. This was also confirmed by Larry Olson on February 19 when he observed an EB vehicle that apparently missed the OR 35 exit and turned left on the WB US 26 to NB OR 35 ramp connection. The alignment of the off-ramp connection is also less visible with the snow on the ground. The OR 35 Exit sign had been knocked down and was lying in the gore area. This may have been the result of driver indecision at the exit. Exiting to the right to cross back across US 26 violates driver expectations. Snow depths were almost up to the bottom of the ¼ mile exit sign to “Hood River”. The visibility of this sign could be impaired with another foot or two of roadside snow. As a result the previously proposed diagrammatic sign showing the ramp connection to OR 35 alignment is an important future safety mitigation project.

Sight distance at the OR 35/Barlow Road intersection (small Sno-Park) location was also more restricted with the snow bank in the northeast quadrant. This requires drivers on the Barlow Road approach to pull up even further beyond the “STOP” sign to see SB traffic approaching from the North on OR 35. The curve sign speed rider is also bent.



Winter Conditions Addendum

Another example of sign visibility issues was the Stop Ahead symbol sign was laying over on the snow bank on the Barlow Road approach to OR 35.



Winter Conditions Addendum

There were numerous signs down with broken wood supports, bent signs and signs covered with snow in the OR 35 Mt Hood Meadows Interchange area. This included curve warning signing and some major intersection guide signs. These signing safety concern issues further support the RSA signing proposals for warning signs on steel supports higher above the ground and for the VMS sign proposal on the Mt Hood Meadows Road approach towards OR 35 to inform and direct traffic leaving the Mt Hood Meadows winter recreation area. The only type of sign substrate not bent or broken was extruded aluminum. As previously stated, there were many sheet aluminum signs that were bent and there were wood rectangular signs that were broken. A broken wood sign along US 26 is shown in the following picture.



Winter Conditions Addendum

Pictures of a covered OR 35 warning sign and an Mt Hood Meadows Interchange intersection sign assembly at OR 35 follow.





The driver impatience behavior trait was exhibited by a closely following small all-wheel drive vehicle. There appeared to be a high percentage of this type of vehicle involved with aggressive driving at the ski areas. There appeared to be a mix of driver types that likely contributes to the lack of driver patience and risk taking behavior traits identified as issues/concerns in the RSA. Larry Olson observed several examples of the impatience on February 19 including passing and WB vehicles turning around He also observed some WB traffic using the Government Camp Loop Road to go around stopped traffic and adding to the US 26 WB congestion when traffic stopped on US 26 to let them reenter at the west end of the loop road. These factors all point to the need for driver education.

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Some of these traits are also likely exasperated by demand exceeding the available parking facilities during peak periods in the winter. Another issue related to the winter parking issue is that some drivers have parked on the narrow shoulder area along OR 35 and had their cars towed. As a result the drivers/passengers have had to figure out a way to get to Hood River where the vehicles have been towed to. This also illustrates the needs for education and better real time communications with winter drivers proposed in the RSA.

The observations on US 26 illustrated the crucial need for the overhead diagrammatic sign recommended in the RSA for EB traffic at the OR 35 interchange. Overhead signing is also needed on OR 35 for both crucial guide and warning signs. Many of the signs are not visible in the winter. The winter crash history on OR 35 showed the need for better warning signing with the majority of crashes during the winter involving vehicles leaving their traffic lane or running off the road. This supports the recommendation in the RSA for the VMS sign for guidance at Mt Hood Meadows interchange for traffic leaving Mt Hood Meadows. This also supports the mitigation measure in this addendum for the overhead and the supplementary curve warning signs on OR 35. Examples of the proposed curve signing and an overhead warning sign installation are shown in the pictures on the next page.

US 26/OR 35 Winter and OR 35 Winter Signing Safety Risk:

- Exposure - High
- Probability - High
- Consequence - High
- Resulting Road Safety Risk - High

Additional US 26/OR 35 Winter Conditions Mitigation Measures:

- Consider forming a panel of experts to develop an effective educational effort to help aggressive and impatient drivers use safer driving actions.
- Consider providing real time information on the internet and on additional advance signing messages by the ski areas informing drivers when/where the parking facilities are full and no longer available. This requires development as an element of the communications plan proposed in the RSA. It will encourage drivers to choose an alternate form of transportation or go to an area where parking is still available.
- Consider providing drivers with real time information on alternate travel modes times and routes during periods of traffic congestion. This is supplementary to the short term high priority mitigations for real time information in the RSA.
- Consider providing additional public information (PSA's) that any vehicles left parked and unattended along highway/roadway shoulders partially on the roadway will likely be towed. The Sno-Park program could be one potential source to consider for providing this type of PSA information.
- Consider alternate durable striping materials such as urethane.
- Consider changing the winter maintenance level of service on OR 35 from level B to level A from US 26 to the Mt Hood Meadows interchange.

Additional OR 35 Winter Conditions Signing Mitigation Measures:

- Consider using wood substrate for diamond shaped and square advisory plaque warning signs.
- Consider telespar as an alternate to wood supports.
- Consider extruded aluminum substrate for rectangular shaped signs.

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- Consider installing supplementary combination horizontal alignment/advisory speed signs (W1-1a, W1-2a) warning signs for the curves at MP 59, MP 60, MP 63 and Mt Hood Meadows interchange (example shown on the next picture).
- Install an overhead "CURVES" warning sign with a "6-MILES" advisory plaque for NB traffic at approximately MP 58.5 and for SB traffic at approximately MP 64.5 (example of overhead warning sign installation on the next page).

Winter Conditions Addendum

