

Cornelius Pass Road Safety Evaluation JTA

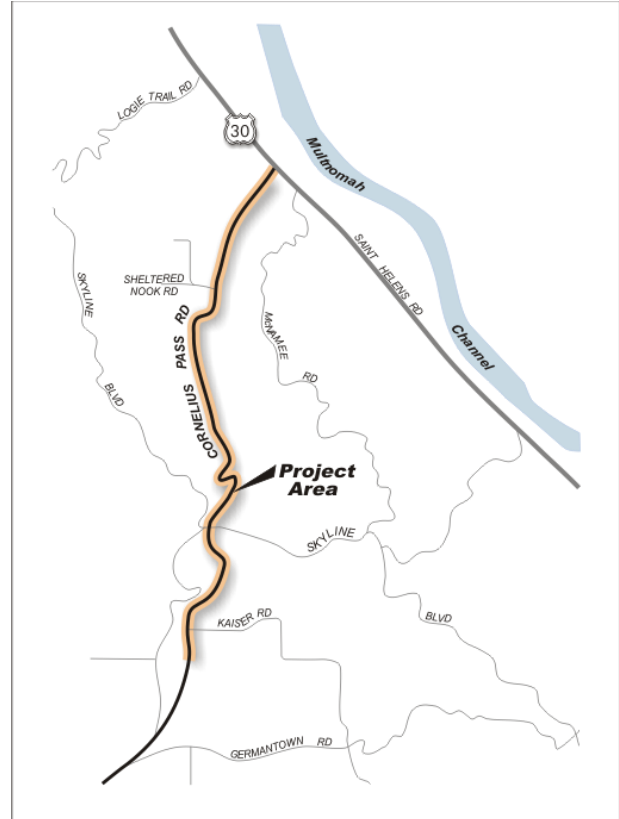
Final Report

BACKGROUND

The Jobs and Transportation Act, adopted by the 2009 Oregon Legislative Assembly, directs the Oregon Department of Transportation (ODOT), in consultation with local government, to develop design alternatives to improve safety for at least one county road that is used for hazardous materials routing in lieu of a state highway. ODOT identified Cornelius Pass Road, an arterial that runs between Washington County (City of Hillsboro) and Multnomah County (Lower Columbia River Highway [US 30]), as a road meeting these requirements. The project vicinity is shown to the right. This road safety evaluation focuses on a five-mile section of Cornelius Pass Road within Multnomah County.

Prior to the 2009 corridor safety directives, the Cornelius Pass Road Work Group was formed following the tragic fatality crash involving a local teenager. The work group focused on developing safety improvements and included representatives from Multnomah, Columbia and Washington counties, ODOT, the Taija Belwood Foundation, the Oregon Trucking Association, Multnomah County law enforcement and several Oregon legislators. Members of this work group contributed to the Federal Highway Administration (FHWA) Road Safety Audit (RSA). The RSA was completed in December of 2008 and covered Multnomah County's five-mile segment of Cornelius Pass Road between the Washington County border and US 30. The RSA identified 18 safety issues along the corridor and provided a set of recommended low-cost improvement options.

Since the completion of the RSA, Multnomah County utilized federal stimulus funds to implement many of the recommended low-cost options. Notable improvements included upgrading critical sections of guardrail, installing centerline and shoulder rumble strips, vehicle speed feedback signs, and a pair of flashing yellow beacons with warning signs. Additionally, ODOT is designing a project to improve the safety and operation of the intersection of US 30 and Cornelius Pass Road.



South Flashing Yellow



Speed Feedback Sign

A project team that included staff from Multnomah County, ODOT, consulting firms, and Portland State University (PSU) was assembled to define the scope of additional potential safety improvements along Cornelius Pass Road. The goal was to propose a range of improvement alternatives and associated costs to improve the safety of Cornelius Pass Road for motor vehicles, freight and hazardous material transport. The consultant design team was co-led by DKS Associates (DKS) and Kittelson & Associates, Inc. (KAI). Additional members of the consultant design team included 3J Consulting, Convergent Pacific, and Howell Consulting. See Appendix “A” (Project Team) for team individuals.

The project team collaborated further to gather information and ideas with representatives from ODOT, PSU, Multnomah County, Washington County, and Portland Public Schools to provide a range of innovative improvement alternatives that include both engineering and non-engineering solutions. This collaborative approach provided several opportunities, as summarized below, to brainstorm ideas and exhaust a range of concepts to address the safety concerns.

- Field Visit: Observed geometric, land use and environmental conditions as well as driver behavior at identified areas of safety concerns.
- Design Workshop #1: Brainstormed ideas for key corridor locations based on collision and crash data.
- Design Workshop #2: Presented, evaluated and screened initial concepts to select and refine alternatives.
- Design Workshop #3: Presented select alternatives determined as part of the refined analysis.

EXISTING CONDITIONS ASSESSMENT

Cornelius Pass Road connects the important transportation corridors of Tualatin Valley Highway (OR 8), Sunset Highway (US 26), and US 30. The Multnomah County segment of Cornelius Pass Road has two-lanes, substandard shoulder widths and no turn lanes (with the exception of the Skyline Boulevard intersection). Within Multnomah County, the average daily traffic (ADT) and truck percentages range between 10,500 vehicles with 12.7% trucks near the Skyline Boulevard intersection and 11,500 with 13.4% trucks near the Sheltered Nook Road intersection.

Collision Data Collection and Analysis

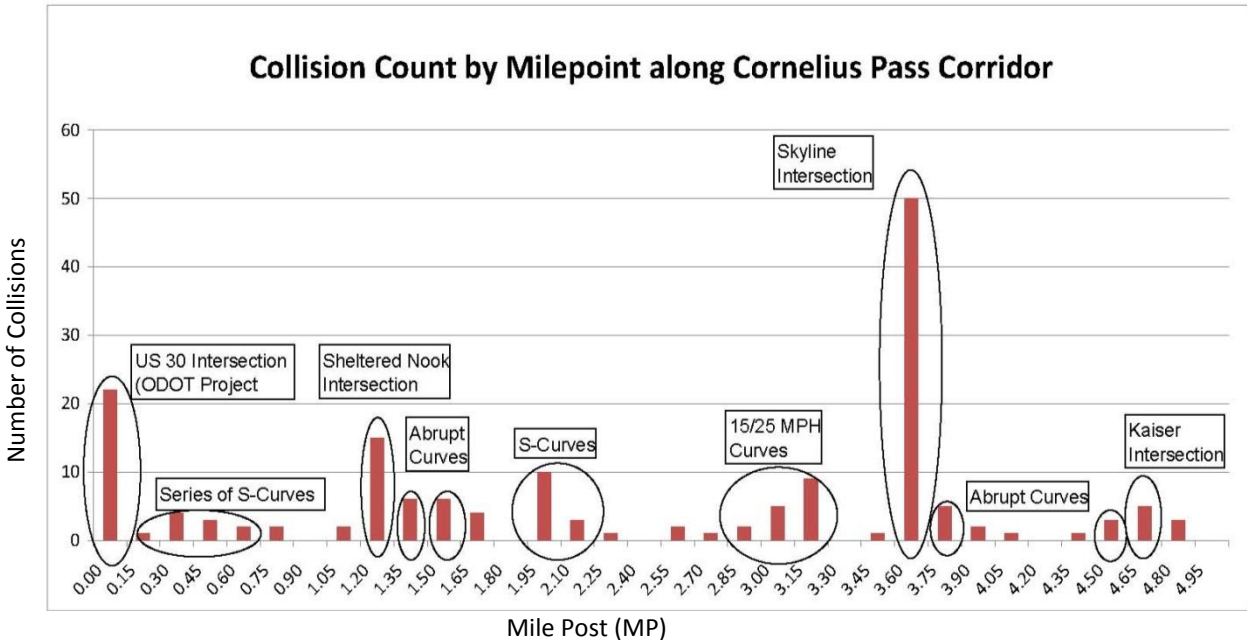
In order to develop a thorough understanding of safety concerns along Cornelius Pass Road, collision data was collected and analyzed from three sources.

- The Multnomah County Sheriff’s Office traffic crash reports, which included collision data from 2003-2007.
- The Oregon Department of Transportation’s Crash Analysis and Reporting Unit collision data from 2007-2009.
- The Oregon Traffic Safety Data Archive (OrTSDA), provided by PSU, which included collision records from 2003-2009.

The collision records from all three sources were combined and duplicate records were identified and consolidated. Then the crash records were analyzed for trends, such as collision severity, collision type, environmental conditions, and time of day. Collision diagrams were created for each record to create a visual tool along the corridor that showed the location, type, and severity of each collision. Collision diagrams are attached in Appendix “B” (Design Workshop #2) that illustrates each project area. Other information such as peak hour traffic volumes, vehicle speeds, and vehicle classifications collected by Multnomah County were also used to enhance the understanding of the safety concerns along Cornelius Pass Road. Traffic data trends were evaluated at three locations along the corridor to identify vehicle class, speed, volume and peak travel times.

Collision Analysis

Along the five-mile corridor of Cornelius Pass Road from the Multnomah County line to Highway 30, 171 collisions records between the years 2003 through 2009 were evaluated. The chart below illustrates the key locations along the corridor where clusters of collisions were identified.



Eleven key locations, as shown in the circled areas above, were identified as areas with safety concerns due to the number of collisions. ODOT already has a project underway to address operational and safety deficiencies at the US 30/Cornelius Pass Road intersection, which is one of the eleven key locations. A detailed review of the corridor wide crash data is included in the attached Appendix "B" (Design Workshop #2). Of all crashes recorded, the majority (nearly 60%) of the collisions occurred under dry, daylight conditions. This implies that roadway conditions are likely contributing to the collisions along the corridor. Ten of the 171 total recorded collisions involved trucks (approximately 6%) while trucks consisted of 12-13% of the total traffic volumes. Based on these records, truck collisions do not appear to be the primary safety concern along the corridor.

Speed studies indicated that travel speeds were not significantly higher than the posted speed limit of 45 mph along the corridor (e.g., the 85th percentile of speed was approximately 45-50 mph in the vicinity of the Sheltered Nook Road intersection). However, collision reports indicated that approximately one-third of the collisions note that the driver was traveling too fast for the conditions. With these types of collisions, the contributing factors are often a combination of driver behavior, environmental conditions, and roadway geometry.

CONCEPTUAL IMPROVEMENT PROJECT LIST

The project team identified 27 potential safety projects by conducting a field visit of the corridor and holding Design Workshop #1. These 27 projects can be divided into three categories:

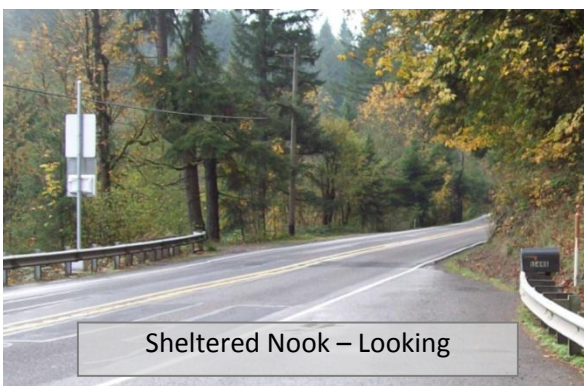
- Location specific improvements (e.g., intersection geometric improvements)
- Corridor wide improvements (e.g., corridor lighting)
- Policy considerations (e.g., corridor design guide)

The improvement project location map (on page 6) shows the high-collision locations that were identified within the study area. The project concepts that were originally considered for improving the safety of the Cornelius Pass Road corridor included 23 different improvement projects at 10 locations along the corridor, two corridor wide projects and two policy consideration packets.

Location Specific Improvements

Of the 10 locations with proposed improvements, seven include areas with either a horizontal or vertical curve or a series of s-curves, and the remaining three locations are intersections. Two or more project alternatives (roadway realignment or sight distance improvements) have been developed for the sections of road with existing curves and collisions. The preliminary projects included a corridor long project that would realign all curves with a less than 45 mile per hour design speed. This would improve driver expectations through the entire Cornelius Pass Road corridor and reduce the likelihood of drivers losing control of their vehicles, which was a contributing factor in a significant number of past collisions. The other improvement alternative considered for these curved sections would be to remove roadside obstacles restricting the drivers' sightline through a curve. This would allow drivers more time to react to changing conditions (such as other vehicles slowing down to make a turn or obstacles on the road). Additionally, both of these project alternatives for the curves could be augmented with a widening of roadway shoulders to allow for increased recovery areas and reduce the likelihood of collisions causing traffic interruptions.

The recommended intersection projects include improving intersection geometrics and sight distance. Geometric improvements include the construction of turn pockets to separate slow moving vehicles from the main traffic stream, thereby reducing the likelihood of rear-end collisions. Improving sight distance along the corridor provides drivers with additional time to react to on-coming vehicles and roadway conditions. As an example, Skyline Boulevard, which had the highest occurrence of collisions, includes a variety of proposals to increase the available sight distance, improve existing turn lanes, and modify the existing traffic control from the existing two-way stop control to a roundabout.



Sheltered Nook – Looking



Skyline – Looking South

Corridor Wide Improvements and Policy Considerations

Proposed improvements along the entire corridor included roadway lighting, roadside treatment (e.g., guardrail), a design guide and potential corridor policy recommendations. The installation of roadway lighting along the corridor could reduce collisions that occur at night. Additional roadside treatments would help reduce the severity of collisions that occur when drivers lose control of their vehicles. A proposed design guide for the corridor and a variety of policies could provide a more consistent roadway and utilize signs to reduce unexpected changes in the road conditions and increase driver awareness.

Larger, more costly improvements, such as additional travel lanes or the general roadway straightening projects were beyond the scope of this evaluation and were not considered because the associated environmental, land-use and capital costs would outweigh the safety benefits gained. Furthermore, based on

the projected volumes for 2030, the capacity of the current two lanes would be sufficient for future traffic needs. The 2030 forecasted traffic will be operating at 87% of the available capacity.

Some of the project concepts may be installed in phases. For instance, roadway lighting could initially be installed where there have been high numbers of collisions at night, while lighting for the entire corridor could be installed at a later date. Appendix “B” (Design Workshop #2) has narrative and exhibits as part of each project area package illustrating more details associated with the proposed improvements.

EVALUATION CRITERIA AND INITIAL CONCEPT SCREENING

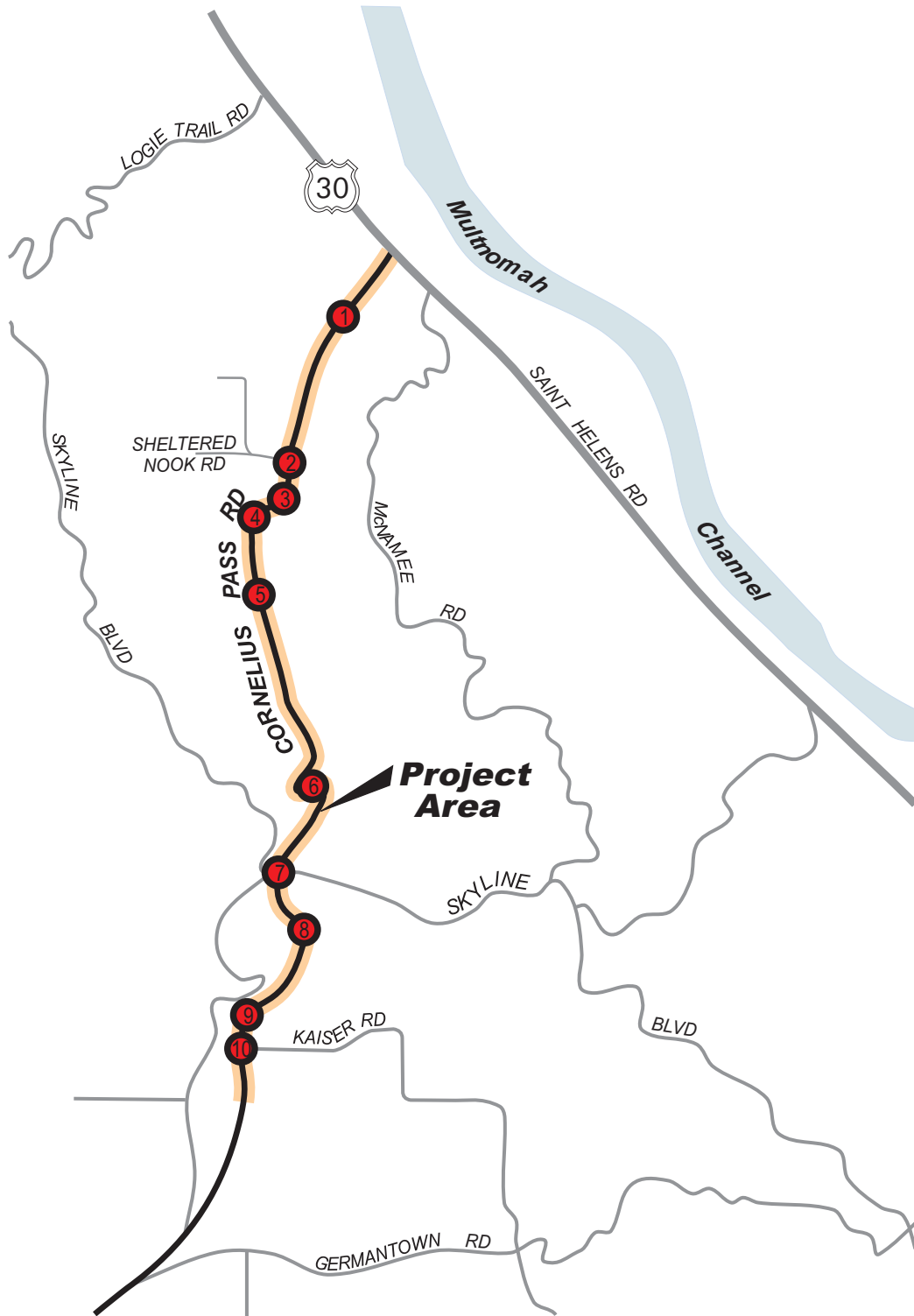
As part of Design Workshop #2, the participants collaboratively agreed on nine evaluation criteria to screen the 27 project alternatives and to select the most promising projects for further analyses. The evaluation criteria include:

- Safety Benefit-cost analysis
- Collision frequency and trends
- Economic impact (e.g., temporary closure due to incident)
- Right-of-way/environmental impacts
- Maintenance
- Future capacity
- Constructability
- Funding sources
- Future compatibility and consistency with the Region’s vision.

The initial screening evaluation was conducted within the workshop setting using a qualitative approach. Each project was assigned a qualitative rating (good, fair, or poor), relative to each of the evaluation criteria. Appendix “C” (Concept Evaluation) provides an overview of the evaluation criteria, evaluation matrix of 27 projects, and benefit-cost analysis methodology.

Based on the results of the evaluation, 13 projects were identified for further refinement. The number for each of the following projects corresponds to the project location on the map found on the following page. Projects 11 through 13 are not identified on the map, since these are corridor long improvements.

1. Series of S-Curves at MP 0.15-0.60: Provide end treatments at all retaining wall ends, provide guardrails (or roadside protection) along steep drop-offs, and provide stopping sight distance (SSD) along the S-curves via tree and vegetation removal.
2. Sheltered Nook Road Intersection: Add a 100-foot long northbound left turn pocket and flatten the existing vertical crest curve on the northern leg of the Cornelius Pass Road/Shelter Nook Road intersection.
3. S-Curves and 8th Avenue Intersection at MP 1.5: Provide SSD along the S-curves, as well as intersection sight distance (ISD) at the 8th Avenue intersection via tree and vegetation removal.
4. S-Curves and Columbia Street Intersection at MP 1.8-2.1: Provide SSD along the S-curves, as well as ISD at the Columbia Street intersection via tree and vegetation removal.
5. Tight 15/25-mph Curves at MP 2.8-3.3 (Minor Widening): Widen the shoulders for both directions of traffic through the area of the 15-mph and 25-mph curves to provide additional recovery area for vehicles.
6. Tight 15/25-mph Curves at MP 2.8-3.3 (Realignment to the West): Replace the 15-mph and 25-mph curves with a new alignment to the west by providing horizontal curves designed for 45-mph.
7. Skyline Boulevard Intersection (Roundabout): Construct a single-lane roundabout with a 160-foot inscribed diameter and provide appropriate left-turn lanes at the Plainview Road intersection and one consolidated grocery store access.



Project Location Map

LEGEND



- Project Location



- Project Area



8. Skyline Boulevard Intersection (Realignment and Access Management): Improve horizontal alignment, provide ISD and SSD, and provide appropriate left-turn lanes at Skyline Boulevard and Plainview Road intersections.
9. Curve at MP 4.5: Improves SSD around the curve by creating a clear zone of vegetation and hillside.
10. Kaiser Road Intersection: Create a northbound paved right-turn pocket and improve ISD.
11. Corridor Roadway Lighting: Provide corridor wide optimal lighting levels along the 5-mile segment of Cornelius Pass Road in Multnomah County using 200 Watt, flat lens (dark sky compliant), cobra head luminaires, mounted at a height of 35 feet and spaced at approximately 165 feet.
12. Improve Cornelius Pass Road Corridor to a 45-mph Facility: Provide curve improvements for a 45-mph design speed along the entire corridor, as well as the improvements at the Sheltered Nook Road, Skyline Boulevard, and Kaiser Road intersections. This corridor project also provides roadway lighting along the entire corridor. This project excludes realignment improvements at the tight 15/25-mph Curves at (MP 2.8-3.3) due to the significant potential environmental and capital costs.
13. Corridor Design Guide and Policies: Develop a design guide and associated policies that provide consistency for the design elements and characteristics for future improvement projects.

For each of these projects, Appendix "D" (Design Workshop #3) provides documentation of the safety concern, a narrative summarizing the proposed improvements with exhibits, a summary of a preliminary cost estimate, and an explanation of how the safety concern is being addressed.

CONCEPTUAL IMPROVEMENT SAFETY BENEFIT/COST ANALYSIS

A safety benefit-cost (B/C) analysis was conducted for each of the 13 selected projects. Projects resulting in B/C ratios greater than 1.00 indicate the project is economically valid from a safety perspective because the estimated benefits exceed the estimated cost. The table below summarizes the results of the B/C analysis (based strictly on predicted safety benefits) over a service life of 20 years. The individual projects contain the conceptual cost estimate and B/C analysis worksheets for each project in Appendix "D".

Map ID	Projects	Benefit Estimate	Cost Estimate	B/C Ratio
1	Series of S-Curves at MP 0.15-0.60	\$773,000	\$1.38 Million	0.56
2	Sheltered Nook Road Intersection	\$3.89 Million	\$1.82 Million	2.14
3	S-Curves and 8 th Avenue Intersection at MP 1.5	\$636,000	\$191,000	3.33
4	S-Curves and Columbia Street Intersection at MP 1.8-2.1	\$100,000	\$914,000	0.11
5	Tight 15/25-mph Curves at MP 2.8-3.3 (Minor Widening)	\$75,000	\$260,000	0.29
6	Tight 15/25-mph Curves at MP 2.8-3.3 (Realignment to the West)	\$675,000	\$13.50 Million	0.05
7	Skyline Boulevard Intersection (Roundabout)	\$9.79 Million	\$3.75 Million	2.61
8	Skyline Boulevard Intersection (Realignment and Access Management)	\$6.58 Million	\$5.30 Million	1.24
9	Curve at MP 4.5	\$1.70 Million	\$1.3 Million	1.31
10	Kaiser Road Intersection	\$960,000	\$200,000	4.80
**	Corridor Roadway Lighting	\$2.82 Million	\$1.00 Million	2.82
**	Improve Cornelius Pass Road Corridor to 45-mph Facility	\$29.1 Million	\$26.8 Million	1.08
**	Corridor Design Guide and Policies*	-	-	-

*The Cornelius Pass Road Design Guide and Policies do not have collision benefit estimates or a B/C ratio because it is not feasible to reasonably estimate the potential monetary safety benefit of these projects.

**Corridor long projects are not shown on the map

The conceptual cost estimates assume a reduced cross section with paved shoulders of two (2) to four (4) feet due to topographical constraints to match the existing approaching roadway. However, Multnomah County's transportation system plan (TSP) identifies the Cornelius Pass Road corridor as a bike route. Therefore, Multnomah County should explore a separated multi-use path along this corridor to accommodate non-motorized travel modes.

Design Considerations

Special care should be taken during the design phase of isolated projects to provide appropriate transition segments, especially at intersections.

The evaluated corridor is heavily vegetated with a number of stream crossings and parallel streams. Environmental features observed during the initial field visit were taken into consideration as alternatives were developed. However, before any of the proposed projects are moved forward, a more detailed inventory of environmental features, including wetlands and potential Threatened and Endangered species, should be undertaken. There are a number of old stone walls along the project corridor that should be examined by a historian to determine if they are eligible for the historic register before any modifications are made to them. An archeological survey of the project improvement areas should also be undertaken. Lastly, storm water runoff, treatment and detention will need to be analyzed for each project as it moves forward.

Replacing several consecutive s-curves with a single large-radii curve and improving curve radii at isolated locations to comply with a consistent design speed of 45 mph would meet driver expectancy along the entire corridor. However, the corridor improvements identified do not address the tight 15/25-mph curves due to topographical and environmental constraints. These locations can be improved by providing appropriate approaching speed reduction treatments and warning signage.

There are additional curves with limited or no collisions history, which were excluded from this evaluation. Despite their exclusion, these additional curves should be investigated as part of the next phase of this potential corridor project. It is important that the entire corridor provides a consistent driver expectation and not potentially shift the existing safety problem from one set of curves to the next.

CONCLUSIONS

Multnomah County has made strides in improving the safety of Cornelius Pass Road since the Road Safety Audit was completed. The work through this JTA study identifies additional safety projects the county could consider should funds become available. Since the project team's focus was specifically towards safety improvements, Multnomah County in collaboration with regional transportation partners and stakeholders may want to consider a broader planning effort that addresses the regional significance of this corridor and its future.

The safety evaluation and design alternatives analysis of the Cornelius Pass Road corridor resulted in 27 initial project alternatives that focused on key locations with collision clusters. The evaluation of these project concepts highlighted 13 projects that were studied in more detail to develop B/C ratios. The study, data and supporting documentation has been prepared and submitted to Multnomah County. The project concepts and information contained are sufficient to enable the county to pursue funding should opportunities arise. Based on the safety B/C ratios, Multnomah County may want to consider the following projects for preliminary design and construction:

Map ID	Project Name	Description	Cost Estimate
2	Sheltered Nook Road Intersection	Add a northbound left turn pocket and flatten the vertical crest curve to the north of the intersection	\$1.82 Million
3	S-Curves and 8 th Avenue Intersection at MP 1.5	Provide stopping sight distance (SSD) along the S-curves, as well as intersection sight distance (ISD) at the 8 th Avenue intersection via tree and vegetation removal.	\$191,000
7	Skyline Boulevard Intersection (Roundabout)	Construct a single-lane roundabout and provide appropriate left-turn lanes at the Plainview Road intersection and one consolidated grocery access.	\$3.75 Million
9	Curve at MP 4.5	Improves stopping sight distance (SSD) around the curve.	\$1.3 Million
10	Kaiser Road Intersection	Create a northbound right-turn lane and improve intersection sight distance (ISD).	\$200,000
**	Corridor Roadway Lighting	Provide corridor wide optimal lighting levels along the 5-mile segment of Cornelius Pass Road.	\$1.00 Million
**	Improve Cornelius Pass Road Corridor to 45-mph Facility	Provide a horizontal alignment that complies with a 45-mph design speed along the entire corridor with the exception of the tight 15/25-mph curves, as well as intersection improvements at Sheltered Nook Road, Skyline Boulevard, and Kaiser Road. The project also includes corridor roadway lighting.	\$26.8 Million