Final Value Engineering Study Report

I-5 Aurora – Donald Interchange

Oregon Department of Transportation

CN B36771

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Prepared by

Value Management Strategies, Inc.

EXECUTIVE SUMMARY

FINAL

A Value Engineering (VE) study, sponsored by Oregon Department of Transportation (ODOT) and facilitated by Value Management Strategies, Inc., was conducted for I-5 Aurora – Donald Interchange in Aurora, OR. The study was conducted at ODOT's Fairview, OR offices June 24-28, 2019. This *Executive Summary* provides an overview of the project, key findings, and the alternatives developed by the VE team.

PROJECT SUMMARY

The I-5 Aurora-Donald Interchange provides a major access point to I-5 for the north Marion County area. I-5 is the most important north-south highway in the state and is the major freight route. Ehlen Road, the county crossroad at the interchange, is a major east-west roadway in north Marion County and provides I-5 access to communities in the north county area as well as indirect access to communities in Clackamas and Yamhill Counties. Several problems have been identified in the general project area including the following:

- Increased congestion in the interchange area, especially on the southbound off-ramp, which has long queues, particularly during the afternoon peak period.
- Conflicts between cars, recreational vehicles, and large trucks result from the three truck stops near the intersection.
- Bents Road intersects with Ehlen Road immediately adjacent to the southbound ramp terminal, resulting in additional conflicts and safety issues in the area of the southbound ramp terminal.

The project consists of the following elements:

- Reconstruction and widening of the existing I-5 northbound and southbound bridges to accommodate a wider cross-section for Ehlen Road.
- Construction of a new diverging diamond interchange (DDI) with new signalized intersections located at the northbound and southbound ramp termini at Ehlen Road.
- A wider, realigned Ehlen Road with a wider cross-section under I-5 to include two lanes in each direction with bike and pedestrian facilities.
- Improvements to Bents Court at Ehlen Road.
- Realignment of Bents Road to align with Bents Court at Ehlen Road.
- Realignment of Dolores Way to create a new intersection farther east with Ehlen Road.
- Southbound off-ramp improvements to reduce queuing.
- Northbound off-ramp improvements to reduce queuing.
- Improvements to stormwater drainage and management.

The estimated cost of the entire project at the time of the VE study was approximately $70,472,000, exclusive of project support costs and right-of-way.

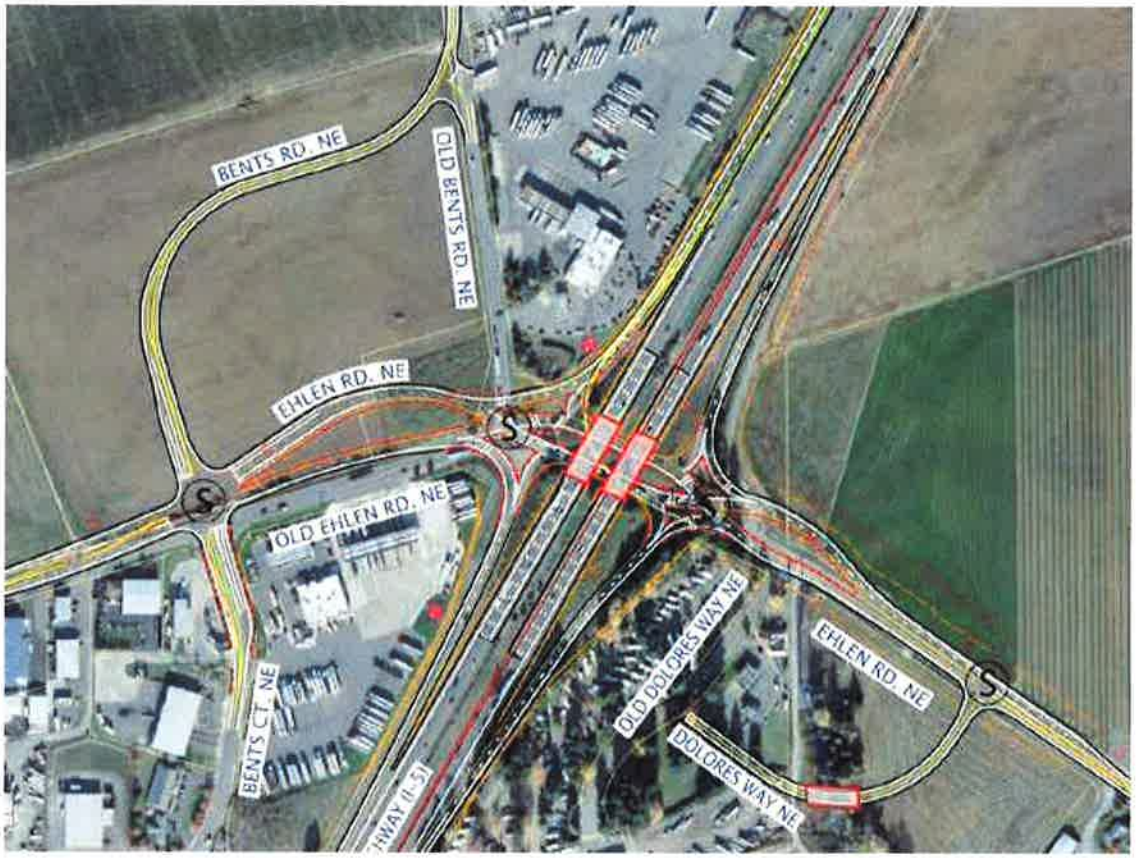


Figure 1, Baseline Concept – Diverging Diamond Interchange

The project will be delivered in two phases; it is anticipated that Phase 1 would include the following elements:

- A new segment of realigned Ehlen Road between the southbound off-ramp terminus and Bents Court.
- Improvements to Bents Court at Ehlen Road.
- Realignment of Bents Road to align with Bents Court at Ehlen Road.
- Southbound off-ramp improvements to reduce queuing.

Phase 2 would complete the remainder of the improvements at an unknown time in the future.

PROJECT PURPOSE AND NEED

The purpose of the project is to improve interchange operations by reducing off-ramp queues and improving operations on Ehlen Road for vehicles accessing the I-5 on-ramps. The project is needed to reduce congestion and address safety concerns.

VE STUDY TIMING

The VE study was conducted during the conceptual design phase (5-10% design). Design refinement for Phase 1 will be completed by fall 2019 and construction bidding is planned for 2021.

VE STUDY OBJECTIVES

The objectives of the VE study were to:

- Identify Phase 1 options
- Identify VE alternatives that will improve value
- Identify VE alternatives that will reduce risk

KEY PROJECT ISSUES

The items listed below are the key drivers, constraints, or issues being addressed by the project and considered during this VE study to identify possible improvements.

- The project is anticipated to be delivered in two phases. Phase 1 would deliver approximately $18 million in construction and $2 million in right-of-way. Phase 2 would deliver the remainder of the project.
- Phase 1 could be in operation for 10-20 years before Phase 2 is delivered.
- The interchange design concept will be a diverging diamond interchange (DDI). This was considered by the project team to offer the best performance relative to the various options that were considered during the alternative analysis.
- The local truck stops on the west side of the interchange, TCA and Flying J, are concerned that the improvements will result in reduced access to their facilities.
- The BPA transmission towers that run adjacent to I-5 southbound may conflict with the retaining wall planned along the southbound on- and off-ramps.

EVALUATION OF BASELINE CONCEPT

During the course of the VE study, a number of analytical tools and techniques were applied to develop a better understanding of the baseline concept. A major component of this analysis was Value Metrics which seeks to assess the elements of cost, performance, time, and risk as they relate to project value. These elements required a deeper level of analysis, the results of which are detailed in the *Project Analysis* section of this report.

Below is a summary of the major observations and conclusions identified during the evaluation of the baseline concept which led the VE team to develop the alternatives and recommendations presented in this report.

- From the standpoint of operational improvements to mainline I-5, the project will result in greatly improved traffic operations for the interchange and reduce queues on the northbound and southbound I-5 off-ramps.
- Local traffic operations will be improved for many of the local roads due to realignment and the addition of signalized intersections. The DDI will improve intersection operations as will the additional lanes on Ehlen Road. Shifting the Ehlen Road intersections with Bents Road and Dolores Way will improve intersection spacing with the ramp intersections, contributing to improved flow.
- Environmental impacts are anticipated to be minimal. The realignment of Ehlen Road, Bents Road, and Dolores Way will result in modifications to existing access for local businesses. The realignment of Dolores Way will require a structure of some kind over a small stream that may possibly have fish passage implications. A water quality feature will be added.
- Construction impacts will be incurred for mainline I-5 traffic due to the need to reconstruct the existing I-5 bridges over Ehlen Road. Retaining walls will be required along the west side of the realigned and widened southbound off-ramps. There may be some additional construction impacts to residents of the adjacent RV park.
- Long-term operations and maintenance of the improved facilities are anticipated to be typical for this type of project. Additional pavement and signals will result in a slight increase in life-cycle costs.
- The current Phase 1 package is anticipated to include improvements to the I-5 southbound off-ramp, realignment of Bents Road, improvements to Bents Court, and construction of a portion of Ehlen Road between the southbound off-ramps and the new signalized intersection at Ehlen Road and Bents Court. It is anticipated that these improvements will amount to approximately $18.7 million in construction costs.

ACCEPTED VE ALTERNATIVES

The VE team developed 20 alternatives for improvement of the project, 10 of which were accepted by the Project Team. The following is a brief summary of the accepted VE alternatives along with their associated potential initial cost savings, potential change in schedule, performance change, and a brief discussion of each. Please note that because the cost data depicted below represent *savings*, a number in parentheses represents a cost *increase*. Full write-ups for all of the VE alternatives are presented in the *VE Alternatives* section of this report.

ACCEPTED VE ALTERNATIVES

Alternative No. and Description	Initial Cost Savings	Change in Schedule	Change in Performance
1.1 Construct a culvert in lieu of a new bridge for Dolores Way realignment	**$1,738,000**	**No change**	**+0.4%**
The alternative concept would install a 6-8-foot diameter culvert in lieu of a bridge to cross the unnamed creek to accommodate the realignment of Dolores Way NE. The 6-8-foot diameter culvert is recommended to meet fish passage and hydraulic requirements (i.e., counter sinking the culvert and for placement of streambed materials into the culvert during construction).			

Alternative No. and Description	Initial Cost Savings	Change in Schedule	Change in Performance
2.0 Modify Bents Rd. realignment and shift south	**$150,000**	**No change**	**+0.1%**
The alternative concept would shift the tie-in point of the realigned Bents Road 400 feet south of the baseline alignment. This improves access to the TCA property.			
3.0 Shift new intersection for Ehlen Rd. and Bents Rd. north and straighten alignment of DDI	**$2,500,000**	**No change**	**+2.0%**
The alternative concept proposes to continue Ehlen Road to the west on a tangent and shift the intersection of Ehlen Road and Bents Road to the north by about 600 feet. This realignment has the effect of creating an Ehlen Road alignment that runs perpendicular to I-5. This adjustment allows for more efficient geometry for the DDI crossovers, reducing the width of the median island under I-5 and optimizes turning sight distances.			
4.0 Reconstruct I-5 bridges as a single structure and modify alignment	**$3,000,000**	**4-month reduction**	**+1.9%**
The alternative concept would consolidate the northbound and southbound I-5 bridges into one structure and shift the I-5 lanes inward toward the median. This eliminates the need for a temporary detour bridge and increases right-of-way available to accommodate the northbound and southbound off-ramp improvements. It also results in reducing or avoiding potential conflicts with the BPA transmission towers.			
6.0 Lengthen NB off-ramp and maintain as a single-lane exit before widening out at the intersection with Ehlen Rd.	**$500,000**	**No change**	**+1.4%**
The alternative concept suggests lengthening the northbound off-ramp and constructing as a single lane, widening out at the intersection with Ehlen Road.			
8.0 Use Level 3 ACP Mix for base course on interstate and all courses on local roads	**$74,000**	**No change**	**+0.4%**
The alternative concept would use a Level 3 ACP mix instead of the Level 4 mix called out in the plans for the base courses and possibly some of the local road reconstruction/new construction. This would reduce cost while providing a comparable level of pavement performance.			
9.0 Eliminate moment slab traffic barrier system & replace with precast pinned 42" barrier	**$900,000**	**2-month reduction**	**+1.5%**
The alternative concept calls for deleting the 42-inch Type "F" traffic barrier coping with moment slab and installing anchored tall "F" barrier with a 3-foot offset from the top of the mechanically stabilized earth-retaining walls on the southbound and northbound ramps. This will reduce cost, improve the construction schedule, and make future barrier repairs easier to perform.			
10.0 Consider use of rock mulch at concrete islands	**$200,000**	**No change**	**0%**
The design team will continue to develop this project feature. It has not been determined what material the concrete island areas will be that are not needed for pedestrians. Recent projects for these features have opted to install rock mulch. Some cost benefit is recognized at this point.			

Alternative No. and Description	Initial Cost Savings	Change in Schedule	Change in Performance
15.0 Widen and improve all NB and SB ramps in their existing alignment with new signals	**N/A**	**N/A**	**N/A**
This concept was essentially accepted as part of the Interim Phase 1 project in conjunction with VE Alternative 18.0 which delivers most of the ramp improvements. Additional Phase 1 funding was secured to allow for these improvements earlier.			
18.0 Construct modified I-5 Bridges; widen Ehlen Rd. under I-5; realign Bents Rd.	**N/A**	**N/A**	**N/A**
This concept was essentially accepted as part of the Interim Phase 1 project in conjunction with VE Alternative 15.0 which delivers most of the ramp improvements; creates an interim tight-diamond interchange; and replaces the I-5 bridges allowing for a four-lane cross-section for Ehlen Rd. Additional Phase 1 funding was secured to allow for these improvements earlier based on the operational benefits afforded by this interim design concept.			

VE STUDY RESULTS

An Implementation Meeting was conducted on October 22, 2019 at the ODOT TLC Building. During this meeting, the Project Team representatives reviewed the VE study results and decided the final disposition of each VE Alternative. As stated in the Executive Summary, ten of the VE Alternatives were accepted by the Project Team.

The VE team identified alternatives to address both Phase 1 and Phase 2 of the project. The VE team identified six different options to consider for Phase 1 but ultimately VE Alternatives 15.0 and 18.0 were accepted resulting in a modified concept that will improve interim functionality for the initial build of the project. Both alternatives would address off-ramp queuing issues for both northbound and southbound I-5 while provide operational benefits to Ehlen Road. This interim Phase 1 concept is illustrated in Figure 2.

VE alternatives 3.0 and 4.0 were considered the most important alternatives that would reduce cost while improving operational performance on Ehlen Road and reducing construction impacts to I-5 by improving the geometry of the DDI. VE Alternative 6.0 offers additional improvement to reduce queues for the northbound I-5 off-ramp. In summary, the eight recommended Phase 2 VE alternatives could reduce project costs by just over $12.5 million, reduce the construction schedule by 10 months, and provide a small performance improvement while mitigating a number of key risks, including potential impacts to the BPA transmission towers. The ultimate Phase 2 build out is illustrated in Figure 3.

Figure 2 – Phase 1 Concept incorporating Accepted VE Alternatives

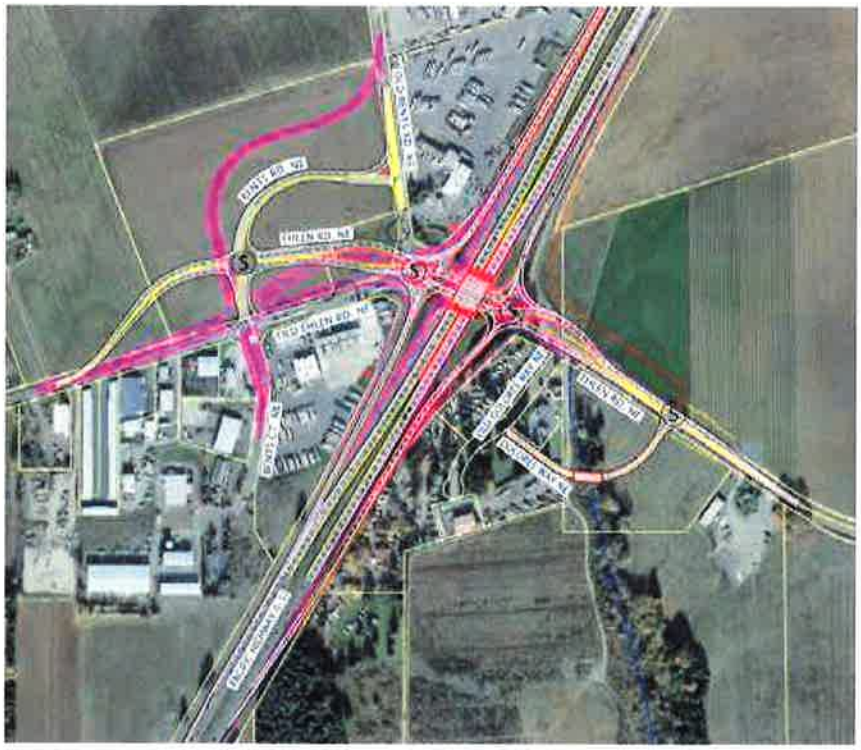
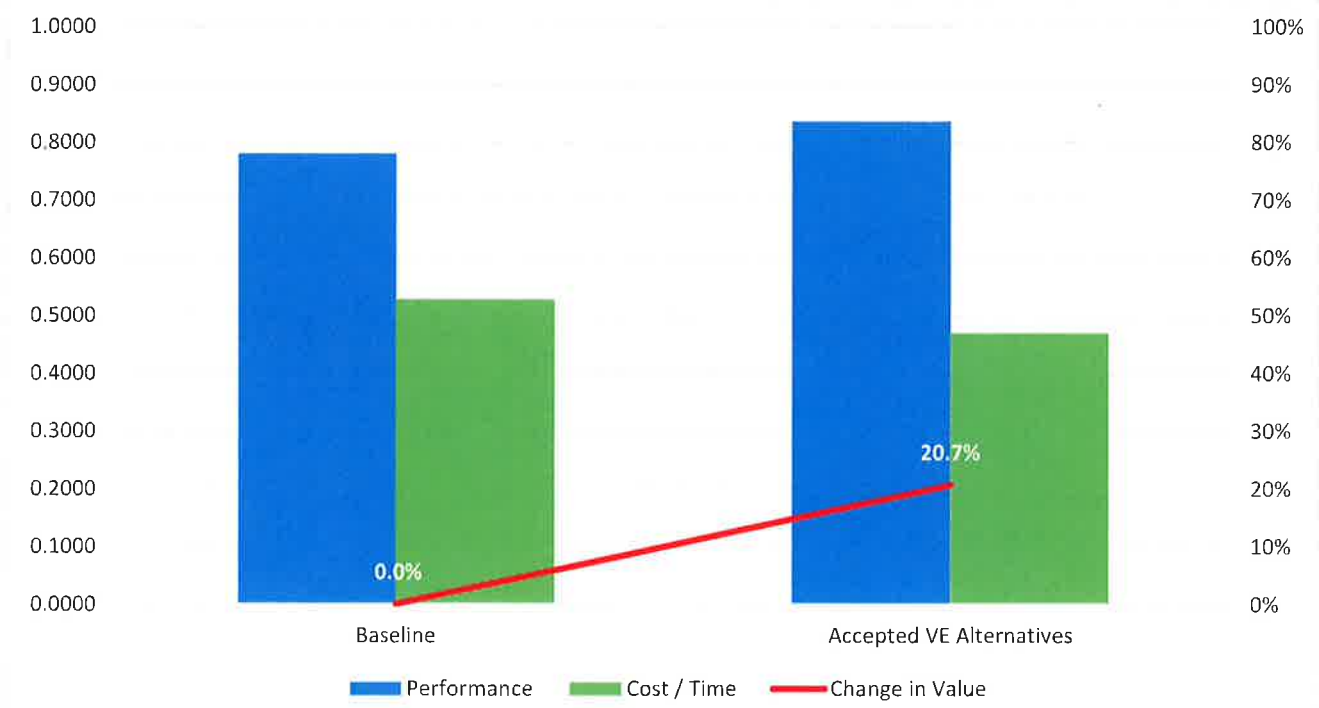


Figure 3 – Phase 2 Concept incorporating Accepted VE Alternatives compared to Baseline Concept (pink)

A summary of the accepted VE alternatives is provided in the following table and chart. The chart illustrates the relative trade-offs between performance (shown by the blue columns) versus cost and schedule (shown by the green columns). The red value line indicates the net % change in total value of the accepted VE alternatives relative to the baseline concept. Please refer to the *Project Analysis* section of this report for additional details on this analysis.

Comparison of Value – Baseline Concept and Phase 2 VE Strategy



Accepted VE Strategy

Strategy Description	Initial Cost Savings	Change in Schedule	Performance Change	Value Change
Accepted VE Alternatives 1.1, 2.0, 3.0, 4.0, 6.0, 8.0, 9.0, 10.0, 15.0, 17.0	$9,062,000	6-month reduction	+7.2%	+20.7%

VE TEAM

VE Study Team

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Alex Lim	ODOT	Bridger
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Karen Strauss	ODOT	Pavement Design
Max Gummer	ODOT	Geotech
Paul Welch	ODOT	Constructability
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Key Project Contacts

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