

Oregon Department of Transportation

Value Engineering Study Report

I-5 @ Beltline Interchange – Unit 4
(Eugene-Springfield) Section
Pacific Highway (Hwy 1)
Lane County

January 6 – 8, 2014

Disclaimer

The information contained in this report is the professional opinion of the team members during the VE Study. These opinions were based on the information provided to the team at the time of the study. As the project continues to develop, new information will become available, and this information will need to be evaluated on how it may affect the recommendations and finding in this report. All costs displayed in the report are based on best available information at the time of the study and unless otherwise noted are in current dollars.

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Introduction

Phases of the Value Engineering Process

The Value Engineering Team employed the five-phase VE job plan in analyzing the project.

- **Investigation Phase** – Investigate the background information, technical input reports, field data, function analysis, and team focus and objectives.
- **Speculation Phase** – Be creative and brainstorm alternative proposals and solutions.
- **Evaluation Phase** – Analyze design alternatives, technical processes, life cycle costs, documentation of logic, and rationale.
- **Development Phase** – Develop technical and economic supporting data to prove the feasibility of the desirable concepts. Develop team recommendations both long and short term.
- **Presentation Phase** – Present the recommendations of the VE team in an oral presentation to the Design Team and in a written report and workbook.

Study Identification

VE team Members

Name	Discipline	Organization	E-mail Address
Harris, Tracy	VE Engineer	ODOT	Tracy.M.Harris@odot.state.or.us
Paslay, Brian	Roadway Design	ODOT	Brian.D.Paslay@odot.state.or.us
Grubbs, Bob	Bridge Design	ODOT	Robert.E.Grubbs@odot.state.or.us
McDaniel- Wilson, Christina	Transportation Analyst	ODOT	Christina.A.McDaniel- Wilson@odot.state.or.us
Lemos, Chuck	Construction PM	ODOT	Charles.A.Lemos@odot.state.or.us

Project Description

The I-5 @ Beltline Interchange – Unit 4 (Eugene-Springfield) Section is a Modernization Project located on I-5 Pacific Highway (Hwy 001) from MP 193.97 to 195.58 and on OR-569 Beltline Highway (Hwy 069) from Coburg Road to Gateway Street. The Key Number is 16861.

This fourth unit constructs a new eastbound Beltline auxiliary lane from Coburg Road to southbound I-5 on-ramp; a new southbound I-5 auxiliary lane from Beltline to westbound I-105 on-ramp; a new eastbound Beltline to northbound I-5 on-ramp, including a structure over I-5; a new Harlow Bridge over I-5; completion of the multi-use path partially constructed in Unit 3; a sound wall south of Beltline and east of Coburg Road; a sound wall west of I-5, south of Harlow Road and north of I-105; noise studies for the new Harlow Bridge and noise mitigation as warranted and numerous retaining walls are on the project. Right-of-Way will be required for this project.

The Project is scheduled for a let date of January 2015 with an anticipated completion fall 2016.

Total project cost is estimated to be \$34.458 million. Funding presently authorized for this project totals \$40 million.

Investigation Phase

Authorizing Persons (Region 2 Management Team)

List name(s) of those having responsibility for the project and the authority to approve.

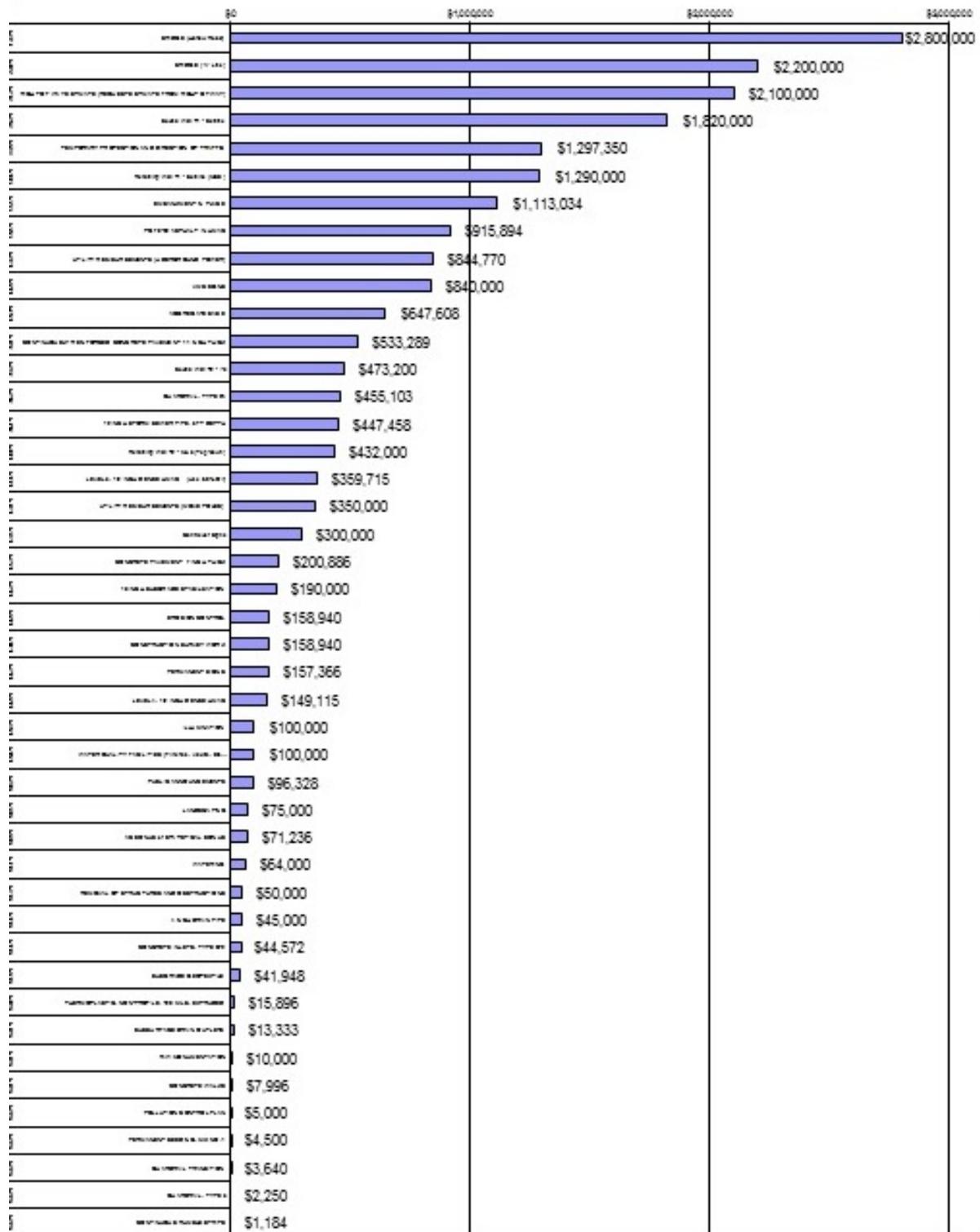
Name	Position	E-mail Address
Brindle, Frannie	Area Manager	Frances.Brindle@odot.state.or.us
Cartwright, Carol	Tech Center Manager	Carol.A.Cartwright@odot.state.or.us
Warren, David	District Manager	David.Warren@odot.state.or.us
Chickering, Sonny	Region Manager	Sonny.P.Chickering@odot.state.or.us

VE Resource Team		
Contact	Position	E-mail Address
Blacketer, Ron	ITS Engineer	Ronald.M.Blacketer@odot.state.or.us
Carman, Chris	Water Quality	Christopher.W.Carman@odot.state.or.us
Castelli, Katie	Geologist	Kathryn.Castelli@odot.state.or.us
Deaton, Carl	Roadway Design	Carl.F.Deaton@odot.state.or.us
Ebling, Bruce	Roadway Design	Bruce.D.Ebling@odot.state.or.us
Finch, Kevin	Assistant District Maintenance Manager	Kevin.D.Finch@odot.state.or.us
Schuytema, Peter	Senior Transportation Analyst	Peter.L.Schuytema
Haas, Dustin	Geotechnical Engineering	Dustin.J.Haas@odot.state.or.us
Inerfeld, Rob	City of Eugene	
Jacobson, Steve	Planner	Stephen.L.Jacobson@odot.state.or.us
James, Derryl	Preliminary Design	Derryl.D.James@odot.state.or.us
Jordan, Christy	Motor Carrier	Christy.A.Jordan@odot.state.or.us
Kargel, Angela	Region Traffic Manager	Angela.J.Kargel@odot.state.or.us
Kim, Ernest	Illumination Designer	Ernest.C.Kim@odot.state.or.us
LaFleur, Christina	Signs	Christina.L.LaFleur@odot.state.or.us
Larsen, Tom	City Traffic Engineer	
Laverdure, Kevin	Right-of-Way – Survey	Kevin.A.Laverdure@odot.state.or.us
Lemos, Chuck	Construction PM	Charles.A.Lemos@odot.state.or.us
Lovingier, Corry	Pavement Specialist	Corben.L.Lovingier@odot.state.or.us
Miller, Preston	Right-of-Way	
Morales, Mike	Environmental	Michael.A.Morales@odot.state.or.us
Morgan, Bill	Lane County Public Works	
Morris, Don	Traffic Control Design	Donald.R.Morris@odot.state.or.us
Nelson, Dani	Traffic	
Nguyen, Thiet	Bridge Design	Thiet.D.Nguyen@odot.state.or.us
Nickels, Bill	FEI Geotech Designer	
Parks, Brian	Electrician	Brian.N.Parks@odot.state.or.us
Sanders, Ann	Project Leader	Ann.I.Sanders@odot.state.or.us
Shippey, Mike	Roadside Development Coordinator	Mike.Shippey@odot.state.or.us
Spencer, Doug	ITS Standards Engineer	Doug.L.Spencer@odot.state.or.us
Thompson, Brian	Utilities	Brian.L.Thompson@odot.state.or.us
Tovar, Robert	Bridge Design	Robeert.J.Tovar@odot.state.or.us
Upton, Dorothy	Region Traffic Engineer	Dorothy.J.Upton@odot.state.or.us
Vogeney, Ken	Springfield Public Works	
Woods, Dustin	Federal Highway	

Documents / Abstracts

The following documentation was provided to the VE Team for evaluation.	
Reports	
Cost Estimate prepared by Carl Deaton	Cost estimate for the project.
DAP Narrative prepared by Carl Deaton	A review of the project from the roadway designer.
Type, Size, & Location Narrative prepared May 10, 2013 by Bridge Engineering Unit Region 1 Tech Center	A review of the bridges on the project.
Traffic Analysis prepared May 2012 by Peter L. Schuytema	Traffic analysis of the project area.
Traffic Volumes prepared December 10, 2010 by Peter L. Schuytema	Traffic volume numbers for the project.
Traffic Control Plan/Stage Construction & Freight Mobility Narrative Edition #2 prepared May 28, 2013	Discussion of Traffic Control & Mobility and Traffic Control & Stage Construction
Narrative for Harlow Road Bridge Replacement prepared June 7, 2012	A discussion of replacing Harlow Road Bridge
Environmental Assessment prepared June 2002 by ODOT	This Environmental Assessment evaluates ODOT's proposal to reconstruct the interchange at the junction of Interstate 5 and the Beltline Highway to current design standards.
Maps / Drawings	
<ul style="list-style-type: none"> • Beltline Interchange roll maps • Pre-DAP Plan Set: I-5 @ Beltline Interchange – Unit 4 (Eugene-Springfield) Section • Electronic Design Files 	

Cost Model



Speculative Phase

Brainstorming

A	Harlow Bridge
A1	Eliminate Harlow Bridge
A2	Construct Harlow Bridge
A3	Realign Harlow Bridge
A4	Pier Wall Interior Bent
B	"A" Line Bridge
B1	Realign "A" Line
B2	Eliminate "A" Bridge add lane to I-5 overcrossing bridge
B3	Reduce width of bridge
C	Sound Wall
C1	Eliminate sound wall overlap (maintain it on shoulder)
D	Embankment in Place
D1	Eliminate Auxiliary Lane on I-5 to I-105
D2	Eliminate Auxiliary Lane on Beltline from Coburg to I-5 maintain 2 Lane split at I-5
E	Misc
E1	Consider Concrete Paving "A" Line from split to the Bridge

Advantages & Disadvantages

Idea No.	Creative Idea Listing	Advantages	Disadvantages
A	Harlow Bridge		
A1	Eliminate Harlow Bridge	Cost savings, time savings	Does not fix vertical clearance issue, only 20 life service life, eliminates auxiliary lane,
A2	Construct Harlow Bridge	fixes vertical clearance issue, provides auxiliary lane, removes service life issues	Cost, time
A3	Realign Harlow Bridge	May eliminate stage construction, better alignment,	Increased retaining walls, R/W and multi-use path impacts,
A4	Pier Wall Interior Bent	Eliminates temporary supports, may function better seismically,	Aesthetics,
B	"A" Line Bridge		
B1	Realign "A" Line	Reduce speed prior to bridge, may save embankment, rock, paving,	Redesign time,
B2	Eliminate "A" Bridge add lane to I-5 overcrossing bridge	Cost saving,	Requires widening bridge, cross slope issues,
B3	Reduce width of bridge (4, 12, 8)	Cost savings, help with traffic calming, may eliminate beam line,	Design exception,
C	Sound Walls		
C1	Eliminate sound wall overlap (maintain it on shoulder)	May save cost depending on length of overlap, Eliminate R/W and maintenance issues, shorter wall height,	Complicates road widening in future, Aesthetics wall right next to roadway,
D	Embankment in Place		
D1	Eliminate Auxiliary Lane on I-5 to I-105	Cost savings, eliminate a need to replace Harlow Bridge, drainage, bike path, sound wall	increase merge, diverge, weaving issues, may exceed vc design standards
D2	Eliminate Auxiliary Lane on Beltline from Coburg to I-5 maintain 2 Lane split at I-5	Cost savings, may save some R/W takes, may save on some utility relocations cost, building what is needed not over building,	increase weave issues,
E	Misc		

Idea No.	Creative Idea Listing	Advantages	Disadvantages
E1	Consider Concrete Paving "A" Line from split to the Bridge	Save on future maintenance costs,	Increased construction cost, time,

Matrix Analysis

Idea No.	Creative Idea Listing	Score	Score	Score	Score	Score	Ave
A	Harlow Bridge						
A1	Eliminate Harlow Bridge						
A2	Construct Harlow Bridge						
A3	Realign Harlow Bridge						X
A4	Pier Wall Interior Bent						X
B	"A" Line Bridge						
B1	Realign "A" Line						X
B2	Eliminate "A" Bridge add lane to I-5 overcrossing bridge						
B3	Reduce width of bridge (4, 12, 8)						X
C	Sound walls						
C1	Eliminate sound wall overlap (maintain it on shoulder)						
D	Embankment in Place						
D1	Eliminate Auxiliary Lane on I-5 to I-105						X
D2	Eliminate Auxiliary Lane on Beltline from Coburg to I-5 maintain 2 Lane split at I-5						X
E	Misc						
E1	Consider Concrete Paving "A" Line from split to the Bridge						

The VE Team did not score the ideas. They had an in depth discussion and moved seven ideas ahead for consideration by the Project Team. Those ideas that were moved forward are marked with a X.

Recommendations

Introduction

The results of this study are presented as individual recommendations to the original concept. The VE recommendation documents in this section are presented as written by the team during the VE Study. While they have been edited from the draft VE Report to correct errors or better clarify the recommendation, they represent the VE team's findings during the VE Study.

VE Recommendations

Each recommendation consists of a summary of the original concept, a description of the suggested change, a listing of its advantages and disadvantages, a cost comparison, and a brief narrative comparing the original design with the recommendation. Sketches and calculations are also presented. The cost comparisons reflect a comparable level of detail as in the original estimate.

Summary of Recommendations

Rec. No.	Description	Cost Savings/Additional	Delta Cost (%)
1	Eliminate Auxiliary Lane on I-5 to I-105	-4.8 M	-21%
2	Eliminate Auxiliary Lane on Beltline from Coburg to I-5 Maintain 2-Lane Split	-22.5 K	-0.10%
3	Realign "A" Line		
4	Realign "D" Line		
5	Reduce Width of A-Line Bridge	-20 K	-0.09%
6	Harlow Bridge – Construct Pier Wall Interior Bent	-40 K	-.018%
7	Realign Harlow Bridge		

Recommendation 1

RECOMMENDATION NO. 1	
Eliminate Auxiliary Lane on I-5 to I-105	
Function:	Auxiliary lane on I-5 between the Beltline on-Ramp and the I-105 off-ramp
	IDEA NO(s). D-1
Original Concept: Eliminate the proposed auxiliary lane on I-5 between the Beltline on-Ramp and the I-105 off-ramp	
Recommendation Concept: To determine need for auxiliary lane, extend project analysis limits south to include both I5 off-ramps at the I-105 interchange. As part of the analysis the volume data, traffic flow and growth rate assumptions should be validated. The analysis should include the peak AM and PM hour.	
Advantages:	Disadvantages:
<ul style="list-style-type: none"> ◆ Cost savings ◆ May eliminate the need to replace Harlow Bridge, drainage, bike path and sound wall 	<ul style="list-style-type: none"> ◆ Merge, diverge, and weaving issues ◆ Traffic volume/flow in the AM hour may be higher than PM (current analysis does not include AM hour)
COST SUMMARY	COST
Original Concept	na
Recommendation Concept	\$300/ft
Savings	Approximately \$4.38 million
Discussion/Justification: The advantages include cost savings and may eliminate the need to replace Harlow Bridge, drainage, bike path and sound wall associated with the construction of the auxiliary lane. The disadvantages include merge, diverge, and weaving issues within this segment of I-5. In addition, the traffic analysis does not include the AM peak hour which may have traffic volumes and flows greater than in the PM peak hour.	
Assumptions and Calculations: Based on data provided and some additional assumptions, the second SB off-ramp at the I105 interchange is likely the location of the controlling v/c. <ul style="list-style-type: none"> • Without the Auxiliary lane the v/c in 2025 is estimated to be approximately 0.83. • Exceeds HDM target (0.75) but not OHP (0.85) • With the Auxiliary lane (at this location) the v/c in 2025 is estimated to be approximately 0.64. • <i>Does not exceed HDM or OHP target</i> • The speed differential in both scenario's is 9.5 mph 	

RECOMMENDATION NO. 1
Eliminate Auxiliary Lane on I-5 to I-105

Sketches/Photos:



Recommendation 2

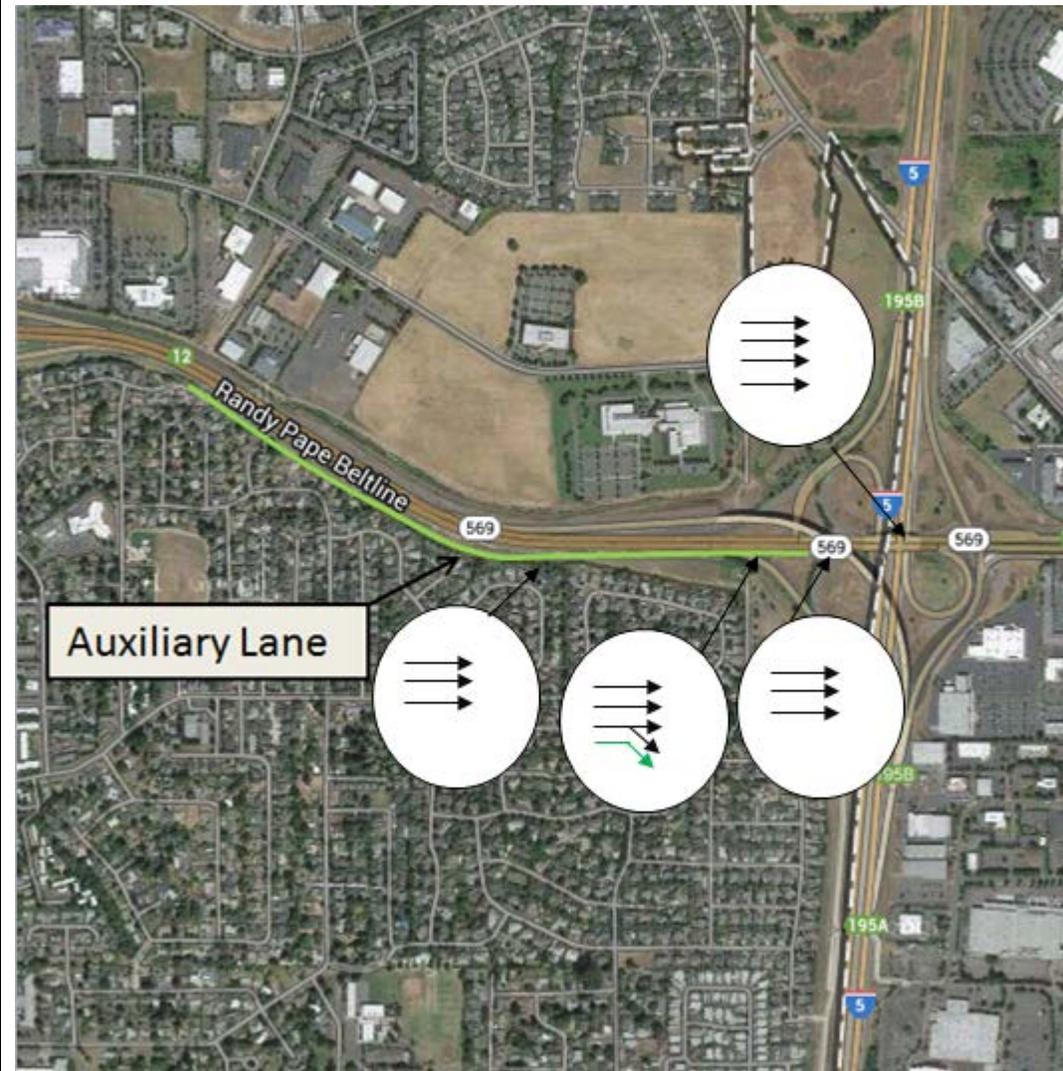
RECOMMENDATION NO. 2	
Eliminate Auxiliary Lane on Beltline from Coburg to I-5	
Maintain 2-Lane Split at I-5	
Function:	Auxiliary lane on Beltline between the Coburg on-ramp and the I-5 Southbound on-ramp
	IDEA NO(s). D-2
Original Concept:	
Shorten or eliminate the proposed auxiliary lane on Beltline between the Coburg on-ramp and the I-5 Southbound on-ramp.	
Recommendation Concept:	
The purpose of the proposed auxiliary lane to facilitate the dual lane off-ramp therefore, the project traffic volumes should be reviewed using updated volume data and growth rate information to determine if the dual lane off-ramp from Beltline to I-5 is required for future traffic operations. The analysis should consider both the AM and PM peak hours.	
Advantages:	Disadvantages:
<ul style="list-style-type: none"> ◆ Cost savings ◆ Less ROW ◆ Less Utility relocation ◆ Constructing “what is needed” to meet demand 	<ul style="list-style-type: none"> ◆ Merge, diverge, and weaving issues ◆ Minimizes decision time for lane assignment ◆ Additional signing
COST SUMMARY	COST
Original Concept	
Recommendation Concept	\$75/foot
Savings	Approximately \$22,500
Discussion/Justification:	
The advantage to removing the auxiliary lane includes reduced project costs, minimizing the residential ROW impacts (largest cost) and utility relocation and also improves public perception by not “over constructing” this section of freeway. The disadvantages include merge, diverge and weaving issues along this segment of Beltline, decreased decision time for lane assignment and additional signing to ensure drivers are aware of correct lane assignment.	
Assumptions and Calculations:	
Based on the information provided during the VE study, it was assumed that 3 lanes east of the gore, a 2-lane off-ramp to I-5 and some sort of Type B auxiliary lane to facilitate the dual lane off-ramp were needed in this section. This assumption should be reviewed to determine that it is still valid.	
<ul style="list-style-type: none"> • If it is determined that the dual lane off-ramp is necessary then the auxiliary lane can be shortened (based on design criteria) resulting in a construction cost savings of approximately \$75 per foot of auxiliary lane reduction. • If it is determined that the dual lane off-ramp is not necessary then the auxiliary lane needed to facilitate the dual lane off-ramp can be removed from the design resulting in a cost savings that reflects the associated cost of construction and ROW impacts. 	

RECOMMENDATION NO. 2
Eliminate Auxiliary Lane on Beltline from Coburg to I-5
Maintain 2-Lane Split at I-5

Sketches/Photos:



RECOMMENDATION NO. 2
Eliminate Auxiliary Lane on Beltline from Coburg to I-5
Maintain 2-Lane Split at I-5

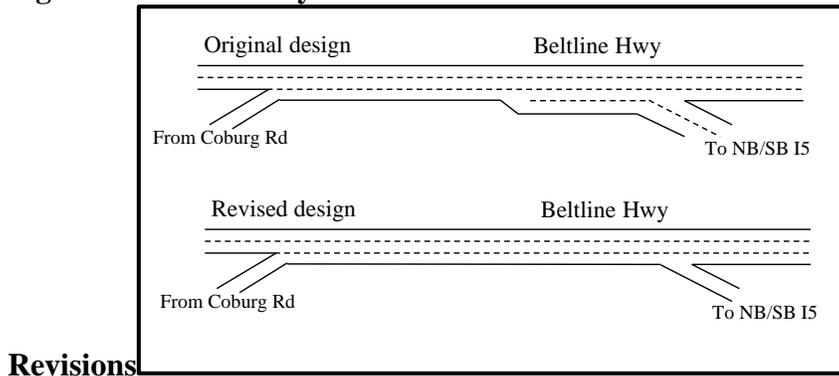


VE Recommendation Follow-up Analysis

Following the VE Study, the I-5/Beltline Interchange Project Unit 4 2025 PM peak hour volumes and assumptions were re-analyzed for recommendations D-1 and D-2 by Peter Schuytema using current traffic count and travel demand model data (Draft Tech Memo: I-5/Beltline Interchange Unit 4 Re-evaluation, dated February 6th, 2014). For sensitivity purposes, 2035 PM peak hour volumes were also created and analyzed following the same methods as for 2025. Since the forecasted growth is relatively slow, the 2035 volumes are not expected to increase substantially over the 2025 and none of the resulting 2035 v/c's exceed the 0.75 Highway Design Manual (HDM) volume to capacity (v/c) guidelines. Given current growth projections, the wider auxiliary lane sections on Beltline Hwy and I-5 are not needed. A single auxiliary lane and off-ramp on Beltline and the existing ramp configuration on I-5 will easily last beyond 2035.

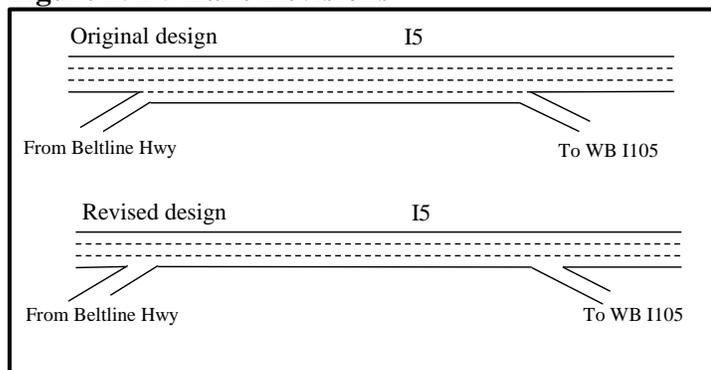
- Recommendation D-1: A two-lane auxiliary lane section with a dual exit ramp at I-5 as originally designed is not needed. For the revised design the 2035 volume to capacity ratio (v/c) is 0.63 which is well below the HDM guideline.

Figure 1. Beltline Hwy Lane



- Recommendation D-2: A single auxiliary lane between the Beltline eastbound to southbound on-ramp and the I-105 westbound off-ramp as originally designed is not needed. Since there is not a heavy ramp-to-ramp volume, the addition of the southbound auxiliary lane will actually worsen operations. For the revised design the 2035 v/c's range from 0.57 to 0.66 which are well below the HDM guidelines.

Figure 2. I-5 Lane Revisions



Recommendation 3

RECOMMENDATION NO. 3 Realign “A” Line	
Function: Geometry	IDEA NO(s). B-1 (A-line)
<p>Original Concept: The A-Line alignment design speed steps down from 70 mph, to 50mph, to 25mph at the loop ramp to go northbound on I-5.</p> <p>Recommendation Concept: Consider changing the intermediate horizontal curve from 50 mph to a 45 mph design speed, and moving that curve slightly northward and eastward.</p> <p>Advantages:</p> <ul style="list-style-type: none"> ◆ May increase safety by encouraging a slower speed earlier along the ramp ◆ Creates more separation from the D-Line (if needed) <p style="text-align: right;">Disadvantages:</p> <ul style="list-style-type: none"> ◆ Nothing significant 	
COST SUMMARY	COST
Original Concept	Unknown
Recommendation Concept	Very similar to Original – although paving/aggregate base quantities would increase slightly.
Savings	None.
<p>Discussion/Justification: The currently proposed alignment will certainly work well and is effective in reducing the ramp speeds from the Beltline speeds in advance of the loop ramp. During our discussions, it was questioned if the current step down was adequate to generate the desired slowing in advance of the loop ramp. The question here is primarily, whether or not stepping down the speeds a little quicker is a benefit? And, secondarily, is there a benefit in gaining more separation between the “A” and “D” lines.</p>	
<p>Assumptions and Calculations: Changed the intermediate curve to a 45 mph design speed, and move adjacent PIs eastward along their tangents.</p>	

RECOMMENDATION NO. 3
Realign "A" Line

Sketches/Photos:

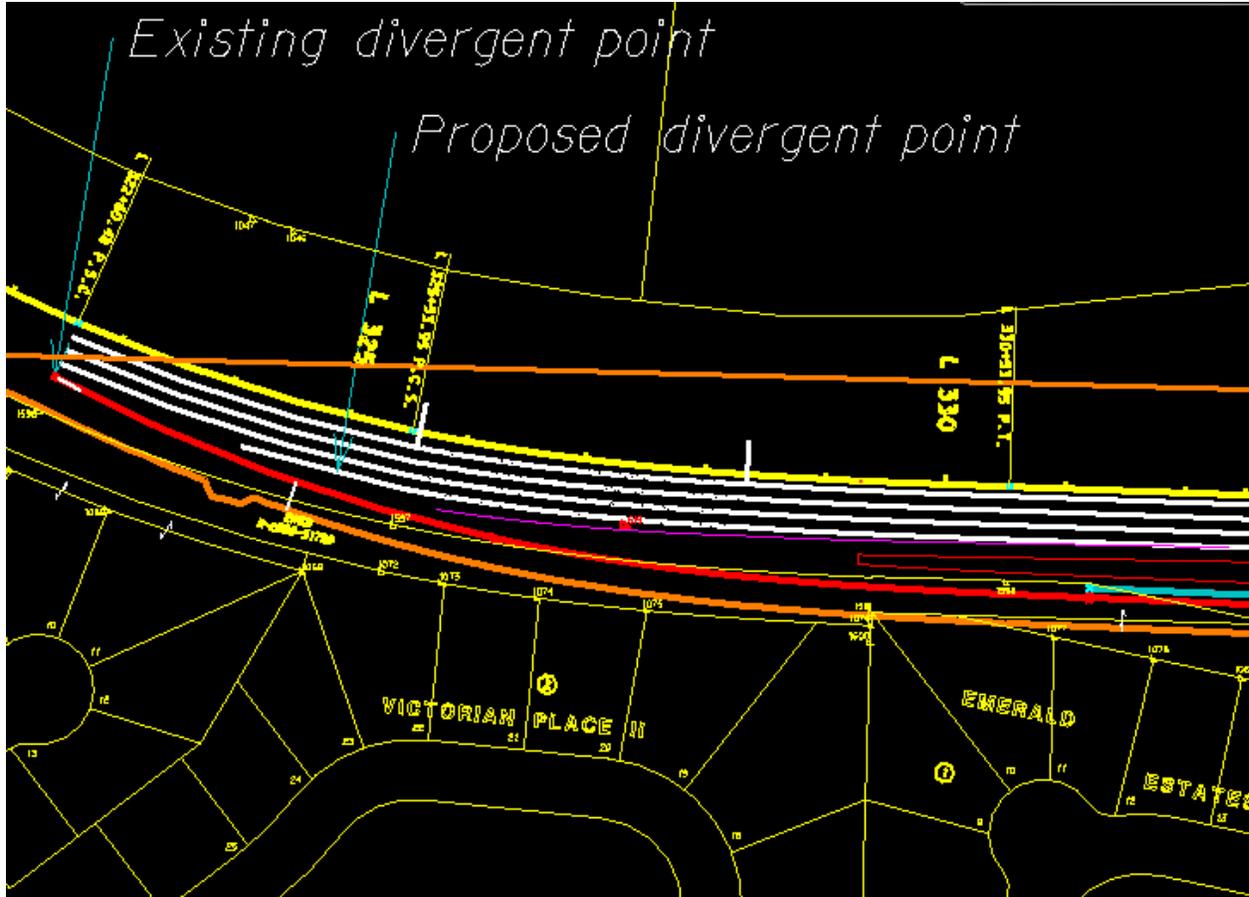


Recommendation 4

RECOMMENDATION NO. 4 Realign “D” Line			
Function: Ramp Alignment	IDEA NO(s). B-1 (D-line)		
<p>Original Concept: Existing I-5 ramp starts to diverge from “L” line at Station 322+60, before splitting into NB and SB ramps.</p> <p>Recommendation Concept: Move the ramp divergent point eastward to approximate station 325+00</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Advantages:</p> <ul style="list-style-type: none"> ◆ Reduces the need for as much right of way from sta 322+60 to ~sta 330+00 ◆ Potentially fewer utility conflicts ◆ Allows for an increased distance to accommodate lane changes before the off-ramp begins. ◆ Potentially less cost </td> <td style="width: 50%; vertical-align: top;"> <p>Disadvantages:</p> <ul style="list-style-type: none"> ◆ Reduced distance between the ramp diverge point, and the point at which the NB and SB I-5 ramps split. </td> </tr> </table>		<p>Advantages:</p> <ul style="list-style-type: none"> ◆ Reduces the need for as much right of way from sta 322+60 to ~sta 330+00 ◆ Potentially fewer utility conflicts ◆ Allows for an increased distance to accommodate lane changes before the off-ramp begins. ◆ Potentially less cost 	<p>Disadvantages:</p> <ul style="list-style-type: none"> ◆ Reduced distance between the ramp diverge point, and the point at which the NB and SB I-5 ramps split.
<p>Advantages:</p> <ul style="list-style-type: none"> ◆ Reduces the need for as much right of way from sta 322+60 to ~sta 330+00 ◆ Potentially fewer utility conflicts ◆ Allows for an increased distance to accommodate lane changes before the off-ramp begins. ◆ Potentially less cost 	<p>Disadvantages:</p> <ul style="list-style-type: none"> ◆ Reduced distance between the ramp diverge point, and the point at which the NB and SB I-5 ramps split. 		
COST SUMMARY	COST		
Original Concept	Unknown		
Recommendation Concept	Unknown		
Savings	Minor material cost savings, but the real savings would come from any realized Utility or RW savings.		
<p>Discussion/Justification:</p> <p>It seems we can move the divergent point eastward, which helps not only the potential right of way impacts, but could also enable the proposed auxiliary lane from Coburg Rd to be extended, which would allow for more room to make the necessary lane changes, while on Beltline, instead of potentially having to make them on the off-ramp before the NB/SB split.</p>			
<p>Assumptions and Calculations:</p> <p>The current design has around 1400 feet from the Beltline divergent point, to the NB/SB split. The HDM has 800’ as the minimum, and 1200’ as desirable. This is NOT to say that the extra length isn’t a benefit, but perhaps it would be more useful to use that length to extend the auxiliary lane.</p>			

RECOMMENDATION NO. 4
Realign "D" Line

Sketches/Photos:

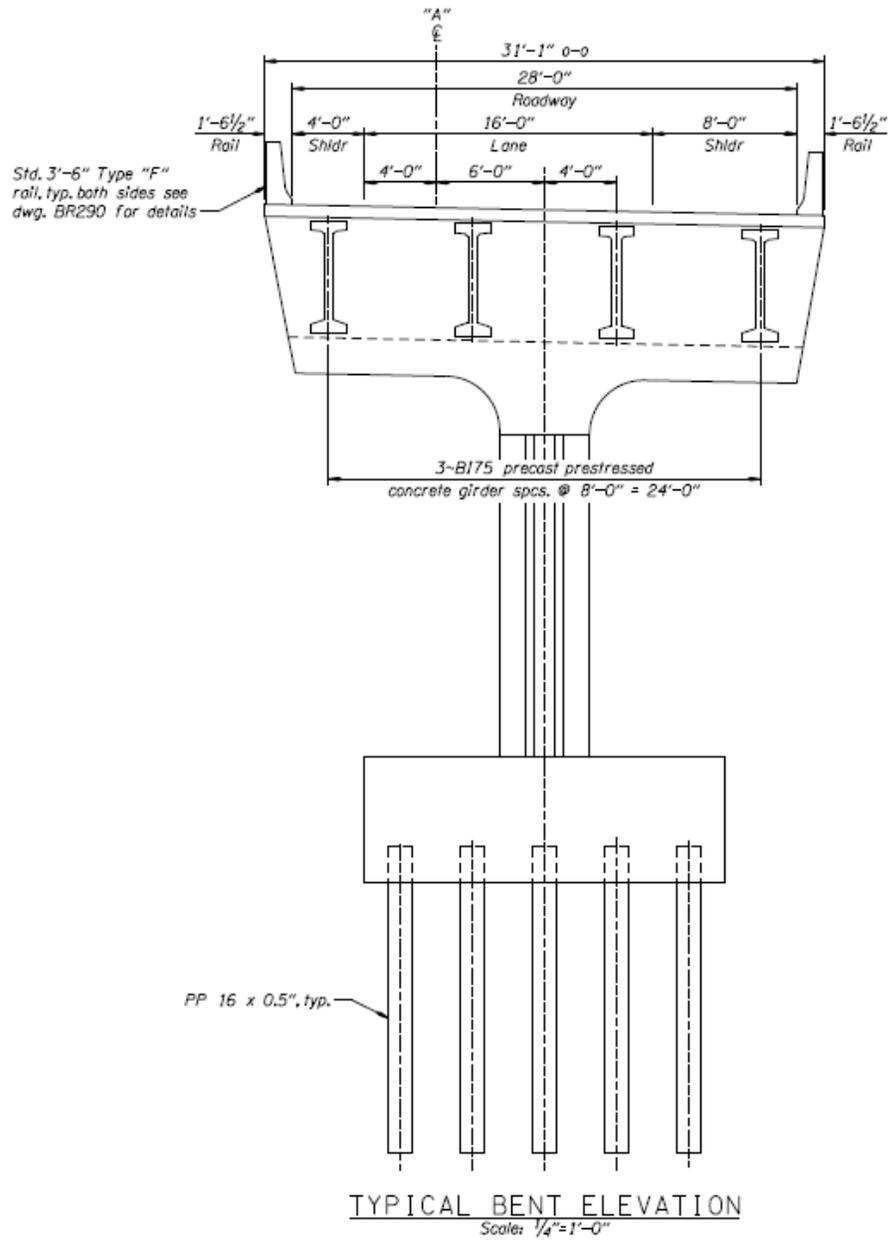


Recommendation 5

RECOMMENDATION NO. 5	
Reduce Width of “A”-Line Bridge	
Function: “A”-Line Bridge	IDEA NO(s). B3
<p>Original Concept: Construct A-Line at a 28’-0” width (4’ shoulder, 16’ lane, 8’ shoulder)</p> <p>Recommendation Concept: Narrow A Line at bridge and beyond to 24’ width (4’ shoulder, 12’ lane, 8’ shoulder)</p> <p>Advantages:</p> <ul style="list-style-type: none"> ◆ Traffic calming headed into loop ramp ◆ Reduced bridge and roadway cost (nominal) 	
<p>Disadvantages:</p> <ul style="list-style-type: none"> ◆ Non-standard design that requires a design exception 	
COST SUMMARY	COST
Original Concept	Bridge cost of \$2.2 million
Recommendation Concept	Slightly reduced bridge and roadway cost
Savings	\$15K-\$20K
<p>Discussion/Justification:</p> <p>There is a safety concern that traffic traveling at a high speed will be placed in a loop ramp with a much lower design speed. In an effort to slow the traffic down, a narrowed roadway and bridge will act as traffic calming and reduce the speed of the traffic as they approach the loop ramp.</p>	
<p>Assumptions and Calculations:</p> <p>Through preliminary layout a prestressed concrete beam line could not be reduced on the narrowed bridge, but still may be possible given further investigation.</p> <p>The cost savings would come from reduced deck concrete and roadway asphalt, base rock, etc.</p>	
<p>Sketches/Photos:</p>	

RECOMMENDATION NO. 5 Reduce Width of "A"-Line Bridge

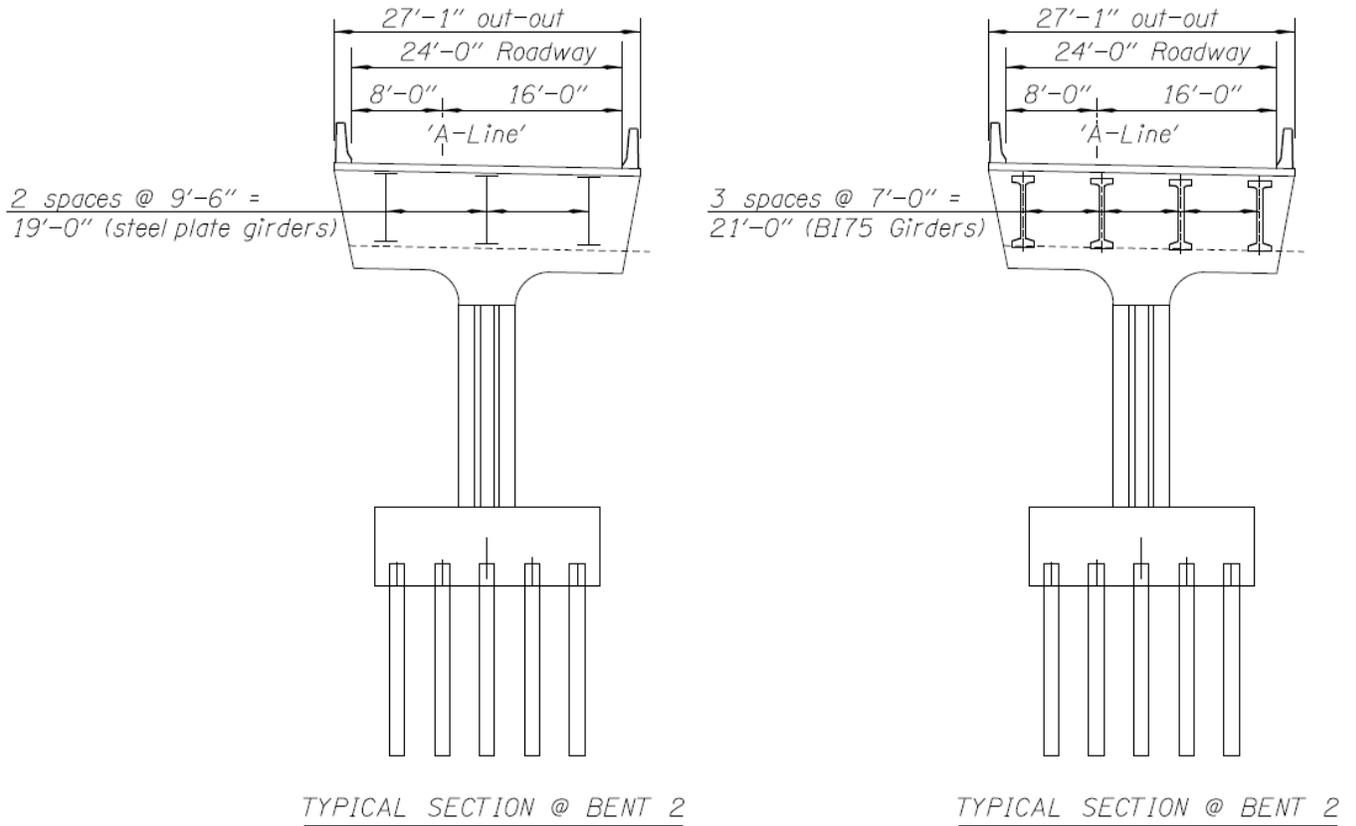
Originally Proposed Bridge Section



RECOMMENDATION NO. 5
Reduce Width of "A"-Line Bridge

VE Study Proposed Bridge Section

*Reduce width of "A-Line" Bridge
to 24'-0" Roadway
(4' shldr, 12' lane, 8' shldr)*



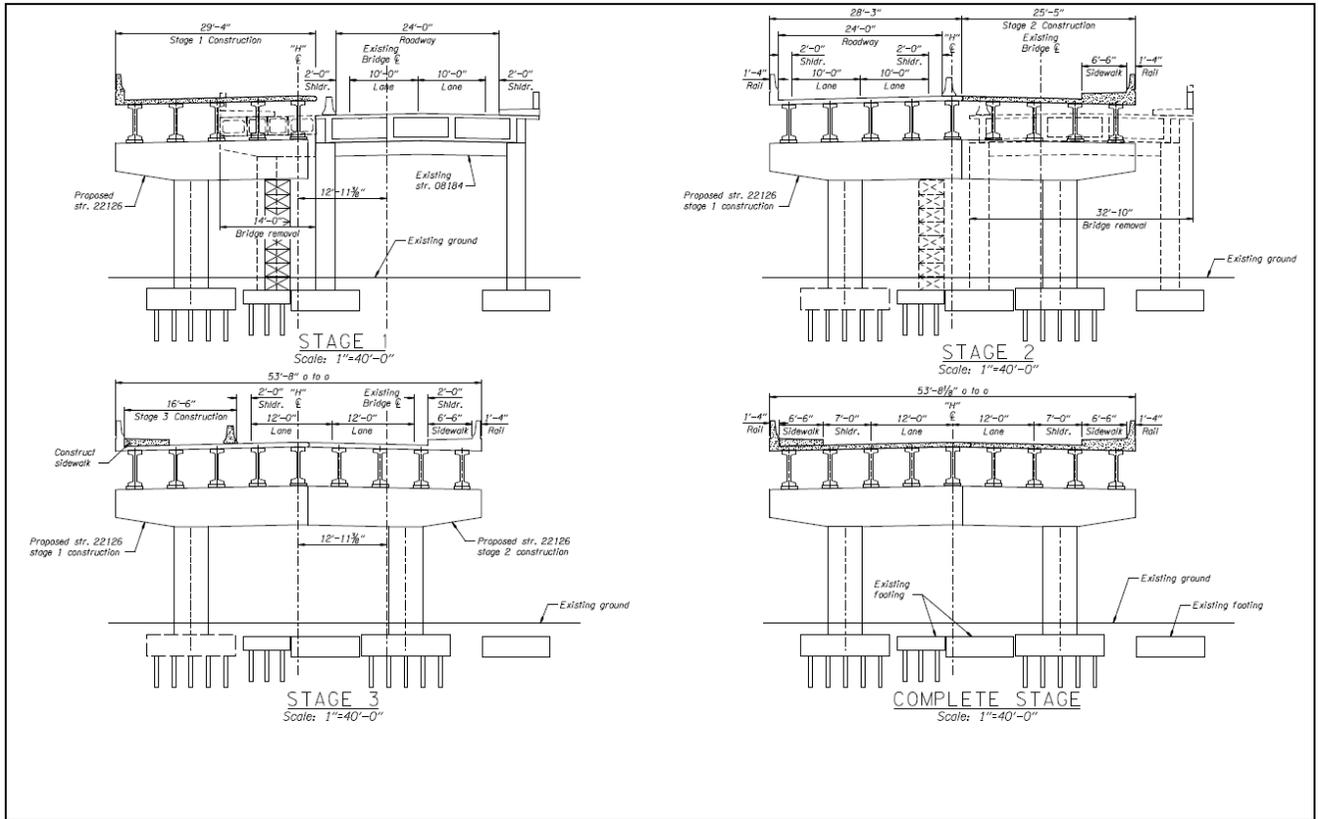
Recommendation 6

RECOMMENDATION NO. 6	
Harlow Bridge - Construct Pier Wall Interior Bent	
Function: Harlow Bridge	IDEA NO(s). A4
<p>Original Concept:</p> <p>Construct the interior bent of the Harlow Road over I-5 bridge as a two short columns supporting a reinforced concrete cap. The cap would be constructed in two stages, requiring temporary supports.</p> <p>Recommendation Concept:</p> <p>Construct the interior bent using a pier wall. This would eliminate the need for staged construction and typically performs better seismically than short columns.</p> <p>Advantages:</p> <ul style="list-style-type: none"> ◆ Typically better seismic performance ◆ Eliminates the need for temporary supports to facilitate staged construction ◆ Reduced construction time ◆ Estimated as slightly cheaper. <p>Disadvantages:</p> <ul style="list-style-type: none"> ◆ Typically considered aesthetically less pleasing. 	
COST SUMMARY	COST
Original Concept	Bridge cost of \$2.8 million
Recommendation Concept	Slightly reduced bridge
Savings	\$25K-\$40K
<p>Discussion/Justification:</p> <p>The originally designed interior bent of the Harlow Road Over I-5 Bridge is a staged constructed two column bent. The staged construction is facilitated with a temporary support. Due to the geometry of the bridge and surrounding area, the resulting columns are relatively short, which is a concern during seismic events.</p> <p>In an effort to reduce the amount of temporary works, cost, and time to construct the bridge; it is proposed to replace the two column bent with a pier wall. The pier wall will eliminate the need for temporary supports and typically performs better in a seismic area.</p>	
<p>Assumptions and Calculations:</p> <p>The pier wall estimate was based on past ODOT cost history. Although seismic evaluation has not been performed, it is assumed that development of plastic hinges in the proposed short columns will be difficult.</p> <p>There may be conflicts with the existing foundations that should be investigated.</p>	
<p>Sketches/Photos:</p>	

RECOMMENDATION NO. 6

Harlow Bridge - Construct Pier Wall Interior Bent

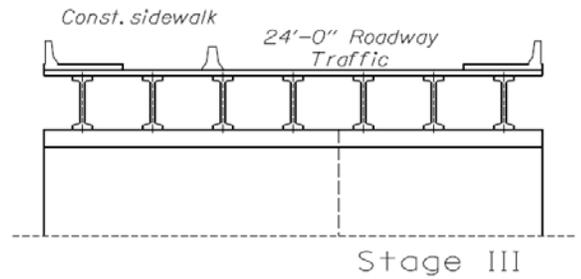
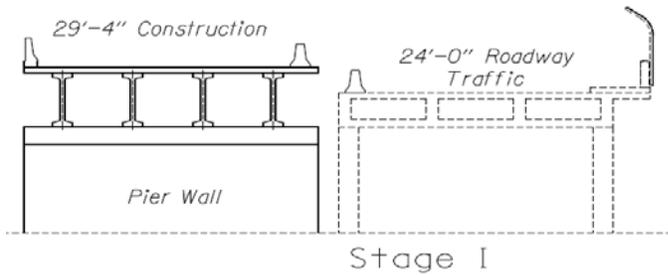
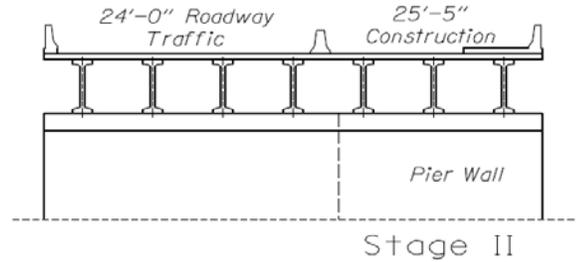
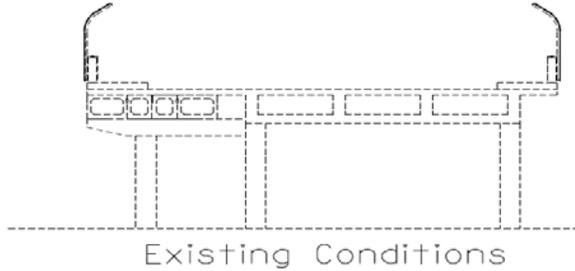
Originally Proposed Bridge Staging



RECOMMENDATION NO. 6
Harlow Bridge - Construct Pier Wall Interior Bent

VE Study Proposed Bridge Staging

Harlow Road Over I-5
 Interior bent proposal



Recommendation 7

RECOMMENDATION NO. 7	
Realign Harlow Bridge	
Function: Bid Item : Harlow Bridge	IDEA NO(s). A-3
<p>Original Concept: Offset new bridge 12'-11" to north of existing centerline.</p> <p>Recommendation Concept: Offset new bridge a farther distance to allow some work room between new and existing bridge and to place construction joint over beam and closer to center of travel lane.</p> <p>Advantages:</p> <ul style="list-style-type: none"> ◆ Increased constructability will result in lower cost for the bridge. Moving construction joint will decrease maintenance and increase life of bridge deck. <p>Disadvantages:</p> <ul style="list-style-type: none"> ◆ Moving alignment will require more and higher retaining walls for bridge approaches. 	
COST SUMMARY	COST
Original Concept	\$2.8M plus Retaining walls
Recommendation Concept	Lower cost bridge plus more retaining walls.
Savings	None, but increased constructability and reduced risk of claims.
<p>Discussion/Justification:</p> <p>It would be likely that the successful contractor would suggest moving the bridge for increased constructability and the costs would be higher at that time. Maintenance may request moving the joint location later in construction because of reliability concerns.</p>	
<p>Assumptions and Calculations:</p> <p>Looking at the alignment and cross sections, it appears possible to move the new bridge farther to the North.</p>	

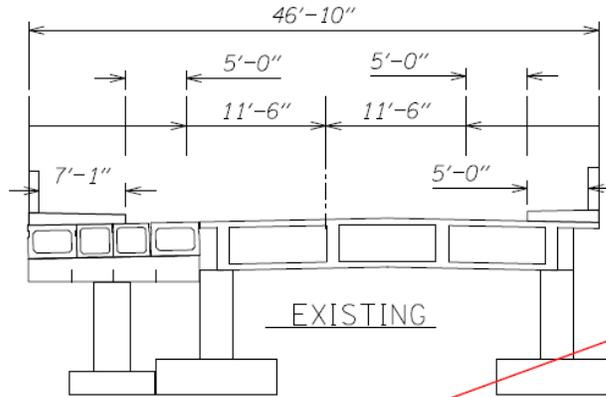
RECOMMENDATION NO. 7 Realign Harlow Bridge

Sketches/Photos:

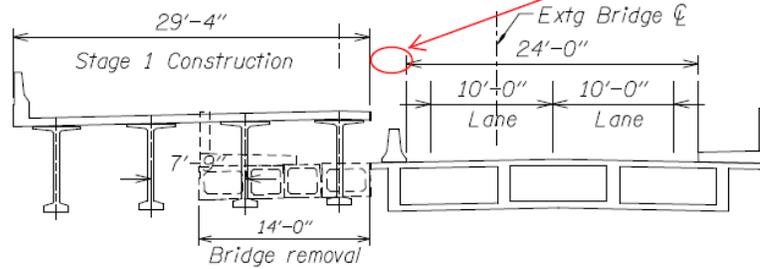
Insert sketch/photo here

*Harlow Bridge (Looking East)
Option 4*

*New bridge centerline is shifted
12'-11" to the North
7' bike lane*

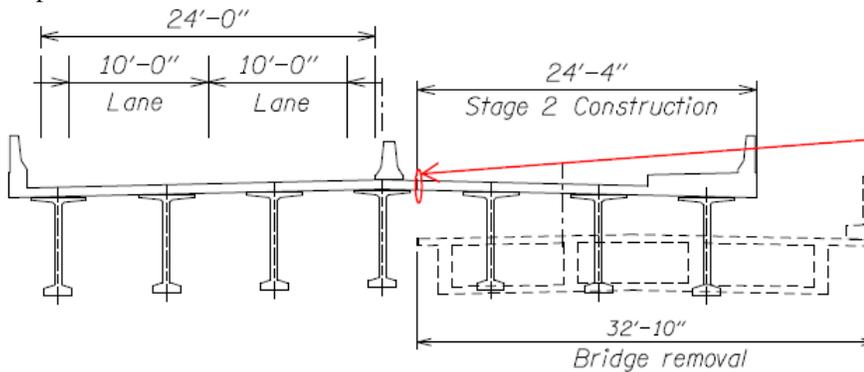


Need room for screed rail, machine and workers.



STAGE 1

Insert sketch/photo here

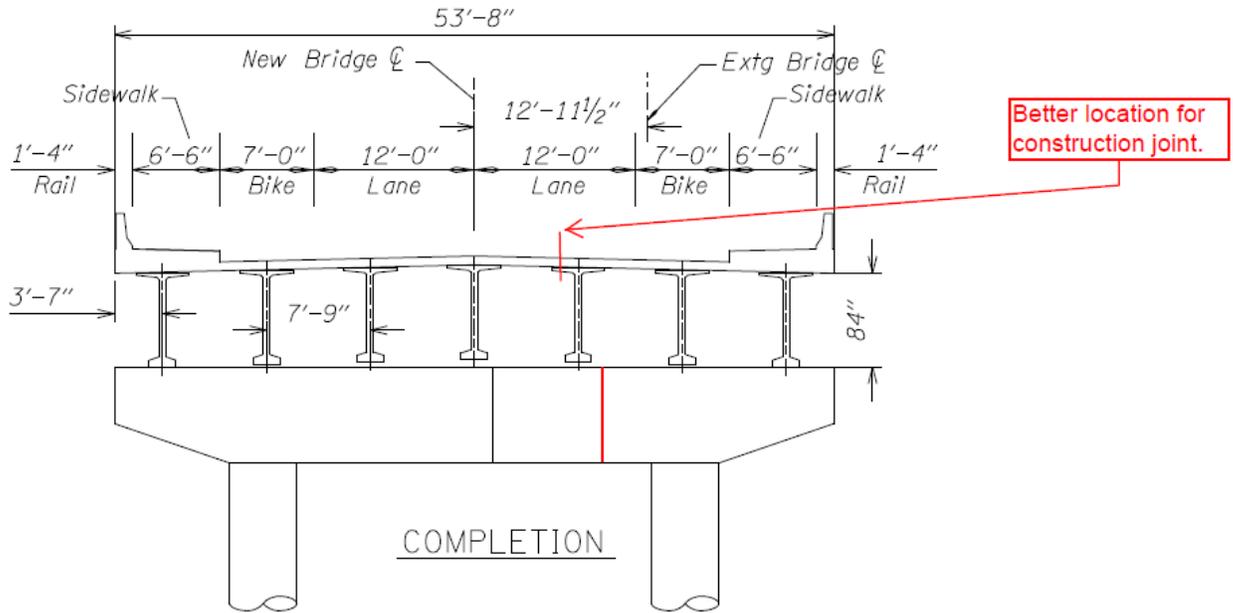


Joint between beams is problematic.

STAGE 2

RECOMMENDATION NO. 7
Realign Harlow Bridge

Insert sketch/photo here



Selected Alternatives: Summary and Disposition

Proposal No.	Description	Construction Cost (Delta)	Disposition (A,R,CA)	Comments
1	Eliminate Auxiliary Lane on I-5 to I-105	-4.8 M		
2	Eliminate Auxiliary Lane on Beltline from Coburg to I-5 Maintain 2-Lane Split	-22.5 K		
3	Realign "A" Line			
4	Realign "D" Line			
5	Reduce Width of A-Line Bridge	-20 K		
6	Harlow Bridge – Construct Pier Wall Interior Bent	-40 K		
7	Realign Harlow Bridge			
A = Accepted R=Rejected CA Conditionally Approved (If CA, note who is responsible to resolve open issues and when				

Presentation

I-5 @ Beltline Interchange – Unit 4



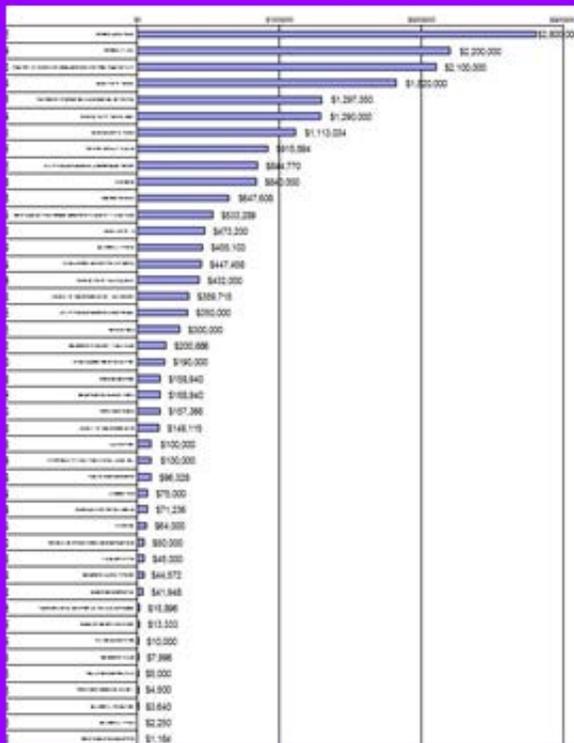
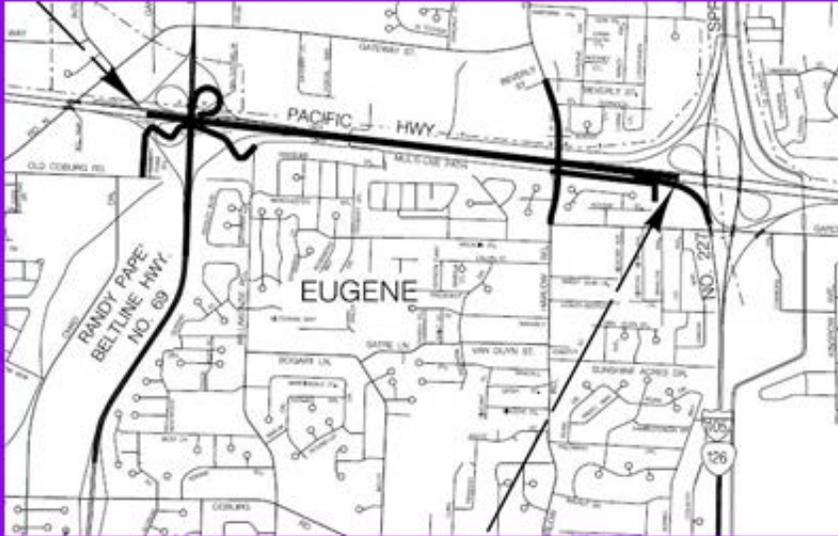
Value Engineering Study

January 2014

Value Engineering Team

- Bob Grubbs
 - Brian Paslay
 - Christi McDaniel-Wilson
 - Chuck Lemos
 - Tracy Harris
- | |
|-----------------|
| Bridge Design |
| Roadway Design |
| Trans. Analyst |
| Construction PM |
| VE Coordinator |

- I-5 MP from MP 193.97 to MP 195.58
- Beltline Coburg Road to Gateway Street
- The total project cost is ~ \$34 million.



Cost Model

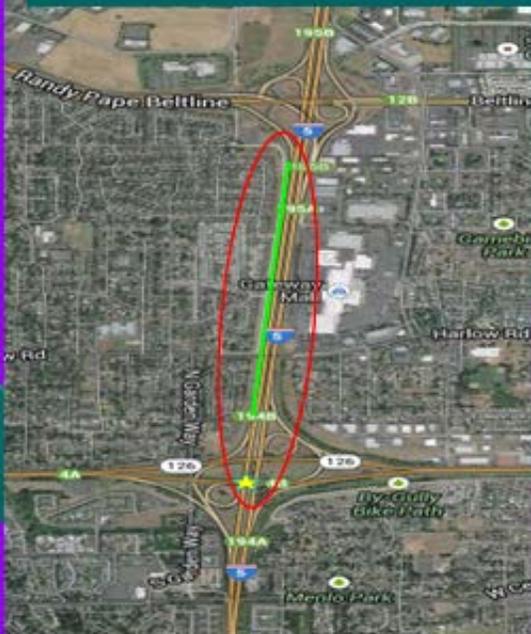
- Harlow Bridge
- "A" Line Bridge
- Sound Wall
 - (Beltline)
- Auxiliary Lanes
 - R/W
 - Embankment
 - Base Rock
 - HMAC

Brainstorming

A	Harlow Bridge
A1	Eliminate Harlow Bridge
A2	Construct Harlow Bridge
A3	Realign Harlow Bridge
A4	Pier Wall Interior Bent
B	"A" Line Bridge
B1	Realign "A" Line
B2	Eliminate "A" Bridge add lane to I-5 overcrossing bridge
B3	Reduce width of bridge
C	Sound Wall
C1	Eliminate sound wall overlap (maintain it on shoulder)
D	Embankment in Place
D1	Eliminate Auxiliary Lane on I-5 to I-105
D2	Eliminate Auxiliary Lane on Beltline from <u>Coburg</u> to I-5 maintain 2 Lane split at I-5
E	Misc
E1	Consider Concrete Paving "A" Line from split to the Bridge

**Christi
McDaniel-Wilson**

D-1: Eliminate Auxiliary Lane on I5 between the Beltline on-ramp and the 1st I105 off-ramp



Advantages:

- Cost savings,
- May eliminate need to replace Harlow Bridge, Drainage, Bike path, Sound wall

Dis-Advantages:

- Merge, diverge, and weaving issues
- Current analysis does not include the AM peak hour

D-1: Eliminate Auxiliary Lane on I-5 between the Beltline on-ramp and the 1st I-105 off-ramp

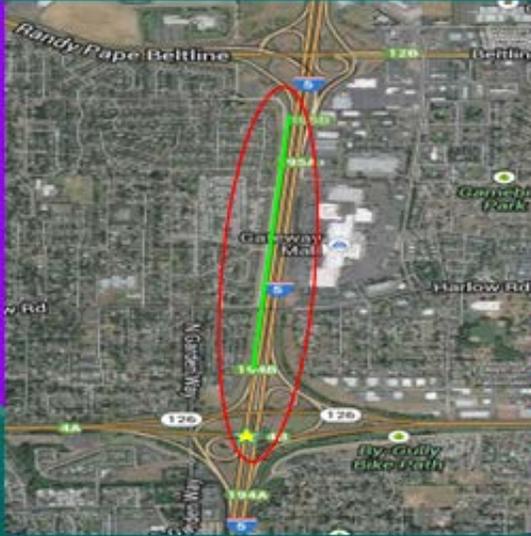


VE Study Results:

Based on data provided and some additional assumptions, the second SB off-ramp at the I105 interchange is likely the location of the controlling v/c.

- Without the Auxiliary lane the v/c in 2025 is estimated to be approximately 0.83.
- Exceeds HDM target (0.75) but not OHP (0.85)
- With the Auxiliary lane (at this location) the v/c in 2025 is estimated to be approximately 0.64.
- *Does not exceed HDM or OHP target*
- The speed differential in both scenario's is 9.5 mph

D-1: Eliminate Auxiliary Lane on I-5 between the Beltline on-ramp and the 1st I-105 off-ramp



Recommendation: Extend project limits south to include both I5 off-ramps at the I105 interchange and analyze both the AM and PM time periods for the future year. Potential Cost Savings ~ \$4.38 million

D-2: Shorten Auxiliary Lane on Beltline between on-ramp and I5 SB on-ramp.



Advantages:

- Cost savings
- ROW
- Utility relocation
- Building what is needed

Dis-Advantages:

- Merge, diverge, and weaving issues
- Minimizes decision time for lane assignment
- Additional signing

D-1: Shorten Auxiliary Lane on Beltline between Coburg on-ramp and I-5 SB on-ramp.



VE Study Review Results:

Based on information provided, the important pieces are 3 lanes east of the gore, a 2-lane off-ramp to I-5 and some sort of Type B auxiliary lane to facilitate the dual lane off-ramp. The auxiliary lane (right only) is developed to support the dual lane off-ramp at I-5.

D-1: Shorten Auxiliary Lane on Beltline between Coburg on-ramp and I-5 SB on-ramp.



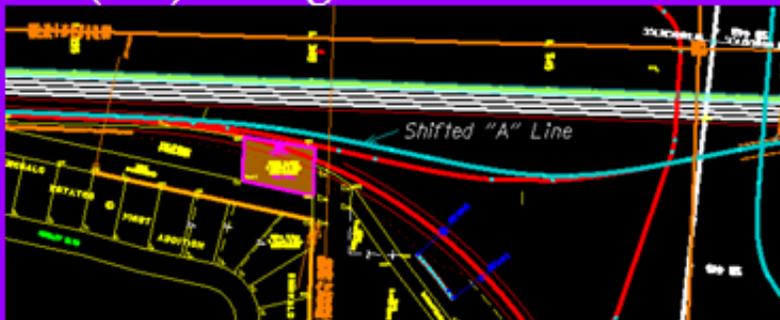
VE Study Review Results:

Based on information provided, dual lanes are required on the off-ramp and the auxiliary lane can be shortened based on design criteria.

Potential Cost Savings ~ \$75/ft

Brian Paslay

(B-1) Realign "A" & "D" Lines



- Reduce intermediate curve left to 45 mph design speed.

Existing divergent point

Proposed divergent point

325+00

VICTORIAN PLACE II

EMERALD ESTATES

- Consists of moving the dual – right divergent point eastward to station 325+00 (about 240')

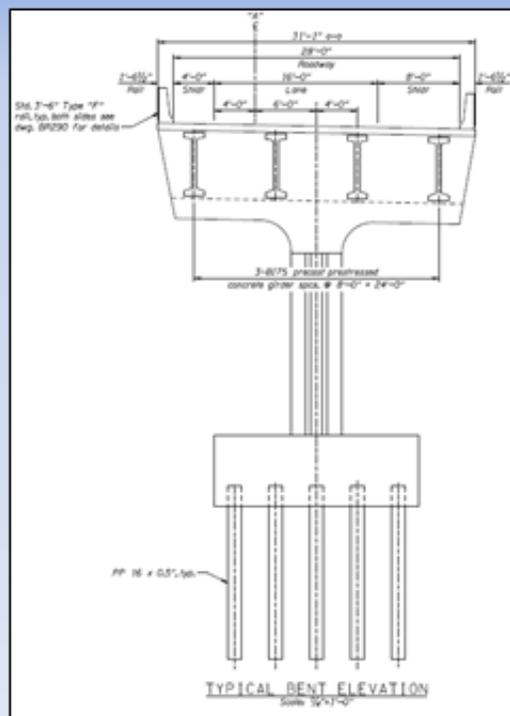
(B-1) Realign “A” & “D” lines

Advantage	Disadvantage
<ul style="list-style-type: none"> •Potentially less R/W impacts •Safety benefit via increased traffic calming through reversing curves •Less utility conflicts (potentially) 	<ul style="list-style-type: none"> •Slightly shorter decision distance for deciding to go NB or SB on I-5

Bob Grubbs

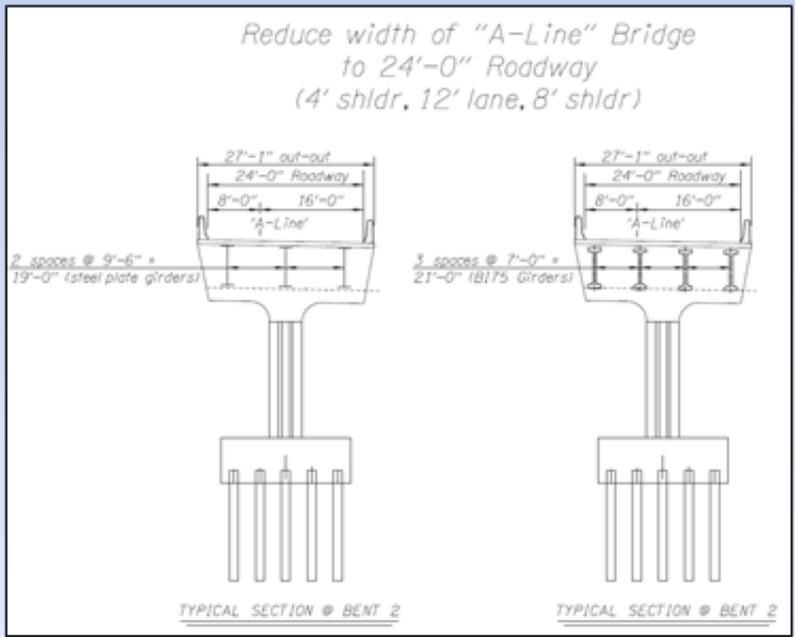
"A"-Line Proposal

Originally Proposed Design



"A"-Line Proposal

Reduce width of A-Line and bridge from proposed 28'-0" to 24'-0"



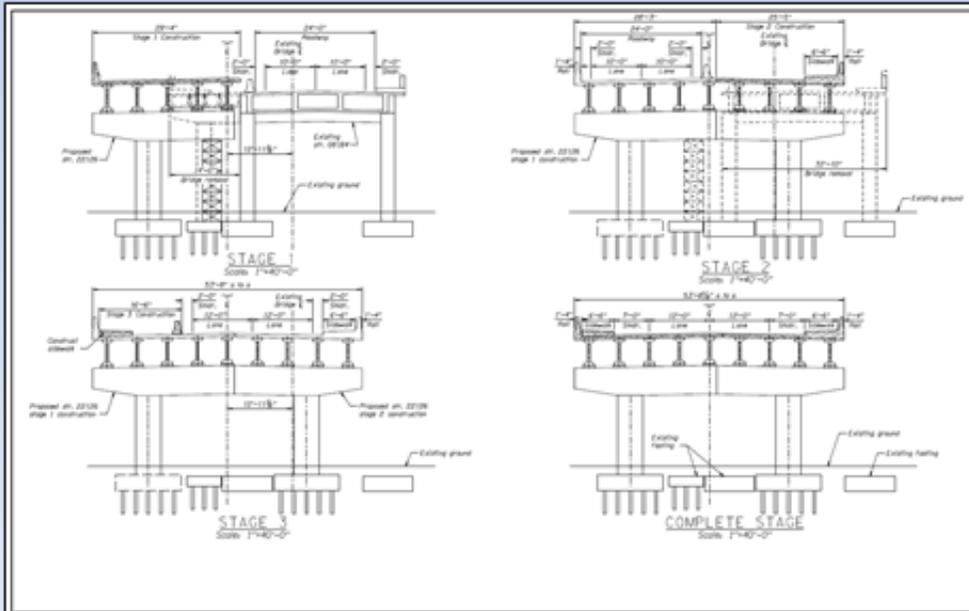
"A"-Line Proposal

Reduce the width of "A"-Line at the Bridge and beyond

Advantage	Disadvantage
<ul style="list-style-type: none"> Traffic calming headed into loop ramp Slightly reduced bridge and roadway cost (\$15K-\$20K) 	<ul style="list-style-type: none"> Non-standard design that requires a design exception No room for future expansion

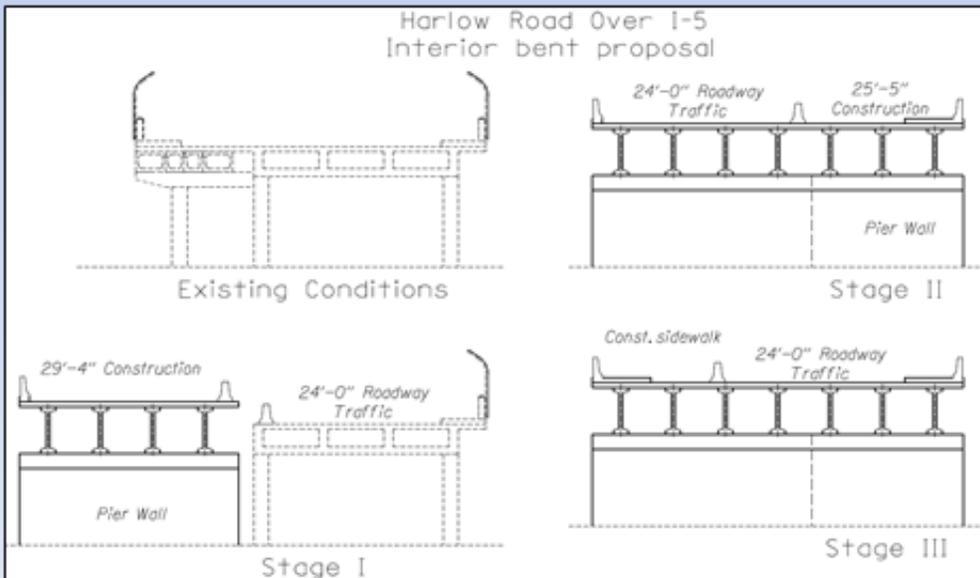
Harlow Road Over I-5 Bridge

Proposed Design



Harlow Road Over I-5 Bridge

Replace two Column interior bent with pier wall



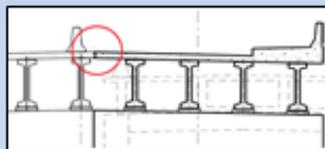
Harlow Road Over I-5 Proposal

Construct the interior bent of the Harlow Road Over I-5 Bridge using a pier wall instead of two column bent.

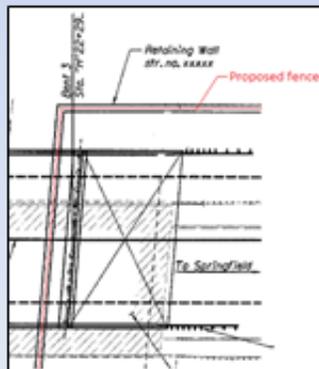
Advantage	Disadvantage
<ul style="list-style-type: none">• Typically better seismic performance• Eliminates the need for temporary supports to facilitate staged construction• Reduced construction time• Estimated as slightly cheaper (\$15K-\$20K)	<ul style="list-style-type: none">• Typically considered aesthetically less pleasing.• May have conflicts with existing footings

Other Proposed Bridge Items

- Harlow Road Over I-5: Place deck construction joint over girder flanges

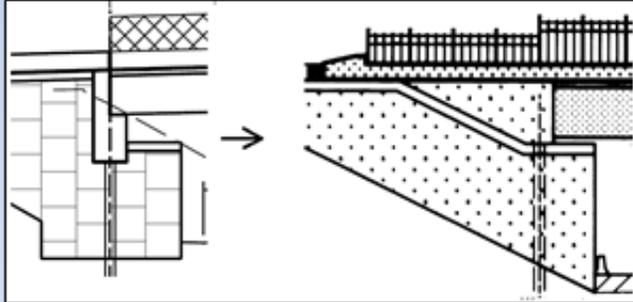


- Place fence on top of MSE Wall for safety of inspectors, maintenance, and others



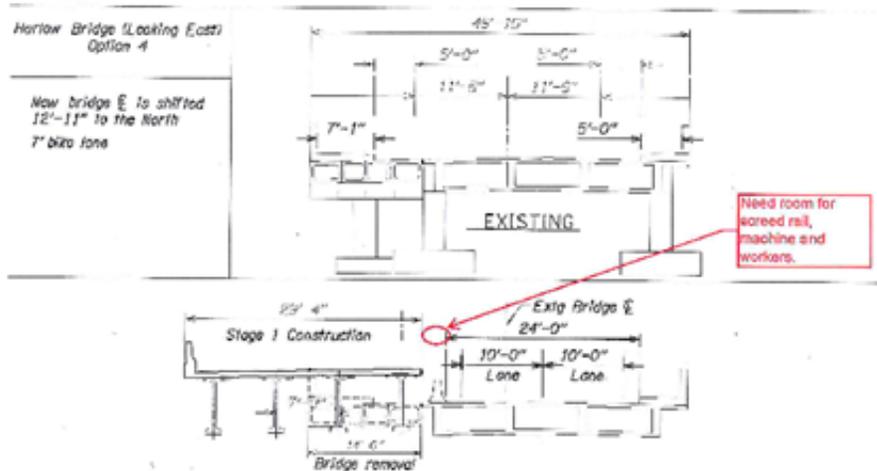
Other Proposed Bridge Items, cont.

- Detail MSE wall abutments for ease of access for inspection and maintenance



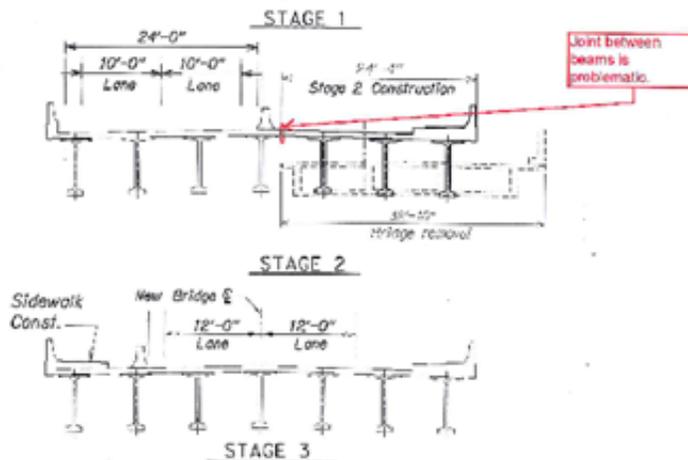
Chuck Lemos

(A-3) – Realign Harlow Bridge

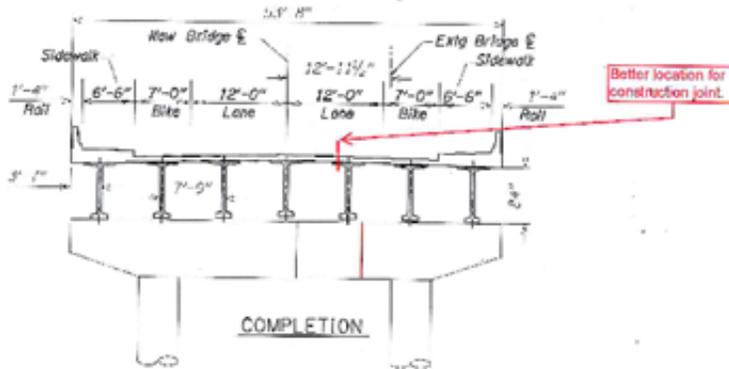


- Move Harlow Bridge alignment farther to the north to increase constructability.

Realign Harlow Br.



A-3 Realign Harlow Br.



(A-3) – ReAlign Harlow Br.

Advantage	Disadvantage
<ul style="list-style-type: none"> • Increased constructability • Increased service life of bridge deck • Decreased maintenance of bridge • Reduces risk of increased CCO 	<ul style="list-style-type: none"> • Additional retaining walls • May increase slightly total cost of Harlow Rd.

Cost Savings: \$0, reduced risk – priceless.

Summary

Proposal No.	Description	Original Cost	Proposed Cost	Potential Savings	Delta %
B-3	Reduce Width of "A" Line Bridge	2,200 M		15-20 K	-0.09%
A-3	Pier Wall Interior Bent	2,800 M		25-40 K	-0.18%
B-1	Realign "A" Line				
D-1	Shorten Aux Lane on Beltline			75/ft	
D-2	Eliminate Aux Lane on I-5			300/ft	

What's Next?

- Draft Report
- Final Report
- PDT Meeting
- Implementation Report
- Annual FHWA Report

Questions?

I-5 @ Beltline Interchange – Unit 4

THANK YOU



Value Engineering Study

January 2014