South Stage Road
Extension Plan

Technical Memorandum

September 16, 2024 Project# 27003.014

To: Lisa Cornutt, Oregon Department of Transportation (ODOT)
Karl MacNair, City of Medford

From: Marc Butorac, PE, PTOE, PMP; Matt Bell; Amy Griffiths, PE

RE: Task 5.2.2: Refined (Most Promising) Alternative Summary

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INTRODUCTION

This memorandum summarizes the refined alternatives analysis and presents Recommended Overpass and Underpass Alternatives with compatible Interchanges for the subsequent future environmental and design phase of the project. Recommended Overpass and Underpass Alternatives with compatible Interchanges were developed based on further evaluation of the transportation impacts, environmental impacts, and structural feasibility and constructability of the eight technically and economically feasible alternatives documented in *TM #5.1.3: Concept Analysis*. Recommendations will be updated as necessary based on input from the Project Management Team (PMT), Project Development Team (PDT), Project Advisory Committee (PAC), and community at upcoming meetings and other engagement activities.

This South Stage Road Extension Facility Plan may be adopted in a subsequent environmental review process in accordance with 23 USC 168, Integration of Planning and Environmental Review,[1] and 23 CFR 450, Planning Assistance and Standards.[2]

1 https://www.govinfo.gov/app/details/USCODE-2022-title23/USCODE-2022-title23-chap1-sec168/summary
2 https://www.govinfo.gov/app/details/CFR-2022-title23-vol1/CFR-2022-title23-vol1-part450

BACKGROUND

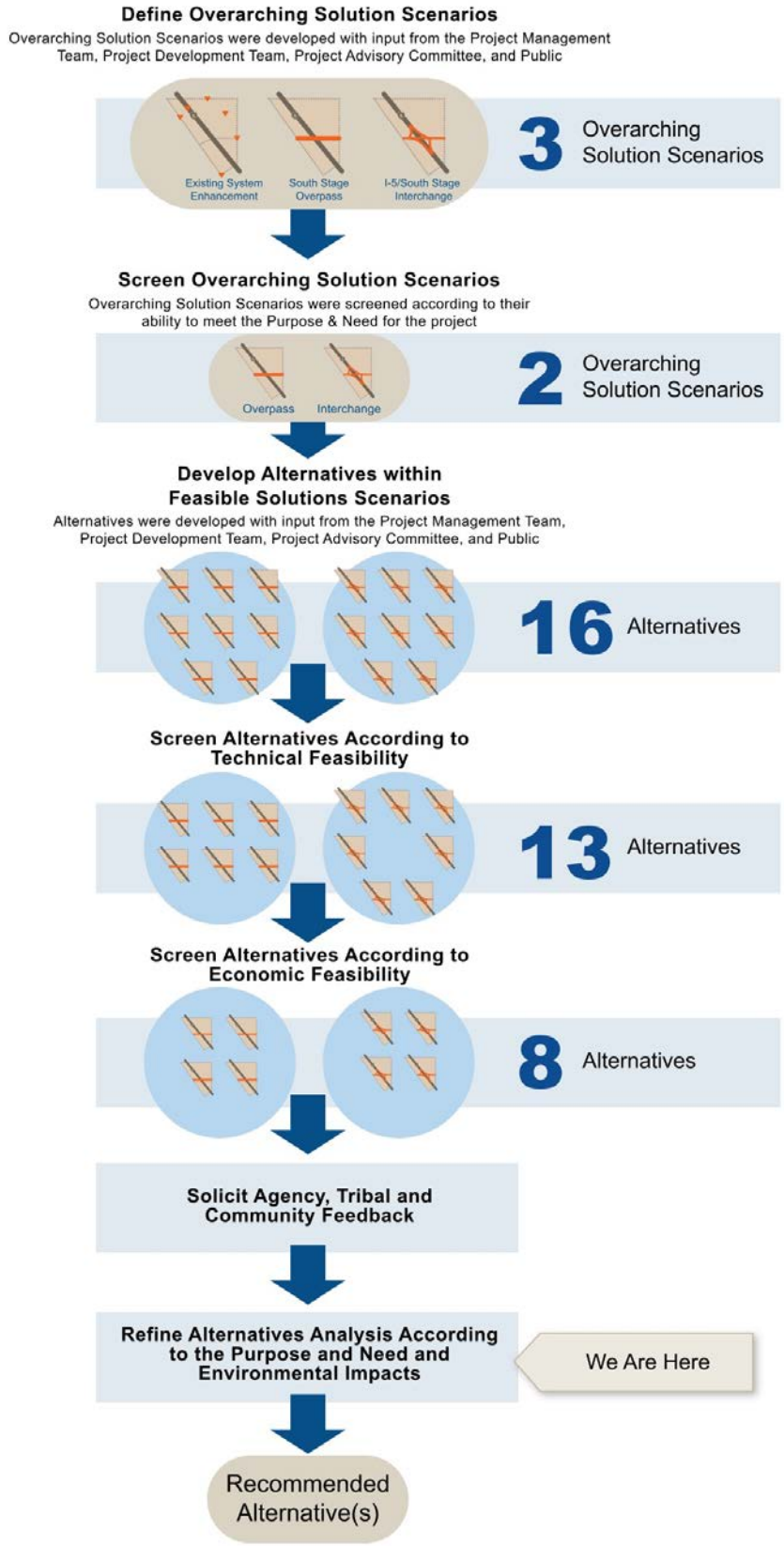
In the previous task, the project team developed and evaluated 16 alternatives to address the Purpose and Need and Goals and Objectives of the South Stage Extension Facility Plan. The alternatives include eight Overpass/Underpass Alternatives and eight Interchange Alternatives. The alternatives were evaluated based on their technical feasibility, economic feasibility, and an initial environmental screening. The results of the evaluation showed that three alternatives (O-5, O-8, I-6) were not technically feasible and another five alternatives (O-6, O-7, I-5, I-7, I-8) were not economically feasible[3]. The results also showed that the Interchange Alternatives as a whole have more environmental impacts than the Overpass/Underpass Alternatives.

The 16 alternatives, evaluation results, and recommendations were presented to the PMT, PDT, PAC, and community at a series of meetings and other engagement activities. A key outcome of the engagement activities was that no other reasonable alternatives beyond those previously evaluated were identified through public and agency outreach. In addition, based on PMT, PDT, PAC and community feedback, there was consensus on the recommendation to remove Alternatives O-5, O-6, O-7, O-8, I-5, I-6, I-7, and I-8 from further consideration based on technical and economic feasibility screening. The remaining eight technically and economically feasible alternatives (O-1, O-2, O-3, O-4, I-1, I-2, I-3, and I-4) were recommended for further analysis and refinement. *Technical Memorandum* (*TM) #5.1.1 Range of Alternatives* includes exhibits of all the initial alternatives.

The purpose of this memorandum is to summarize the results of the further analysis and document how the project team refined and identified Recommended Overpass and Underpass Alternatives with compatible Interchanges. Figure 1 illustrates the alternatives development and recommendation process.

[3] Economic feasibility was assessed by considering the relative cost opinions of alternatives compared to other alternatives with adequate capacity and lesser impacts to right-of-way, existing building structure, and other infrastructure impacts.

Figure 1. Alternatives Development and Recommendation Process



ALTERNATIVES ANALYSIS SUMMARY

As indicated above, the project team provided further analysis of the eight technically and economically feasible alternatives (four Overpass/Underpass and four Interchange) to support identification of Recommended Overpass and Underpass Alternatives with compatible Interchanges. The following memoranda were developed by the project team to document the analysis results.

- **TM #5.2.2.1: Transportation Analysis Appendix:** This memorandum identifies the transportation system performance under year 2045 traffic conditions with development of the Overpass/Underpass and Interchange Alternatives. This memorandum also identifies other transportation system improvements needed to support the Overpass/Underpass and Interchange Alternatives as well as the pedestrian and bicycle-related improvements. The results of the analysis show that the Overpass/Underpass Alternatives are sufficient to meet the Purpose and Need of the South Stage Extension Facility Plan and that an interchange is not needed within the 2045 planning horizon.
- **TM #5.2.2.2: Environmental Screening Analysis Appendix:** This memorandum identifies the environmental impacts of the eight technically and economically feasible alternatives (four Overpass/Underpass and four Interchange). This memorandum shows that of the eight-remaining alternatives, those that traverse north of the Pacific Power & Light (PPL) substation (O-1, O-3, I-1, I-3) have more impacts on existing infrastructure and adjacent land uses than those that traverse to the south. As a result, this memorandum recommends that Alternatives O-2 and O-4 and compatible interchanges I-2 and I-4 be advanced for additional engineering and environmental analysis in the Facility Plan.
- **TM #5.2.1: Refined Alternatives and Cost Opinions:** This memorandum identifies refinement modifications to the Recommended Overpass and Underpass Alternatives with compatible Interchanges. This memorandum also provides further evaluation of the technical and economic feasibility of the alternatives and provides magnitude of construction cost opinions.
- **TM #5.2.2.3: Structural and Constructability Analysis Appendix:** This memorandum identifies considerations for the construction of the Recommended Overpass and Underpass Alternatives with compatible Interchanges. Based on the preliminary, concept level, planning information provided in the analysis, the modified Overpass (O-2) and the forward compatible modified Interchange (I-2) appear feasible from a structural and constructability perspective. The modified Underpass (O-4) and the forward compatible modified Interchange (I-4) are likely feasible, but further study of the tall cut retaining walls and staging during the I-5 bridge construction would be needed in a future phase to confirm this finding.

Based on the information provided in these memoranda, as well as discussions with the City, ODOT environmental staff, and Federal Highway Administration (FHWA), and feedback from the community, the project team identified Recommended Overpass and Underpass Alternatives

with compatible Interchanges to be included into the Facility Plan and further considered during the subsequent future environmental and design phase of the project.

REFINED ALTERNATIVES ANALYSIS

Based on operational, safety, and environmental analyses, and following a series of meetings and engagement activities with the PDT, PAC, and the community this spring, the project team used the following approach to refine alternatives analysis and recommend alternatives for the Facility Plan.

1. Screening of Overpass/Underpass and Interchange Alternatives

The *TM #5.2.2.1 Transportation Analysis Appendix* identifies the transportation system performance under year 2045 traffic conditions with development of the Overpass/Underpass and Interchange Alternatives. The analysis builds on prior work and includes refinement of the intersection operations analysis, evaluation of freeway mainline, merge, and diverge operations, and identification of projects to fill gaps in the pedestrian and bicycle network. The analysis supports development of the most promising alternatives by identifying the transportation system performance and identifying the transportation system needs under each alternative.

As described in *TM #5.2.2.1 Transportation Analysis Appendix*, the analysis does not show a distinct need for an interchange within the 2045 planning horizon according to the Purpose and Need. Therefore, additional analysis and study would be required, if demand conditions change, to demonstrate that there is a need for an interchange. Travel demand at this point in time suggests an interchange would not be needed until after 2045. Because of the proximity to the I-5 interchanges at South Medford (north) and Phoenix Road (south), if an interchange alternative is ultimately selected, an interchange spacing design exception would be required through ODOT and FHWA. Further, the Interchange Alternatives would have greater impacts to environmental resources because of the greater footprint compared to Overpass/Underpass Alternatives.

The preliminary analysis results were presented to the City of Medford for discussion with the recommendation that the Interchange Alternatives be eliminated from further consideration. The City of Medford, in coordination with the City Council and Chamber of Commerce, provided a letter dated June 21, 2024, in which they indicated they believe there is a need for the Overpass/Underpass within the 2045 planning horizon, but regardless, they also anticipate a future need and would like to include an interchange alternative in the Facility Plan. The need for an interchange is heavily influenced by future employment and/or population growth east of I-5 and south of Juanipero Road. This is projected to be a high growth area for the city. The City of Medford asked the project team to consider the future need for an interchange beyond the

2045 planning horizon and to ensure that recommended Overpass/Underpass Alternatives were forward compatible to support a future interchange.

In response to the City of Medford, the project team recommends a phased approach to the Facility Plan: identify a Phase 1 Overpass/Underpass Alternative that has forward compatibility with a Phase 2 Interchange Alternative. Forward compatibility in this sense is the design of an Overpass/Underpass that, in the future when warranted by the 20-year traffic forecast, could be converted to an interchange with relatively minor disturbance to the existing facility. Both Phase 1 and Phase 2 could be developed in the near term when funding is available for completing environmental review, however only Phase 1 could proceed through design and construction until an interchange is justified according to a future 20-year forecast.

2. Environmental Screening

The analysis summarized in *TM #5.2.2.2 Environmental Screening Analysis Appendix* identifies the environmental impacts of the eight-remaining alternatives (four Overpass/Underpass and four Interchange). In reviewing the potential alternatives with respect to the existing PPL substation and high voltage powerlines located east of I-5, as well as right-of-way needs, developed and approved land uses, and available wetlands mapping, Alternatives O-1/I-1 and O-3/I-3 were determined to have greater potential impacts and similar benefits as Alternatives O-2/I-2 and O-4/I-4. Key findings from the memorandum include:

- East of I-5, Alternatives O-1/I-1 and O-3/I-3 traverse the corridor north of the substation and require the relocation of the high voltage powerlines. Alternatives O-2/I-2 and O-4/I-4 are south of the substation and avoid these impacts.
- Alternatives O-1/I-1 and O-3/I-3 have right-of-way needs from the Centennial Golf Course and commercial property to the north to preserve the five-lane right-of-way footprint previously recommended. The southerly alignments of Alternatives O-2/I-2 and O-4/I-4 avoid these impacts.
- Alternatives O-1/I-1 and O-3/I-3 have 2.60 acres of impact to developed and approved land uses. Alternatives O-2/I-2 and O-4/I-4 avoid these impacts.

As a result, the project team recommends advancing Alternatives O-2/I-2 (Overpass) and O-4/I-4 (Underpass) for additional engineering and environmental analysis in the Facility Plan.

3. Overpass vs. Underpass Alternative Comparison

Further refinement modifications and analysis of the four-remaining alternatives (two Overpass/Underpass and two interchange) are summarized in *TM #5.2.1 Alternative Refinements and Cost Opinions*. The memorandum identifies the rational for the refinements and presents the results of the refined technical and economic feasibility analysis, including magnitude of

construction cost opinions and right of way, existing building structure, and other infrastructure impacts. The analysis summarized in *TM #5.2.2.3 Structure and Constructability Analysis Appendix* identifies considerations for the construction of the four-remaining alternatives and indicates that further study of the Underpass alternatives would be needed in a future phase to further confirm the overall feasibility. Key findings from the memorandum include:

1. O-2 (Overpass) and O-4 (Underpass) have the same horizontal alignment. Both would be on structure between I-5 and San George Estates to avoid fill in the Bear Creek floodway and minimize impacts in the Bear Creek Greenway.
2. O-2 (Overpass) has a higher potential for visual and noise impacts along the San George Estates frontage due to elevated roadway compared to O-4 (Underpass), which would be at-grade or close to at-grade. However, the O-4 (Underpass) has potential constructability challenges that need to be reviewed to confirm feasibility.
3. Refined design work and cost estimating of these alternatives with their respective forward compatible (Phase 2) interchanges (I-2 / I-4) indicated that there is not enough of an economic differentiator to justify the dismissal of the alternatives based on the potential differences in potential visual and noise impacts that may necessitate sound walls.

As a result of the screenings and comparisons above, the project team preliminarily recommends that the Overpass/Underpass Alternatives (O-2/O-4) and the forward compatible Interchange Alternatives (I-2/I-4) be included in the Facility Plan and further evaluated during the subsequent future environmental and design phase of the project.

RECOMMENDED OVERPASS AND UNDERPASS ALTERNATIVES WITH COMPATIBLE INTERCHANGES

The Recommended Overpass and Underpass Alternatives with compatible Interchanges developed by the project team are presented below. Documentation of the alternatives would clearly state that the interchange development would only be initiated when adopted 20-year forecasts show a distinct benefit from the interchange that the Overpass/Underpass alternative could not accommodate by itself. In addition, the project team recommends several other transportation system improvements in the study area necessary to support each alternative.

Overpass and Underpass Alternatives

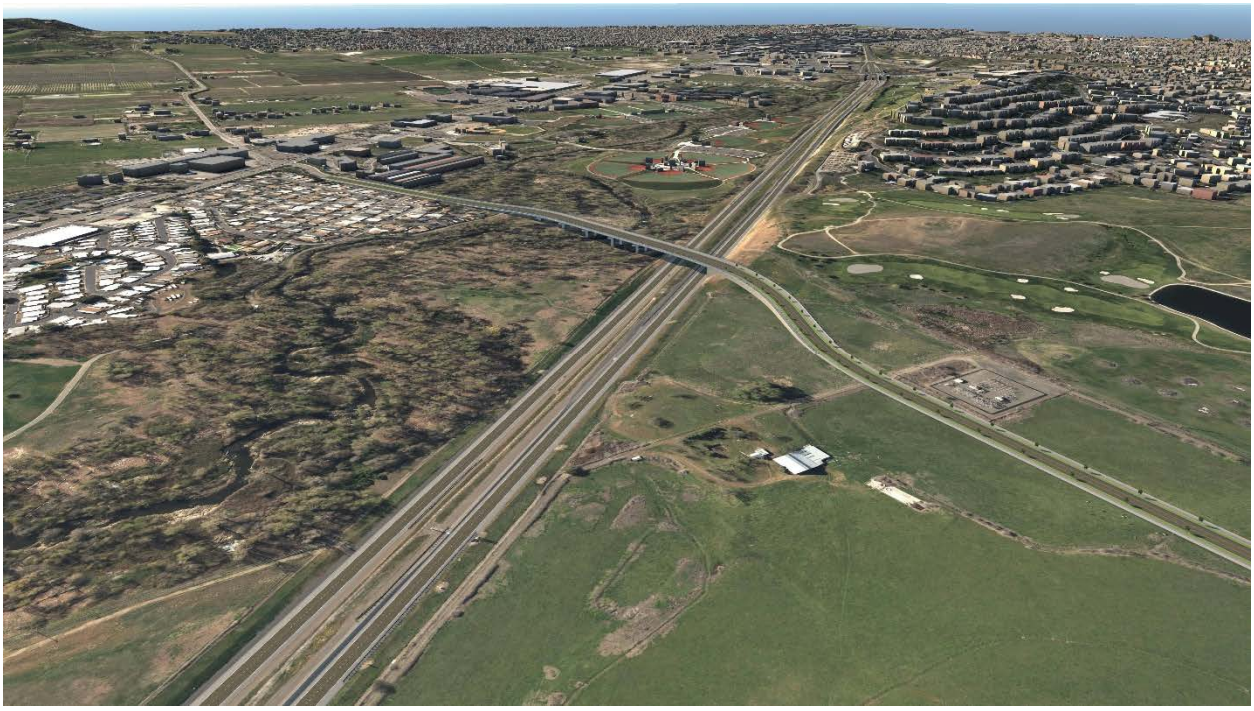
The initial Overpass (O-2) and Underpass (O-4) alternatives were modified from what was initially presented in *TM# 5.1.1: Range of Alternatives* to shift the alignment south of the PPL substation.

MODIFIED OVERPASS ALTERNATIVE O-2

The modified horizontal alignment of Alternative O-2 extends South Stage Road to the east where it makes a slight bend to cross the Bear Creek floodway at an approximately 90-degree angle, crosses I-5 at an approximately 35-degree skew, then curves to the south around the existing PPL substation. The vertical profile increases from the existing elevation of South Stage Road west of Samike Drive to gain the elevation needed to cross over I-5 with the appropriate vertical clearance then transitions down to meet existing grade near the existing PPL substation. Exhibit 1 and Exhibit 2 illustrate the plan and profile views of Modified Alternative O-2.

Exhibit 1. Modified Overpass Alternative O-2 Plan View

Exhibit 2. Modified Overpass Alternative O-2 Profile View

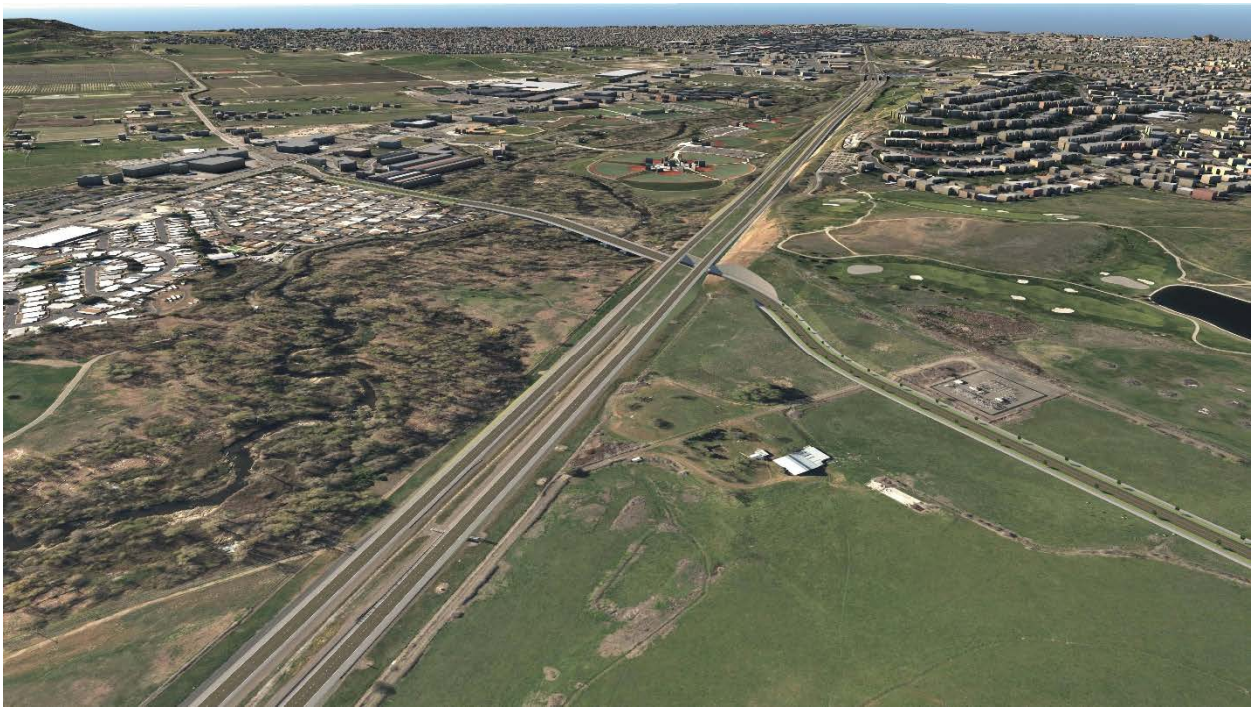


MODIFIED UNDERPASS ALTERNATIVE O-4

The modified horizontal alignment of Alternative O-4 is the same as O-2. The difference is that the vertical profile of Modified Alternative O-4 increases relatively slightly from the existing elevation of South Stage Road east of Samike Drive in order to gain the elevation needed to cross the Bear Creek floodplain but stays low enough to pass below I-5. The vertical profile of I-5 will have to be raised in both directions to allow for South Stage Road to pass below. On the east side of I-5, the vertical profile is significantly lower than the existing grade, likely requiring tall retaining walls. Exhibit 3 and Exhibit 4 illustrate the plan and profile views of Modified Alternative O-4.

Exhibit 3. Modified Underpass Alternative O-4 Plan View

Exhibit 4. Modified Underpass Alternative O-4 Profile View



Compatible Interchange Alternatives

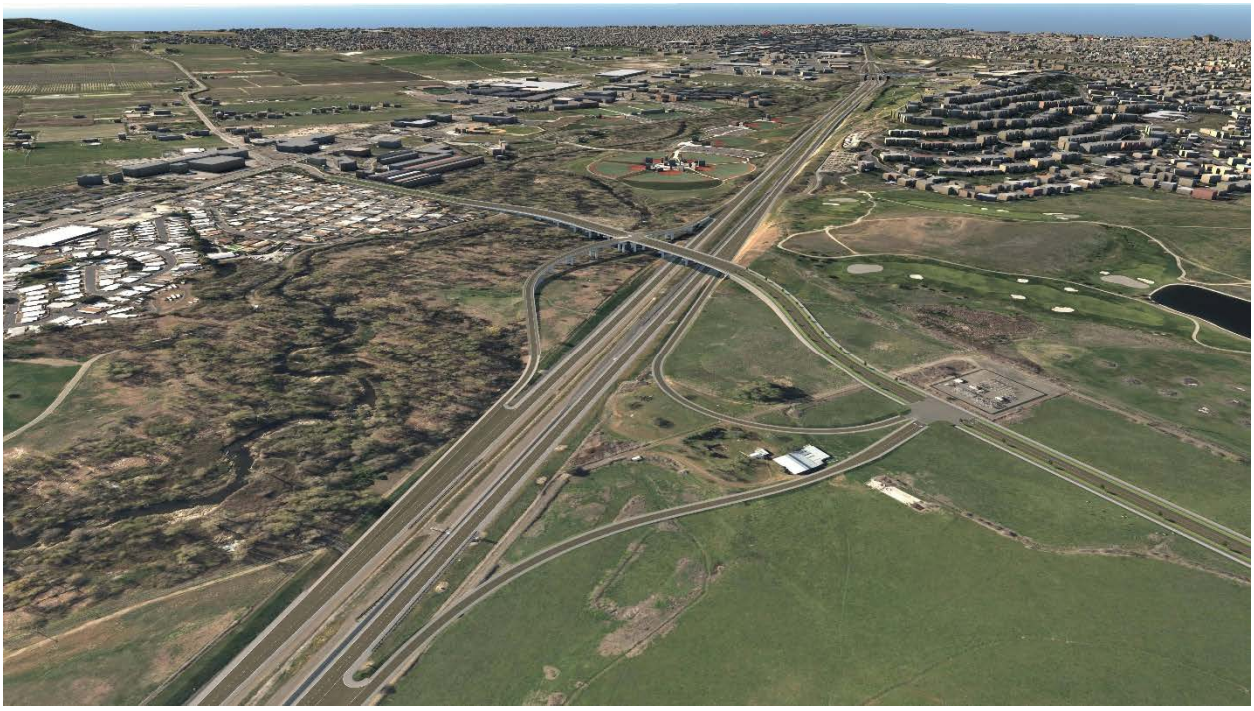
The compatible alternatives consist of modified versions of the interchange (I-2 and I-4) alternatives.

MODIFIED OVERPASS INTERCHANGE ALTERNATIVE I-2

The modified horizontal alignment and vertical profile of Alternative I-2 are similar to O-2; however, there are some differences due to the presence of the I-5 northbound (NB) on-ramp and the I-5 southbound (SB) ramp terminal. The I-5 NB on-ramp would most likely cross under the South Stage Road bridge east of I-5 due to the Parclo A configuration while the I-5 SB ramp terminal would be located on South Stage Road west of I-5. Due to the diamond configuration for the SB ramps, the South Stage Road profile needs to be relatively level at the SB ramp terminal. Exhibit 5 and Exhibit 6 illustrate the plan and profile views of Modified Alternative I-2. Further evaluation and design will be necessary during the environmental phase to ensure forward compatibility.

Exhibit 5. Modified Overpass Interchange Alternative I-2 Plan View

Exhibit 6. Modified Overpass Interchange Alternative I-2 Profile View

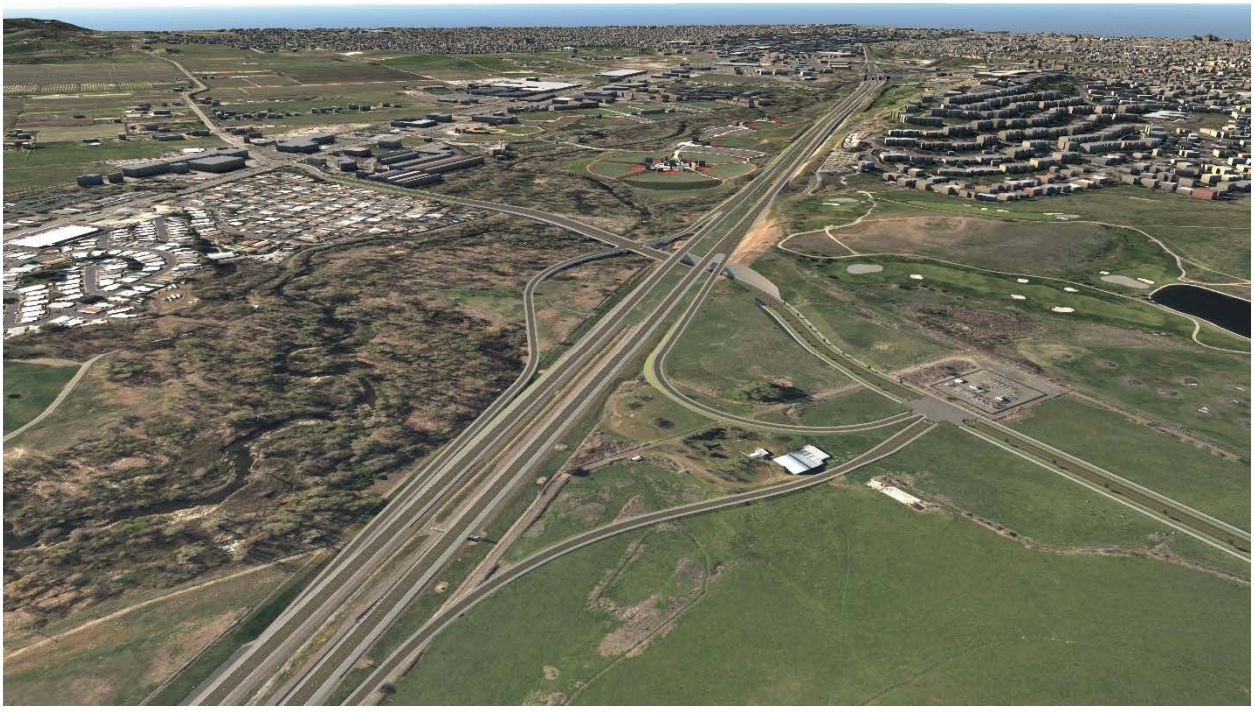


MODIFIED UNDERPASS INTERCHANGE ALTERNATIVE I-4

The modified horizontal alignment of Alternative I-4 is the same as I-2 while the vertical profile is the same as O-4; however, there are some differences due to the presence of the I-5 northbound (NB) on-ramp and the I-5 southbound (SB) ramp terminal. The I-5 NB on-ramp would most likely cross over South Stage Road east of I-5 due to the Parclo A configuration and require an additional bridge to carry the NB on-ramp over South Stage Road. The South Stage Road vertical alignment would need to be relatively flat in order to accommodate the future I-5 SB ramp terminal connections. Exhibit 7 and Exhibit 8 illustrate the plan and profile views of Modified Alternative I-4. Further evaluation and design of this alternative will be necessary during the environmental phase to ensure forward compatibility.

Exhibit 7. Modified Underpass Interchange Alternative I-4 Plan View

Exhibit 8. Modified Underpass Interchange Alternative I-4 Profile View



Recommended Transportation System Improvements

As indicated above, *TM #5.2.2.1 Transportation Analysis Appendix* identifies transportation system improvements needed to support the recommended Overpass and Underpass and compatible Interchange Alternatives in addressing the project Purpose and Need. This includes intersection improvements and pedestrian and bicycle-related improvements. Table 1 summarizes the recommended improvements along South Stage Road that are included in the total cost estimates associated with the alternative and indicates if they are part of existing adopted planning documents. Table 2 documents the other transportation system improvements that should be incorporated into the City of Medford and City of Phoenix Transportation System Plan separate from the project to support overall growth in the region.

Table 1. Recommended South Stage Road Improvements

Intersection/ Segment	Overpass/Underpass Alternatives	Interchange Alternatives	Part of Adopted Planning Documents
Phoenix Road/ South Stage Road	Construct a Single Lane Roundabout **Cost Opinion:** $6,593,000		This project is not included in adopted planning documents, however the intersection exceeds the operating target under no-build conditions.
Golf View Drive/ Future South Stage Road	Construct a Single Lane Roundabout **Cost Opinion:** $5,038,000		This project is not included in adopted planning documents, and the intersection improvements are needed as a result in additional demand along South Stage Road as part of the Overpass/Underpass and Interchange Alternatives.
OR99/South Stage Road	Construct a separate westbound right-turn lane and a sidewalk on south side of the east leg of the intersection. **Cost Opinion:** $684,000		This project is not included in adopted planning documents, and the intersection improvements are needed as a result in additional demand along South Stage Road as part of the Overpass/Underpass and Interchange Alternatives.
South Stage Road/ Samike Dr-Devonshire Lane	Construct a Traffic Signal when warranted **Cost Opinion:** $1,510,000		This project is not included in adopted planning documents, and the intersection improvements are needed as a result in additional demand along South Stage Road as part of the Overpass/Underpass and Interchange Alternatives. The signal will also provide safe and efficient pedestrian, bicycle, and transit access to and from the San George Estates and the Bear Creek Trail.

Table 2. Recommended Transportation System Improvements

Intersection/ Segment	Overpass/Underpass Alternatives	Interchange Alternatives	Part of Adopted Planning Documents
OR99/Garfield	Alternative Mobility Standard of 0.96 **Cost Opinion:** $50,000	Alternative Mobility Standard of 0.94 **Cost Opinion:** $50,000	The alternative mobility standard is not part of existing planning documents, however, the intersection exceeds the operating target of 0.85 under no-build conditions.
OR99/N Phoenix-Bolz Road	Construct separated eastbound right- and left-turn lanes on the west leg of the intersection and ***a secondary northbound right-turn lane on the south leg of the intersection***. **Cost Opinion:** $1,640,000	Construct separated eastbound right- and left-turn lanes on the west leg of the intersection. **Cost Opinion:** $681,000	This project is not included in adopted planning documents, however, the intersection exceeds the operating target under no-build conditions.
Juanipero Way/ Golf View Drive	Convert the intersection from two-way to all-way stop control. **Cost Opinion:** $11,000		This project is not included in adopted planning documents, however the intersection exceeds the operating target under no-build conditions.
Golf View Drive/Barnett Road	Construct separate eastbound and westbound left-turn lanes. **Cost Opinion:** $1,250,000		This project is not included in adopted planning documents, however the project exceeds the average crash rate and critical crash rate under no-build conditions.

Cost Opinions for Recommended Alternatives

The magnitude of construction cost opinions provided in *TM #5.2.1 Alternatives Refinement and Cost Opinions* were combined with the cost opinions for the transportation system improvement projects shown above to arrive at the preliminary recommended alternative cost opinion ranges. Table 2 summarizes the cost opinions and provides a range for comparative purposes.

Table 3. Preliminary Recommended Alternative Cost Opinions

	Modified Overpass O-2	Modified Underpass O-4	Modified Overpass Interchange I-2	Modified Underpass Interchange I-4
Description	South Stage Southerly Realignment Modified	South Stage Underpass Modified	South Stage Southerly Realignment Modified	South Stage Underpass Interchange Modified
Overpass/Underpass/ Interchange Cost	$148M	$199M	$189M	$242M
Other Transportation System Improvement Cost for projects along South Stage Road	$14M	$14M	$14M	$14M
Total Cost Opinion – Low[1]	**$161M**	**$213M**	**$203M**	**$256M**
Total Cost Opinion – High (+30%)	**$210M**	**$277M**	**$264M**	**$333M**

[1] Costs are rounded to the nearest million dollars. However, this rounding introduces visual discrepancies in table summations because the estimated values were added before rounding.

Additional Considerations

The following summarizes additional considerations for the project team as the preliminary recommendations are advanced through the planning and environmental process:

- **Additional engineering for forward compatibility**: As indicated in *TM #5.2.2.3 Structure and Constructability Analysis Appendix,* additional engineering of the Overpass and Underpass Alternatives is needed to ensure forward compatibility with the Interchange Alternatives.
- **Underpass Feasibility**: As indicated in *TM #5.2.2.3 Structure and Constructability Analysis Appendix*, additional engineering of the Underpass alternatives is needed to determine the feasibility of the retaining walls east of I-5 and the staging of construction for raising I-5 travel lanes in both directions.

- **Horizontal Alignment:** As indicated in *TM # 5.2.2.2 Environmental Screening Analysis Appendix*, it is not possible at this concept level of planning to decide on the final horizontal alignment (north or south of the substation) of the ultimate Overpass and Underpass Alternatives. Based on what the project team knows at this time, the identified alignment and phasing is recommended. However, as additional environmental and engineering is conducted, the alignment may need to shift to avoid or minimize environmental impacts.
- **Visual and noise impacts**: As indicated in *TM #5.2.1 Refined Alternatives and Cost Opinions*, potential future visual and noise impacts with the Overpass alternatives may necessitate further mitigation (e.g., soundwalls) bringing the costs between the Overpass and Underpass alternatives more closely together in the future environmental phase.

FINDINGS

Based on the analysis results and rationale presented herein, the project team recommends that that the Overpass and Underpass Alternatives (O-2/O-4) and compatible interchange alternatives (I-2/I-4) along with the recommended transportation system improvement projects be included in the Facility Plan. Based on the analysis, Overpass/Underpass Alternatives (O-2/O-4) meet the Purpose and Need according to the 2045 planning horizon, while the compatible Interchange Alternatives (I-2/I-4) may be needed beyond the horizon year.

NEXT STEPS

The project team will finalize recommendations and document the process in the Facility Plan.

APPENDICES

- TM #5.2.1 Refined Alternatives and Cost Opinions
- TM #5.2.2.1: Transportation Analysis Appendix
- TM #5.2.2.2: Environmental Screening Analysis Appendix
- TM #5.2.2.3: Structural and Constructability Analysis Appendix