

FINAL TECHNICAL MEMORANDUM #5

OR 66 Green Springs Highway IAMP

Interchange Area Alternatives Analysis

Date: August 31, 2012

Project #: 11881

To: Project Management Team

From: Hermanus Steyn, PE & Matt Kittelson, PE, & Jeff Whitman, PE

This memorandum documents the development and evaluation of local circulation and interchange form alternatives for the OR 66/US 97 interchange area in Klamath Falls, Oregon. This memorandum includes:

- Overview of the process used to develop initial concepts
- Qualitative assessment of initial concepts
- Refinement of alternatives
- Evaluation of alternatives

CONCEPT DEVELOPMENT PROCESS AND INITIAL CONCEPTS

The project team hosted a visioning workshop held in December 2011 that gathered information from local officials, property owners, and citizens related to specific transportation issues and possible roadway modification scenarios. Workshop attendees were given background information on traffic patterns, land use designations, and future growth assumptions.

The visioning workshop participants generated many concepts. These ideas served as a starting point for the alternatives presented and evaluated in this memorandum. Technical Memorandum #4 summarized the initial concepts submitted through the visioning workshop process.

The study area was divided into three areas to allow for simplified development of future combinations of solution concepts. The following summarizes the sub-areas and the respective concepts:

- West of the interchange
 - Concept W-1 Realign OR 140
 - Concept W-2 Align OR 140 with OR 140 east of interchange
 - Concept W-3 Realign OR 140 and disconnect Balsam Drive and Delap Pit Road



Exhibit 1 Concept W-1 – Realign OR 140



Exhibit 3 Concept W-2 – Align OR 140 with OR 140 East of Interchange



Exhibit 2 Concept W-3 – Realign OR 140 and Disconnect Balsam and Delap Pit Road

East of the interchange

- Concept E-1 Greensprings Drive-Memorial Drive Frontage Road
- Concept E-2 Realign Greensprings Drive
- Concept E-3 Realign Greensprings Drive & Memorial Drive
- Concept E-4 Memorial Drive Jughandle



Exhibit 4 Concept E-1 –Greensprings-Memorial Frontage Road



Exhibit 6 Concept E-3 – Memorial Full Access



Exhibit 5 Concept E-2 – Realign Greensprings



Exhibit 7 Concept E-4 – Memorial Drive Jughandle

- Interchange form
 - Concept I-1 Improve Existing Interchange
 - Concept I-2 Diamond Interchange
 - Concept I-3 Partial Cloverleaf Interchange
 - Concept I-4 Single-Point Urban Interchange (SPUI)
 - Concept I-5 Diverging Diamond Interchange (DDI)
 - Concept I-6 Full Cloverleaf Interchange



Exhibit 8 Concept I-1 – Improve Existing Interchange



Exhibit 10Concept I-3 – Partial Cloverleaf Interchange



Exhibit 9 Concept I-2 – Diamond Interchange



Exhibit 11Concept I-4 – SPUI Configuration



Diamond Interchange



Exhibit 13Concept I-6 – Full Cloverleaf Interchange

PRELIMINARY QUALITATIVE EVALUATION OF INITIAL CONCEPTS

The consultant team conducted an evaluation and comparison of the initial concepts based on qualitative measures. The comparison is intended to identify those concepts that do not have any "fatal flaws" and warrant detailed evaluation.

To help determine how to rank each of the concepts according to the evaluation criteria, a scoring system was developed. In essence, each evaluation criterion was assigned a range of numerical values (+2, +1, 0, -1, or -2). The concepts that achieve each metric better than others receive a "+2", those that do not impact the metric receive a "0", those that underperform compared to other concepts receive a "-2" score, and those that fall in between receive a "+1" or "-1" score. The following outlines the elements considered in the initial evaluation and aspects of each that characterized the variations between concepts.

These evaluation criteria were originally documented in Technical Memorandum #2.

Transportation Operations

- Safety
- Local connectivity and mobility
- Freight mobility

Multimodal Accessibility

- Pedestrian mobility
- Bicycle mobility
- Transit mobility

Land Use

- Right-of-way impacts
- Consistency with adopted land use and economic development plans
- Transportation capacity impacts of changes in land use intensity
- Impacts to utilities

Economic Development

- Near-term growth (1-5 years)
- Mid-term growth (5-15 years)
- Long-term growth (15-25 years)

Environmental, Social, and Equity factors

- Environmental impacts
- Socio-economic impacts

Accessibility and Connectivity

- Access spacing requirements
- Future access for undeveloped properties
- Local roadway connectivity

Cost

• Cost relative to other alternatives

Implementation

- Ability to construct in phases
- Local impacts during construction
- Impacts to existing and proposed developments

Table 1 provides a summary of the preliminary evaluation of initial concepts.

Each concept was compared to other concepts within each sub-area and the lowest scoring concepts (those that scored less than +0.500) were removed from further consideration. More detailed notes regarding the associated scores are provided in Appendix "A".

| Table 1 | Initial Qualitative | Concept | Evaluation |
|---------|---------------------|---------|------------|
|---------|---------------------|---------|------------|

| Concept | Operations | Multimodal | Land Use | Economic Develop. | Enviro., Social, and Equity Factors | Accessib. & Connectiv. | Cost | Implem. | Average Score | Recommended for Additional Evaluation? |
|---------|------------|------------|----------|----------------------|--|---------------------------|------|---------|------------------|--|
| | | | Wes | t Interchange C | oncepts | | | | | |
| W-1 | +1 | 0 | +1 | +1 | 0 | +2 | +1 | +1 | +0.875 | Yes |
| W-2 | -1 | 0 | 0 | -1 | 0 | -1 | 0 | -2 | -0.625 | No |
| W-3 | +2 | 0 | +1 | +1 | 0 | +1 | +2 | +2 | +1.125 | Yes |
| | | | Eas | t Interchange C | oncept | | | | | |
| E-1 | +1 | +1 | +1 | +1 | -1 | +1 | +1 | +2 | +0.875 | Yes |
| E-2 | 0 | +1 | -1 | -2 | -1 | -1 | +1 | 0 | -0.375 | No |
| E-3 | +1 | +1 | +2 | +1 | -2 | +1 | -1 | -1 | +0.250 | No |
| E-4 | +2 | +2 | +1 | +2 | -1 | +2 | -2 | +1 | +0.875 | Yes |
| | | | Inter | change Form C | oncepts | | | | | |
| I-1 | +1 | +1 | +2 | +2 | +1 | +2 | +2 | +2 | +1.625 | Yes ¹ |
| I-2 | -1 | +1 | +1 | +1 | -1 | +2 | +1 | +1 | +0.500 | Yes ¹ |
| I-3 | -2 | +1 | +1 | -1 | -1 | +2 | +1 | +1 | +0.375 | No |
| I-4 | +2 | -2 | -2 | -2 | -2 | +2 | -2 | -2 | -1.000 | No |
| I-5 | +2 | -1 | +1 | +1 | +1 | +2 | -1 | +1 | +0.750 | Yes |
| 1-6 | +2 | -2 | -2 | -2 | -2 | +2 | -2 | -2 | -1.000 | No |

Note: Concept I-1 and I-2 are similar and are considered to represent phased improvements in subsequent alternatives. Specifically, improvements to the existing interchange can be constructed in conjunction with adding a diagonal northbound on-ramp. A diamond interchange in isolation (i.e., closure of the existing loop on-ramp) will not be considered for operational reasons.

Table 2 provides information on the primary reason a concept was recommended for elimination and not considered for further evaluation. More detailed notes regarding the associated scores and supplemental to the information provided in Table 2 are provided in Appendix "A".

 Table 2
 Primary Reason for Concept Elimination

| Concept | Primary Reason for Concept Elimination |
|-------------|---|
| Westside C | oncepts |
| | The realignment of OR 140 to be the through route instead of OR 66 does not result in an operational |
| VV-2 | benefit long-term and causes difficulties for properties to develop in the southwest quadrant of the interchange. |
| Eastside Co | ncept |
| | Realigning Greensprings Drive along the north-south property line results in the new Greensprings |
| F_2 | Drive/OR 140 intersection to be at an undesirable location in relation to the longitudinal grade along OR |
| L-2 | 140. Further, the realignment does not result in adequate access spacing distances between the new |
| | intersection location and existing northbound ramp terminal intersection. |
| | The realignment of Greensprings Drive to share the northerly alignment of Memorial Drive would result |
| F-3 | in the need to expand the existing bridge along OR 140 to the east. Given the likely high cost of this |
| L-J | improvement and negative local circulation benefits for the existing businesses on Greensprings Drive, |
| | this concept was not considered further. |
| Interchange | e Form Concepts |
| | Converting the US 97 southbound off-ramp from a typical exit ramp to a loop ramp in the southwest |
| I-3 | quadrant of the interchange does not support the forecasted high demand of southbound US 97 off- |
| | ramp to OR 140 westbound traffic during the p.m. peak hour. |
| 1.4 | The anticipated road realignments, the size of the new structure will result in high improvement costs |
| 1-4 | with little benefits |
| | The construction of a full cloverleaf interchange would have significant right-of-way impacts and high |
| I-6 | construction costs. Further, the large interchange would provide significantly more capacity than is |
| | needed based on the current forecasts. |

At Project Team (PT) Meeting #4, the following modifications were identified to concepts that were identified for further evaluation:

- Combined Concepts W-1 and W-3 as a revised Concept W-1 that shows the realignment of OR 140 to the west, and keeps the Delap Pit Road connection with the realigned OR 140, while disconnecting Balsam Drive.
- Revised Concept E-1 that provides a frontage road from Greensprings Drive and disconnect Memorial Drive from the frontage road.
- Revised Concept E-4 that forms a jughandle configuration with Greensprings Drive (north)-Memorial Drive (south) and disconnects the Memorial Drive connection to the north.
- Revised Concept I-2 that keeps the existing eastbound to northbound loop on-ramp and adds the westbound to northbound on-ramp.

In summary, one west side concept, two east side concepts, and three interchange form concepts were recommended for additional evaluation based on this evaluation and PT Meeting #4.

REFINEMENT OF ALTERNATIVES

This section defines the major issues and considerations addressed by the remaining concepts in the three geographical project focus areas and further outlines why specific alternatives were modified to address those considerations.

West Side Alternatives

The major consideration on the west side of the interchange was the future alignment of OR 140 and OR 66. Specifically, consideration was given to both facilities to operate at the through east-west route. OR 66 currently operates in this function. The bullet points below discuss the results of this evaluation.

- Vehicular operations can be expected to operate acceptably in the future with either roadway alignment in place. Additional turn lanes would be required under both scenarios. These are summarized below:
 - **OR 66 as the through route:** A dedicated westbound right-turn lane operating with overlap phasing would result in OR 140/OR66 intersection operating with a volume-to-capacity (v/c) ratio of 0.71.
 - **OR 140 as the through route:** This configuration would require two westbound left-turn lanes from OR 140 onto OR 66 and would result in the OR 140/OR 66 intersection operating with a v/c ratio of 0.58.
- The OR 66 as the through route scenario results in the need to accommodate heavy westbound right turns onto OR 140. Under future conditions, accommodating right-turns is likely to be less problematic during the critical p.m. peak hour.
- The OR 140 as the through route scenario need to accommodate heavy westbound leftturns onto OR 66 that will result in unusual long left-turn pockets.
- The southwest quadrant of the interchange is planned for commercial development. As such, vehicular trips coming from the east (US 97 or OR 140) would likely be required to make two left-turns into the site under the **OR 140 as the through route** scenario.

Based on these observations and as discussed during PT Meeting #4, the team recommended to retain OR 66 as the through movement as the preferred alternative for the west side of the interchange. However, the OR 140/OR 66 intersection is currently closely spaced to the OR 140/US 97 Southbound Ramps intersection and should be relocated to the west based on access spacing standards to improve safety and operations.

Other considerations on the west side of the interchange include the connections of Balsam Drive and Delap Pit Road. Both intersect with the highway network in locations that do not adhere to applicable access spacing standards, resulting in potentially unsafe and/or inefficient traffic operations. As such, the recommended connections for each facility were considered and are discussed below.

- Delap Pit Road: This facility provides access to several residential lots, as well as the local Oregon Department of Forestry (ODF) office. The ODF office responds to fires on private lands from this location on both an emergency and routine basis. As such, the Delap Pit Road connection to OR 140 is an important factor in their response time. Considering this, the option to connect Delap Pit Road to the north, for which right-of-way (ROW) has previously been purchased, and closing the access at OR 140 becomes less desirable. Further, the required connection to Riverside Drive is likely a complicated and potentially expensive alternative from a geometric standpoint. For these reasons, maintaining a connection on the highway system for Delap Pit Road is preferable. To this end, a realignment of Delap Pit Road with OR 140 to the northwest is being evaluated. Potential modifications to this approach include:
 - Limiting Delap Pit Road to right-in/right-out in its current or proposed location (as an interim or long-term option).
 - $\circ\,$ Providing limited access to Delap Pit Road through the construction of an emergency gate at the access point.
- Balsam Drive: This facility provides access to the Stewart-Lennox neighborhood via OR 66. However, the Westside Refinement Plan has planned for this connection to be closed given the extensive grid system and alternative connections to the highway. As such, this connection is being evaluated as closed.

In summary, Alternative W-1 (Realign OR 140 and Disconnect Balsam) as illustrated in Figure 1 captures the only alternative identified for future considerations on the west side of the interchange.

Conceptual Cost Estimate

A conceptual cost estimate was developed for Alternative W-1. The estimated project cost including engineering fees, but excluding right-of-way costs for this improvement is approximately \$5.8 million. Additional details are provided in Appendix "B". This estimate reflects the following major assumptions:

- Remove existing portions of OR 140 and Balsam Drive due to road realignments
- Widen OR 66 to add travel lanes required to improve mobility, as well as bike lanes and sidewalks along both sides.
- Provide retaining wall along the realignment of Delap Pit Road.

Accesses Along OR 140 & OR 66

The proposed improvements for the west side identify the realignment of Delap Pit Road to OR 140 based on access spacing guidelines. A limited number of private accesses exist along OR 140 between OR 66 and Orindale Road. However, future developments and/or redevelopments will need to

address access spacing standards and the required safety and operational analyses to provide access to their developments.

There are numerous accesses that will continue to exist along OR 66 to the west of the proposed realigned OR 140. There are limited opportunities to consolidate accesses and/or relocate to side streets. In addition, the existing right-of-way does not provide the latitude to consider frontage roads without significantly impacting properties along OR 66. Providing a raised median to limit access to right-in/right-out would encourage undesirable U-turns at the key intersections



Exhibit 14Potential Roundabout Configuration

along OR 66; however intersection can be designed to accommodate U-turns. However, if a series of roundabouts are considered at the key intersections along OR 66, then those would provide flexibility in applying access management treatments along this section of OR 66.



KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING / PLANNING

East Side Alternatives

The area east of the interchange faces several distinct issues related to access spacing associated with roadway functional classification, longitudinal grade, and the existing bridge of the southern portion of Lake Ewauna. These are summarized below:

- The functional classification of OR 140 changes to an expressway designation east of US 97, resulting in an access spacing requirement of ½ mile necessary to maintain safe and efficient operations for such facilities. This standard is violated by the existing Greensprings Drive intersection location.
- The expressway designation encourages grade separated crossing (i.e., interchange form or overcrossings/undercrossings) along OR 140. The Washburn Way connection with OR 140 to the east is currently an interchange. However, several other prominent connections along this stretch of OR 140 are currently at-grade intersections. The ultimate intersection configuration of intersections east of the interchange should consider the long-term vision for this stretch of highway in terms of access control and/or grade separation. Local businesses along Greensprings Drive rely on access to OR 140 and easy access to US 97 to retain viable operations. Any closure and/or relocation of access points along OR 140 should consider these impacts and strive to provide adequate alternative accommodations.
- An existing longitudinal grade of approximately 3% exists east of the interchange with the grade descending towards the river. This grade makes acceleration difficult for larger vehicles traveling to the west (up the grade) and requires consideration when siting new access points along this segment of OR 140.
- The existing bridge over the south portion of Lake Ewauna has no available area to add additional lanes on the existing structure. As such, new lanes across the bridge (through lanes or turning lanes) would result in a need to widen the bridge. Due to the high cost of such improvements, this constraint should be taken into account when considering improvements to the existing Memorial Drive/OR 140 intersection.

Two alternatives for the east side of the interchange address these issues and/or constraints in the most comprehensive manner. The following two alternatives for the eastside were identified. These include:

- Alternative E-1 (Greensprings Drive-Memorial Drive Frontage Road): This alternative will
 provide at-grade access further to the east to meet applicable access spacing standards
 necessary to provide safe and efficient operations and minimize the vertical longitudinal
 grade issue. Figure 2 shows the functional layout of this alternative.
- Alternative E-4 (Greensprings Drive-Memorial Drive Jughandle): This option would provide a jughandle style interchange with grade-separation in the vicinity of the existing Memorial Drive intersection. With the underpass in place, the access on OR 140 in the

location identified in Alternative E-1 would be changed to right-in/right-out movements only. Figure 3 illustrates the functional layout of this alternative.

These two alternatives also provide the potential for a phased implementation approach for the highway to the east of the interchange. Alternative E-1 would address near-term needs, while it can be upgraded to Alternative E-4 when future operational and/or safety demands require improvements at this access point.

Conceptual Cost Estimate

Conceptual cost estimates were developed for Alternatives E-1 and E-4. The estimated project costs including engineering fees, but excluding right-of-way costs for these improvements are approximately \$5.3 million and \$9.9 million respectively. Additional details are provided in Appendix "C".

This estimate for Alternative E-1 reflects the following major assumptions:

- Realign Greensprings Drive and Memorial Drive to for frontage roads along OR 140.
- Remove existing Greensprings Drive and Memorial Drive intersections on OR 140 due to their associated realignments.
- Widen OR140 for left turn lanes at proposed the Greensprings Drive/Memorial Drive intersection
- Widen OR 140 to provide bike lanes.
- Relocated existing cul-de-sac at end of Memorial Drive north of OR140.

This estimate for Alternative E-4 has the same major assumptions as Alternative E-1 plus the following additional items:

- Construct underpass structure under OR140 and the approaches along Greensprings Drive and Memorial Drive to complete the jughandle configuration.
- Rebuild the new intersection on OR 140 with Memorial Drive-Greenspring Drive to limit access to right-in/right-out movements only.

2012 - 10:29am

Aug 28, .

Fig01.dwg

7200\11881

DAcPublish





mcfadder

Aug 28, 2012 - 10:30am

p\AcPublish_7200\11881_Fig01.dwg

Interchange Alternatives

Operational analysis of future conditions revealed that major operational deficiencies are not expected at the interchange during the horizon year. As such, major capacity improvements to the interchange are not considered priorities at this time. Rather, modifications should be focused on improvements to overall interchange safety and the accommodation of US 97 south to OR 140 west demand and vice versa, which is forecasted to be the major vehicle movements in the vicinity of the interchange during the weekday a.m. and p.m. peak hours, respectively.

Based on these priorities, the following improvements to the interchange are proposed without requiring modifications to the existing US 97 overpass structure:

- Alternative I-1 (Improve Existing Interchange): Improvements at the existing interchange entail the realignment of the southbound off-ramp improve the intersection section sight distances, as well as the longitudinal grade and landing area along the ramp. Figure 4 provides the functional layout of this alternative.
- Alternative I-2 (Improve Existing Interchange and Additional Northbound On-ramp): The alternative expands Alternative I-1 by adding a directional westbound to northbound on-ramp eliminating the existing westbound left-turn lane. This improvement would provide enhancements to the interchange that could be phased and implemented over time. With the addition of this ramp, the existing US 97 northbound off-ramp connecting Greensprings Drive across of Memorial Drive should be removed. Figure 5 illustrates the functional layout of this alternative.
- Alternative I-5 (Diverging Diamond Interchange [DDI]): The new interchange form provides additional capacity while maintaining the existing US 97 overpass structure, but will require the realignment of the OR 140 approaches to provide appropriate intersection geometries for the switch overs. Figure 6 shows the functional layout of this interchange.

Again, these three interchange alternatives provide the potential for a phased implementation plan:

- Phase 1: Alternative I-1 would address existing safety issues.
- Phase 2: Alternative I-2 provides additional capacity at the northbound ramp terminal.
- Phase 3: Alternative E-5 increases interchange capacity.

The conventional on- and off-ramps would be the same for all these alternatives, minimizing major construction costs for the improvements.

Conceptual Cost Estimate

Conceptual cost estimates were developed for Alternatives I-1, I-2, and I-5. The estimated project costs including engineering fees, but excluding right-of-way costs for these improvements are approximately \$5.7 million, \$7.5 million, and \$12.8 million respectively. Additional details are provided in Appendix "D".

This estimate for Alternative I-1 reflects the following major assumptions:

- Realign southbound off- and on-ramps to improve intersection angle and longitudinal grade.
- Widen OR 140 to provide bike lanes and sidewalks along both sides.
- Install a retaining wall along southbound off-ramp that is parallel with Delap Pit Road due to topography.

This estimate for Alternative I-2 has the same major assumptions as Alternative I-1 plus the following additional items:

- Build additional northbound on-ramp in northeast quadrant of the interchange.
- Install retaining wall along east side of new northbound on-ramp.
- Remove existing northbound off-ramp serving Greensprings Drive.

This estimate for Alternative I-5 reflects the following major assumptions:

- Realign southbound off- and on-ramps to improve intersection angle and longitudinal grade.
- Remove existing northbound loop on-ramp and rebuild US 97 northbound off-ramp.
- Construct northbound on-ramp and associated retaining wall in northeast quadrant of the interchange.
- Widen OR 140 to provide bike lanes and sidewalks along both sides.
- Rebuild OR 140 underneath the existing US 97 overpass into a diverging diamond interchange configuration with bike lanes and sidewalks.
- Install two new signals at the DDI ramp terminal intersections.



Tab: 04

10:31am

2012 -

Aug 28,

Fig01.dwg

7200\11881_

cPublish

at/spr

C:Use



KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING / PLANNING

OR 66 Green Springs Highway IAMP



KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING / PLANNING

Improvements Along US 97

During the evaluation of the transportation system the following two access points were identified as potential issues.

- Second northbound off-ramp to the north of the existing interchange
- Reames Country Club access point to the south of the existing interchange

Second Northbound Off-ramp

The need of this second low-volume northbound off-ramp is not required from an operational point of view and rerouted traffic can be accommodated at the interchange. Access to the northeast quadrant of the interchange is limited and the timing of the recommended closure should be considered from a transportation system point of view. Therefore, the implementation of the improvements proposed on the eastside of the interchange should be in place prior to the closure of this secondary on-ramp.

Reames Country Club Access

The proximity of this access in relation to the southbound on-ramp and northbound off-ramp has operational and safety issues. Three options are being considered to accommodate access to Reames Country Club due to the closure of the existing access.

- Option #1: A new approximately ¼-mile connection can be provided from the clubhouse parking lot through the golf course to Memorial Drive which will likely require modifications to a few holes on the golf course. With the implementation of the proposed improvements on the east side of the interchange, the existing US 97 access can be closed and/or converted to a right-in/right-out with full access to Memorial Drive.
- Option #2: An approximately ½-mile frontage road can be provided from the existing access along the east of US 97 to the south up to the existing industrial access approximately 970 feet north of the Lake Ewauna/railroad Bridge.
- Option #3: An approximately one mile frontage road can be provided from the existing access along the east of US 97 to the north along the northbound off-ramp and then following the south side of OR 140 to connect with the proposed Memorial Drive frontage road access.

At the PT Meeting #5, a revised option (see Figure 7) was discussed with the Reames Country Club representative that connects the existing parking lot through the golf course to Memorial Drive. Figure 7 shows the transportation system with the closure of the second northbound off-ramp and the relocation of the Reames Country Club Access to Memorial Drive.

OR 66 Green Springs Highway IAMP



KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING / PLANNING

EVALUATION OF ALTERNATIVES

There are one west side alternative, three interchange alternatives, and two east side alternatives from which six potential transportation system improvements (combinations of alternatives) can be developed in the vicinity of the existing US 97/OR 140 interchange. Therefore, three interchange system scenarios were identified for more detailed evaluation.

The purpose of these analyses is to show how the alternatives could be combined and implemented together. These alternatives could be modified as necessary to accommodate the needs of local property owners and agencies.

Table 3 shows the three scenarios evaluated based on the west area, east area, and interchange form alternatives considered.

| Evaluation Scenario | Westside Alternative | Interchange Alternative | Eastside Alternative |
|----------------------------|---|---|---|
| Scenario #1 | Alternative W-1: Retain OR 66 as the through movement Relocate OR 140/OR 66 intersection to the west Disconnect Balsam Drive Realign Delap Pit Road to connect to OR 140 | Alternative I-1: Construct improvements to the existing interchange, including: Realign southbound offramp • | Alternative E-1: Relocate existing Greenspring Drive and Memorial Drive access points and provide access via frontage roads. Placement should meet applicable access spacing standards and adequately account for vertical curve impacts. |
| Scenario #2 Scenario #3 | | Alternative I-2: Construct improvements identified in Scenario 1. Construct additional northbound on-ramp in the northeast quadrant. Alternative I-5: | Alternative E-4: Construct a jughandle interchange at the location of the existing Memorial Drive/OR 140 intersection. Disconnect Greensprings Drive/OR 140 and provide frontage road access to |

Table 3Detailed Evaluation Scenarios

These scenarios are displayed in Figure 8, Figure 9, and Figure 10, respectively.

As stated, the alternatives for the subareas were developed so they can be implemented in phases as the traffic demand increases, as well as with the development and/or redevelopment of properties.

8

ug 28, 2012 -



KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING / PLANNING 8

ug 28, 2012



KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING / PLANNING



INTERCHANGE AREA SCENARIO #3 KLAMATH FALLS, OREGON



Intersection Control Alternatives

The interchange area scenarios are compatible with different types of intersection control. For the purposes of this analysis, the installation or construction of **traffic signals** or **roundabouts** was evaluated. In all cases, traffic control treatments should be constructed when warranted by safety issues, operational demand, and system needs.

Improvements/Notes for All Scenarios:

Several transportation system impacts would not change based on the traffic control identified for spot intersection improvements. These include the following:

- Emerald Street/OR 66 would likely become the main access point for vehicles previously utilizing Balsam Drive (which is proposed to be closed at OR 140). With additional traffic, the Emerald Street/OR 66 intersection would operate acceptably as side-street stopcontrolled.
- Delap Pit Road would operate acceptably as a side-street stop controlled intersection at its new alignment on OR 140.

Signalized Intersection Control

The described scenarios were analyzed based on the assumption that signalized intersections would be installed where additional traffic control is needed. Below is a description of the resulting improvements to the transportation system by scenario.

All Scenarios:

- OR 140/OR 66 would require the addition of a dedicated right-turn lane with overlap phasing in the westbound direction to accommodate future demand. This intersection is controlled by a traffic signal today.
- US 97/OR 140 Southbound Ramp Terminal would require a traffic signal to be installed and dual right-turn lanes in the southbound direction. Given the heavy traffic demand, the dedicated right turn lane proposed at the OR 140/OR 66 intersection should start immediately to the west of the ramp terminal. This would result in a weaving section, but since the two intersections are approximately ¼ mile apart, and the majority of the traffic is making this movement, the weave should not present major safety issues.



Exhibit 15OR 140 between SB Ramp and OR140 Intersection

Scenario #1:

- US 97/OR 140 Northbound Ramp Terminal would continue to operate acceptably as a side-street stop controlled intersection.
- The new Greenspring Drive-Memorial Drive/OR 140 intersection (created from the realignment of Greensprings Drive and Memorial Drive [frontage roads]) may require the installation of a traffic signal. Additional turning lanes may be necessary to promote efficient signal operations.

Scenario #2:

- US 97/OR 140 Northbound Ramp Terminal would experience minor delay with the addition of the northbound directional on-ramp. This intersection would remain functional as side-street stop-controlled.
- The jughandle interchange would operate with excess capacity under future conditions. The right-in/right-out connections with OR 140 would operate acceptably as side-street stop-controlled intersections. The benefits of this improvement would be most profound related to maintaining the existing expressway designation along OR 140 and providing acceleration areas for heavy vehicles traveling up the grade to the west.

Scenario #3:

- The diverging diamond interchange configuration would provide ample opportunity for travel demand growth beyond the forecast year.
- The rest of the intersections would operate similarly to those in Scenarios #1 and #2.

Roundabout Control

The described scenarios were analyzed based on the assumption that roundabout intersections would be installed where additional traffic control is needed. Below is a description of the resulting improvements to the transportation system by scenario.



Exhibit 16 A series of roundabouts along OR 140

All Scenarios:

- OR 140/OR 66 would be designed with two through lanes in the westbound and eastbound directions, consistent with the cross section of OR 140/OR 66 today. The southbound approach would be single lane. With this configuration, the intersection would operate acceptably.
- US 97/OR 140 Southbound Ramp Terminal would require a dedicated right-turn lane southbound. All other approaches could be single lane from an operational standpoint, but would be designed with two through lanes westbound and eastbound to match the existing cross section of OR 140.

Scenario #1:

- US 97/OR 140 Northbound Ramp Terminal would continue to operate acceptably as a side-street stop controlled intersection.
- The new Greenspring Drive/Memorial Drive/OR 140 intersection (created from a realignment of Greensprings Drive and Memorial Drive) would require the installation of a roundabout. This location would operate acceptably with two through lanes in the westbound direction, which is consistent with the existing OR 140 cross section in the vicinity of the interchange, and single lane approach on all other legs.

Scenario #2:

- US 97/OR 140 Northbound Ramp Terminal would experience minor delay with the addition of the northbound directional on-ramp. This intersection would remain functional as side-street stop-controlled.
- The jughandle interchange would operate with excess capacity under future conditions. The right-in/right-out connections on OR 140 would operate acceptably as side-street stop-controlled intersections. The benefits of this improvement would be most profound related to maintaining the existing expressway designation along OR 140 and providing acceleration areas for heavy vehicles traveling up the grade to the west.

Scenario #3:

- The diverging diamond interchange configuration would provide ample opportunity for travel demand growth beyond the forecast year. However, the ramp terminals will not be able to function as roundabouts due to the switching of traffic for a DDI.
- The rest of the intersections would operate similarly to those in Scenarios #1 and #2.

Intersection Control Summary

For comparison purposes, the traffic operations results for roundabout and signalized options under Scenario #1, shown in Figure 8 and described previously, are shown in Table 4. Comments are provided related to the configuration of each intersection under each control option.

| | Signalize | d Control | Roundabo | ut Control | |
|---|-----------------------|---------------------|----------------------|--------------------|--|
| Intersection | Delay/LOS | v/c | Delay/LOS | v/c | Comments |
| 8. OR 140/OR 66 | 12.4/B (Overall) | 0.71 (Overall) | 16.2/C (East leg) | 0.75 (East leg) | Signal: Dedicated WB right-turn lane Roundabout: Two through lanes east/west |
| 10. US 97 SB Ramps/OR 140 | 14.6/B (Overall) | 0.67 (Overall) | 10.2/B (West leg) | 0.48 (West leg) | Signal: Carry additional westbound lane to OR 140/OR 66 Roundabout: Two through lanes east/west Would require channelized SB right-turn lane. |
| 11. US 97 NB Ramps/OR 140 | 31.5/D (south leg) | 0.31 (south leg) | 10.5/B (East leg) | 0.54 (East leg) | Signal: Would not require signalization Roundabout: Two through lanes westbound |
| 13 Greensprings Drive/Memorial Drive/OR 140 | 8.2/A (Overall) | 0.73 (Overall) | 9.4/A (East leg) | 0.50 (East leg) | Signal: Combined intersection. Would likely require dedicated left-turn lanes on mainline, at a minimum. Roundabout: Two through lanes westbound |

| Table 4 | Scenario #1 | Intersection | Control | Comparison |
|---------|-------------|--------------|---------|------------|
|---------|-------------|--------------|---------|------------|

A complete summary of the traffic operations for the three scenarios and the respective traffic operations results are summarized in Figure 11, Figure 12, and Figure 13, respectively. These operational results assumed signalized intersection control, where necessary.



OR 66 Green Springs Highway IAMP

13

Layout Tab:

Aug 30, 2012 - 9:00am - openbnd

K:\H_Portland\projfile\11881 - Greensprings IAMP\dwgs\figs\11881_Fig01.dwg

Appendix A Detailed Concept Review This section details the quantitative analysis conducted to evaluate the concepts presented within this memorandum.

WEST SIDE CONCEPTS

Concept W-1: Realign OR 140

Transportation Operations (+1)

Concept would result in a roadway alignment that is well suited to serve future travel demand, but would retain connections to OR 140 (Balsam Drive and Delap Pit Road) that may cause slightly deteriorated transportation operations in the future.

Multimodal Accessibility (0)

Retaining the existing alignment of the highway does not enhance or degrade the ability for pedestrians, bicycles, or transit to navigate the transportation network in the area.

Land Use (+1)

This alignment would have limited right-of-way impacts and impacts to nearby land uses.

Economic Development (+1)

This configuration would improve roadway operations by providing more access spacing and retain the ability for adjacent properties to easily develop in the future.

Environmental, Social, and Equity factors (0)

This concept would have minimal impacts to environmental, social, or equity factors.

Accessibility and Connectivity (+2)

Access spacing along OR 140 would be improved and access to developed and undeveloped properties would not be compromised.

Cost (+1)

This configuration would require the realignment of Delap Pit Road and Balsam Drive, but not the reorientation of OR 140.

Implementation (+1)

The project could be constructed in phases and would have minimal impacts to local users during construction.

Concept W-2: Align OR 140 with OR 140 East of Interchange

Transportation Operations (-1)

The concept would result in a roadway alignment that is not well suited to serve future travel demand along the highways or into proposed development lands.

Multimodal Accessibility (0)

The realignment of the highway does not enhance or degrade the ability for pedestrians, bicycles, or transit to navigate the transportation network in the area.

Land Use (0)

The realignment of OR 140 would cause some impacts to adjacent land uses, but would also make additional lands available be vacating the existing alignment.

Economic Development (-1)

Access to adjacent properties could be complicated by this configuration.

Environmental, Social, and Equity factors (0)

This concept would have minimal impacts to environmental, social, or equity factors.

Accessibility and Connectivity (0)

This concept would likely be the most expensive west side alternative due to significant realignment

Cost (+1)

This concept would likely be the most expensive west side alternative due to the large realignment effort that would be required.

Implementation (-2)

Construction of this alignment would redefine the existing transportation system making near term improvements likely "throw away" when this alternative was ultimately constructed.

Concept W-3: Realign OR 140 and Disconnect Balsam and Delap Pit Road

Transportation Operations (+2)

Concept would result in a roadway alignment that is well suited to serve future travel demand, but eliminate the Balsam Drive connection retain in Concept W-1, improving future transportation operations.

Multimodal Accessibility (0)

Retaining the existing alignment of the highway does not enhance or degrade the ability for pedestrians, bicycles, or transit to navigate the transportation network in the area.

Land Use (+1)

This alignment would have limited right-of-way impacts and/or impacts to nearby land uses.

Economic Development (+1)

This configuration would improve roadway operations by providing more access spacing and retain the ability for adjacent properties to develop in the future.

Environmental, Social, and Equity factors (0)

This concept would have minimal impacts to environmental, social, or equity factors.

Accessibility and Connectivity (+1)

Access spacing along OR 140 would be improved and access to developed and undeveloped properties would not be compromised. The removal of Balsam Drive would result in less local street connectivity, but would likely be an overall benefit to the area wide transportation system.

Cost (+2)

This configuration would require the realignment of Delap Pit Road, but not the reorientation of OR 140.

Implementation (+2)

The project could be constructed in phases and would have minimal impacts to local users during construction.

EAST SIDE CONCEPTS

Concept E-1: Greensprings Drive-Memorial Drive Frontage Road

Transportation Operations (+1)

This concept would consolidate access locations along OR 140, improving operations and access spacing, but would retain an at-grade intersection which is inconsistent with the expressway designation of the section of highway.

Multimodal Accessibility (+1)

This concept would provide an improved access point along the highway for pedestrians and bicyclists, but would still require an at-grade crossing movement for these users.

Land Use (+1)

Relatively direct access would be provided to existing businesses, particularly those along Greensprings Drive.

Economic Development (+1)

This concept would retain accessibility to a number of existing businesses as well as future developable lands.

Environmental, Social, and Equity factors (-1)

The realignment of Greensprings Drive and Memorial Drive would result in longer roadway connections and, thus, increased environmental impacts.

Accessibility and Connectivity (+1)

This concept would increase access to the northern extent of Memorial Drive (currently closed at OR 140) and provide a direct north-south connection from Memorial Drive and Greensprings Drive.

Cost (+1)

The construction of frontage roads and a new at-grade intersection would be relatively inexpensive compared to other alternatives considered.

Implementation (+2)

This concept could be phased in its implementation by constructing the north and south leg separately.

Concept E-2: Realign Greensprings Drive

Transportation Operations (0)

This concept would consolidate access locations along OR 140, but it would place the new intersection on the existing longitudinal grade, potentially resulting in safety and/or operational issues.

Multimodal Accessibility (+1)

This concept would provide an improved access point along the highway for pedestrians and bicyclists, but would still require an at-grade crossing movement for these users.

Land Use (-1)

Access to the existing businesses along Memorial Drive and Greensprings Drive would be indirect compared to existing configurations and other concepts presented.

Economic Development (-2)

Access to existing business and developable lands would be indirect, potentially reducing the desirability to development lands in the area.

Environmental, Social, and Equity factors (-1)

The realignment of Greensprings Drive and Memorial Drive would result in longer roadway connections and, thus, increased environmental impacts.

Accessibility and Connectivity (-1)

This concept provides a direct north-south connection from Memorial Drive and Greensprings Drive, but would make the existing Greensprings Drive and Memorial Drive alignments less accessible.

Cost (+1)

The construction of frontage roads and new at-grade intersection would be relatively inexpensive compared to other alternatives considered.

Implementation (0)

This concept would result in impacts near existing developed properties based on the proposed alignment of the combined Greensprings Drive and Memorial Drive facility.

Concept E-3: Realign Greensprings Drive & Memorial Drive

Transportation Operations (+1)

This concept would consolidate access locations along OR 140, improving operations and access spacing, but would retain an at-grade intersection which is inconsistent with the expressway designation of the section of highway.

Multimodal Accessibility (+1)

This concept would provide an improved access point along the highway for pedestrians and bicyclists, but would still require an at-grade crossing movement for these users.

Land Use (+2)

Relatively direct access would be provided to existing businesses and no ROW would be required from adjacent property owners.

Economic Development (+1)

This concept would retain accessibility to a number of existing businesses as well as future developable lands.

Environmental, Social, and Equity factors (-2)

This alignment would result in the need to expand the existing bridge on OR 140 just to the east, potentially resulting in environmental impacts.

Accessibility and Connectivity (+1)

This concept would increase access to the northern extent of Memorial Drive (currently close at OR 140), thus providing a direct north-south connection along Memorial Drive.

Cost (-1)

The likely need to expand the existing bridge on OR 140 just to the east makes this concept a more expensive construction project.

Implementation (-1)

Required bridge improvements would result in the need for a large amount of funds prior to the construction of the new intersection.

Concept E-4: Memorial Drive Jughandle

Transportation Operations (+2)

An interchange design would have high levels of capacity available to accommodate future growth.

Multimodal Accessibility (+2)

This concept would provide a grade separated undercrossing of the highway.

Land Use (+1)

Relatively direct access would be provided to existing businesses, but some ROW would be required to construct the highway access roads.

Economic Development (+2)

An interchange would likely make land nearby more desirable due to the increased highway access.

Environmental, Social, and Equity factors (-1)

The construction of the interchange would require a large footprint and potentially have environmental impacts associated with the construction.

Accessibility and Connectivity (+2)

Access to and over the highway would be greatly increased for Memorial Drive and Greensprings Drive users with this concept.

Cost (-2)

The construction of a jughandle interchange would be expensive compared to the other alternatives.

Implementation (-1)

The construction of the interchange could be phased as a secondary improvement after the construction of an at-grade intersection that realigned Greensprings Drive and Memorial Drive.

INTERCHANGE FORM CONCEPTS

Concept I-1 – Improve Existing Interchange

Transportation Operations (+1)

The existing interchange is well suited to serve west to north demand (a.m. peak hour) and south to west demand (p.m. peak hour).

Multimodal Accessibility (+1)

The existing interchange configuration, with some pedestrian and bicycle improvements, could adequately serve bicycle and pedestrian users.

Land Use (+2)

Right-of-way impacts and other impacts to adjacent properties would be minimized with this concept.

Economic Development (+2)

The economic viability of the area would be improved by providing a safer, more efficient interchange in its current form.

Environmental, Social, and Equity factors (+1)

Environmental impacts would be minimized by not expanding the footprint of the interchange.

Accessibility and Connectivity (+2)

This concept would not inhibit local street connectivity or prohibit access to nearby properties.

Cost (+2)

Improvements to the existing interchange would likely be the least expensive improvement alternative.

Implementation (+2)

Construction of this improvement could be done in phases and would have minimal impacts to adjacent land uses during construction.

Concept I-2 – Diamond Interchange

Transportation Operations (-1)

The removal of the northbound loop ramp would have a negative impact related to serving west to north demand, which is expected to be heavy during the a.m. peak hour.

Multimodal Accessibility (+1)

The removal of the northbound loop ramp could improve multimodal access to the area by eliminating the free right-turn that exists today.

Land Use (+1)

This concept would likely require the removal of the currently vacant development to the northeast of the interchange.

Economic Development (+1)

The economic viability of the area would be improved by providing an improved interchange, but the removal of the northbound loop ramp would reduce west to north capacity.

Environmental, Social, and Equity factors (-1)

The footprint of the interchange would be expanded to the northeast quadrant of the interchange, causing potential environmental impacts in the area.

Accessibility and Connectivity (+2)

This concept would not inhibit local street connectivity or prohibit access to nearby properties.

Cost (+1)

The removal of the existing loop ramp and construction of the new diagonal ramp would minimal costs compared to other concepts considered.

Implementation (+1)

Construction of this improvement could be done in phases and would have minimal impacts to adjacent land uses during construction, though an adjacent property (northeast quadrant) would likely be removed by this concept.

Concept I-3 – Partial Cloverleaf Interchange

Transportation Operations (-2)

This interchange configuration is not well suited to serve future demand patterns and would likely result in deteriorated operations from the existing configuration.

Multimodal Accessibility (+1)

The north side of the highway would have continuous, unimpeded access for pedestrians through the interchange ramp terminal area.

Land Use (+1)

This concept would have impacts to the vacant land to the southwest, but would not have impacts in the northeast quadrant.

Economic Development (-1)

The economic viability of the area would be impacted negatively by the likely poor operations of this interchange configuration.

Environmental, Social, and Equity factors (-1)

The footprint of the interchange would be expanded to the southwest quadrant of the interchange, causing potential environmental impacts in the area.

Accessibility and Connectivity (+2)

This concept would not inhibit local street connectivity or prohibit access to nearby properties.

Cost (+1)

The removal of the existing southbound off-ramp and construction of the new ramps in the southwest quadrant would be minimal costs compared to other concepts considered.

Implementation (+1)

Construction of this improvement could be done in phases, those some impacts could result for users using the southbound on-ramp during construction.

Concept I-4 – Single-Point Urban Interchange (SPUI)

Transportation Operations (+2)

This interchange configuration would have high capacity and be able to handle large amounts of increased demand.

Multimodal Accessibility (-2)

SPUI configurations are known to have challenges related to serving bicycle and pedestrian users.

Land Use (-2)

The interchange configuration would have a large footprint with impacts to all quadrants of the interchange.

Economic Development (-2)

The large footprint of the interchange and configuration would make development nearby the interchange difficult.

Environmental, Social, and Equity factors (-2)

This concept would have large environmental impacts due to the massive reconstruction that would be required for construction.

Accessibility and Connectivity (+2)

This concept would not inhibit local street connectivity or prohibit access to nearby properties.

Cost (-2)

The construction of a SPUI would have high costs due to the reconstruction of the overpass that would be necessary and the approach realignments.

Implementation (-2)

This concept would have significant impacts to the area during construction.

Concept I-5 – Diverging Diamond Interchange (DDI)

Transportation Operations (+2)

A DDI would provide a significant amount of reserved capacity for the interchange.

Multimodal Accessibility (-1)

Pedestrian and bicycle users unfamiliar with the DDI form may be initially confused by the interchange.

Land Use (+1)

The interchange would not have a large footprint, limiting impacts to adjacent properties.

Economic Development (+1)

Improved traffic operations and reserve capacity made available by this configuration would be attractive to entice economic development.

Environmental, Social, and Equity factors (+1)

By remaining within the existing interchange footprint, this configuration would have minimal environmental impacts.

Accessibility and Connectivity (+2)

This concept would not inhibit local street connectivity or prohibit access to nearby properties.

Cost (-1)

Construction of a DDI would require the installation of two traffic signals and significant reconstruction within the ramps terminals and external approaches.

Implementation (+1)

This concept could be phased with other improvements to the interchange.

Concept I-6 – Full Cloverleaf Interchange

Transportation Operations (+2)

A full cloverleaf interchange would have large amounts of reserve capacity to serve future development.

Multimodal Accessibility (-2)

All movements on and off the highway would be potentially high speed, causing significant conflicts for bicycle and pedestrian users.

Land Use (-2)

The footprint of this concept would be quite large with severe impacts to all quadrants of the interchange.

Economic Development (-2)

The large footprint would inhibit development near the interchange, potentially causing decreased economic viability.

Environmental, Social, and Equity factors (-2)

The large footprint would have significant environmental impacts, including the need to excavate hills nearby to accommodate the new on- and off-ramps.

Accessibility and Connectivity (+2)

This concept would not inhibit local street connectivity or prohibit access to nearby properties.

Cost (-2)

The cost to construct this interchange would be significant.

Implementation (-2)

The construction of this interchange would be a major project with many logistical difficulties.

Appendix B West Side Concept Cost Estimates

OR 66 GREEN SPRINGS IAMP Revised Concept W-1: Realign OR-140 W-1

Project Sheet: W-1 Note: The Construction Cost Index for 2010 was estimated to be 219

| | Proposed Road Improvements | | | | | | |
|--|----------------------------|-----------------|--------------------|----------------|--|--|--|
| Item | Unit | Quantity | Unit Cost | Total | | | |
| Excavation (Cut) | cu. yd. | 16,114 | \$15.00 | \$241,716 | | | |
| Embankment (Fill) | cu. yd. | 5,371 | \$20.00 | \$107,430 | | | |
| Pavement Rehabilitation | sq. ft. | 0 | \$4.00 | \$0 | | | |
| New Pavement | sq. ft. | 145,175 | \$8.00 | \$1,161,400 | | | |
| New Curb | lin. ft. | 3,320 | \$15.00 | \$49,800 | | | |
| New Sidewalk & Concrete Median | sq. ft. | 19,920 | \$5.00 | \$99,600 | | | |
| Pavement markings | lin. ft. | 13,210 | \$1.00 | \$13,210 | | | |
| Signage | each | 20 | \$500.00 | \$10,000 | | | |
| Pavement Removal | sq. ft. | 116,578 | \$2.00 | \$233,156 | | | |
| | | Subto | otal A (Roadworks) | \$1,916,312 | | | |
| Storm Drainage System | | % of Subtotal A | 20% | \$383,262.38 | | | |
| Landscape Improvement | | % of Subtotal A | 5% | \$95,815.59 | | | |
| Street Lighting | each | 8 | \$7,000.00 | \$56,000.00 | | | |
| Private Utility Coordination | Lump/Sum | 1 | \$50,000.00 | \$50,000 | | | |
| New Traffic Signal | each | 1 | \$250,000.00 | \$250,000 | | | |
| Traffic Signal Modification | each | 0 | \$100,000.00 | \$0 | | | |
| Retaining Walls | sq. ft. | 5,060 | \$50.00 | \$253,000 | | | |
| Structures | sq. ft. | 0 | \$150.00 | \$0 | | | |
| Railroad Crossing & Signalization | each | 0 | \$750,000.00 | \$0 | | | |
| | | | Subtotal B (Other) | \$1,088,078 | | | |
| Subtotal 1 (Subtotals A + B) | | | | \$3,004,390 | | | |
| Mobilization | | % of Subtotal 1 | 10% | \$300,438.98 | | | |
| Erosion Control | | % of Subtotal 1 | 5% | \$150,219.49 | | | |
| Traffic Control | | % of Subtotal 1 | 5% | \$150,219.49 | | | |
| Subtotal 2 (Mobilization & Traffic Con | trol) | | | \$600,878 | | | |
| Total (Subtotals 1 + 2) | | | | \$3,605,268 | | | |
| Plus Contingencies | | % of Total | 30% | \$1,081,580.34 | | | |
| Estimated Construction Cost | | | | \$4,686,848 | | | |
| Architectural/Engineering | | % of Est. Cost | 15% | \$703,027.22 | | | |
| Construction Management | | % of Est. Cost | 10% | \$468,684.82 | | | |
| Estimated Professional Fees | \$1,171,712 | | | | | | |
| Right-of-Way | \$0 | | | | | | |
| Estimated Property Acquisition | \$0 | | | | | | |
| | | | | | | | |
| Estimated Project Cost | | | | \$5,858,560 | | | |

Appendix C East Side Concept Cost Estimate

OR 66 GREEN SPRINGS IAMP Revised Concept E-1: Greensprings Dr / Frontage Rd Project Sheet: E-1 Note: The Construction Cost Index for 2010 was estimated to be 219

| Proposed Road Improvements | | | | | | |
|--|-------------|-----------------|--------------------|--------------|--|--|
| Item | Unit | Quantity | Unit Cost | Total | | |
| Excavation (Cut) | cu. yd. | 18,515 | \$15.00 | \$277,722 | | |
| Embankment (Fill) | cu. yd. | 5,772 | \$20.00 | \$115,440 | | |
| Pavement Rehabilitation | sq. ft. | 0 | \$4.00 | \$0 | | |
| New Pavement | sq. ft. | 166,800 | \$8.00 | \$1,334,400 | | |
| New Curb | lin. ft. | 4,828 | \$15.00 | \$72,420 | | |
| New Sidewalk & Concrete Median | sq. ft. | 28,968 | \$5.00 | \$144,840 | | |
| Pavement markings | lin. ft. | 3,250 | \$1.00 | \$3,250 | | |
| Signage | each | 16 | \$500.00 | \$8,000 | | |
| Pavement Removal | sq. ft. | 32,507 | \$2.00 | \$65,014 | | |
| | | Subto | otal A (Roadworks) | \$2,021,086 | | |
| Storm Drainage System | | % of Subtotal A | 20% | \$404,217.20 | | |
| Landscape Improvement | | % of Subtotal A | 5% | \$101,054.30 | | |
| Street Lighting | each | 16 | \$7,000.00 | \$113,750 | | |
| Private Utility Coordination | Lump/Sum | 1 | \$50,000.00 | \$50,000 | | |
| New Traffic Signal | each | 0 | \$250,000.00 | \$0 | | |
| Traffic Signal Modification | each | 0 | \$100,000.00 | \$0 | | |
| Retaining Walls | sq. ft. | 0 | \$50.00 | \$0 | | |
| Structures | sq. ft. | 0 | \$150.00 | \$0 | | |
| Railroad Crossing & Signalization | each | 0 | \$750,000.00 | \$0 | | |
| | | | Subtotal B (Other) | \$669,022 | | |
| Subtotal 1 (Subtotals A + B) | | | | \$2,690,108 | | |
| Mobilization | | % of Subtotal 1 | 10% | \$269,010.75 | | |
| Erosion Control | | % of Subtotal 1 | 5% | \$134,505.38 | | |
| Traffic Control | | % of Subtotal 1 | 5% | \$134,505.38 | | |
| Subtotal 2 (Mobilization & Traffic Con | trol) | | | \$538,022 | | |
| Total (Subtotals 1 + 2) | | | | \$3,228,129 | | |
| Plus Contingencies | | % of Total | 30% | \$968,438.70 | | |
| Estimated Construction Cost | | | | \$4,196,568 | | |
| Architectural/Engineering | | % of Est. Cost | 15% | \$629,485.16 | | |
| Construction Management | | % of Est. Cost | 10% | \$419,656.77 | | |
| Estimated Professional Fees | \$1,049,142 | | | | | |
| Right-of-Way | \$0 | | | | | |
| Estimated Property Acquisition | \$0 | | | | | |
| | | | | | | |
| Estimated Project Cost | \$5,245,710 | | | | | |

OR 66 GREEN SPRINGS IAMP

 Revised Concept E-4: Greensprings Dr / Memorial

 Project Sheet:
 E-4

 Note: The Construction Cost Index for 2010 was estimated to be 219

| Proposed Road Improvements | | | | | | |
|--|-------------|-----------------|--------------------|----------------|--|--|
| Item | Unit | Quantity | Unit Cost | Total | | |
| Excavation (Cut) | cu. yd. | 37,296 | \$15.00 | \$559,440 | | |
| Embankment (Fill) | cu. yd. | 9,324 | \$20.00 | \$186,480 | | |
| Pavement Rehabilitation | sq. ft. | 0 | \$4.00 | \$0 | | |
| New Pavement | sq. ft. | 252,000 | \$8.00 | \$2,016,000 | | |
| New Curb | lin. ft. | 0 | \$15.00 | \$0 | | |
| New Sidewalk & Concrete Median | sq. ft. | 0 | \$5.00 | \$0 | | |
| Pavement markings | lin. ft. | 5,250 | \$1.00 | \$5,250 | | |
| Signage | each | 26 | \$500.00 | \$13,000 | | |
| Pavement Removal | sq. ft. | 39,007 | \$2.00 | \$78,014 | | |
| Median | ft. | 270 | \$30.00 | \$8,100 | | |
| | | Subto | otal A (Roadworks) | \$2,866,284 | | |
| Storm Drainage System | | % of Subtotal A | 20% | \$573,257 | | |
| Landscape Improvement | | % of Subtotal A | 5% | \$143,314 | | |
| Street Lighting | each | 53 | \$7,000.00 | \$367,500 | | |
| Private Utility Coordination | Lump/Sum | 1 | \$10,000.00 | \$10,000 | | |
| New Traffic Signal | each | 0 | \$250,000.00 | \$0 | | |
| Traffic Signal Modification | each | 0 | \$100,000.00 | \$0 | | |
| Retaining Walls | sq. ft. | 0 | \$50.00 | \$0 | | |
| Structures | sq. ft. | 7,314 | \$150.00 | \$1,097,100 | | |
| Railroad Crossing & Signalization | each | 0 | \$750,000.00 | \$0 | | |
| | | | Subtotal B (Other) | \$2,191,171 | | |
| Subtotal 1 (Subtotals A + B) | | | | \$5,057,455 | | |
| Mobilization | | % of Subtotal 1 | 10% | \$505,745.50 | | |
| Erosion Control | | % of Subtotal 1 | 5% | \$252,872.75 | | |
| Traffic Control | | % of Subtotal 1 | 5% | \$252,872.75 | | |
| Subtotal 2 (Mobilization & Traffic Con | trol) | | | \$1,011,491 | | |
| Total (Subtotals 1 + 2) | | | | \$6,068,946 | | |
| Plus Contingencies | | % of Total | 30% | \$1,820,684 | | |
| Estimated Construction Cost | | | | \$7,889,630 | | |
| Architectural/Engineering | | % of Est. Cost | 15% | \$1,183,444.47 | | |
| Construction Management | | % of Est. Cost | 10% | \$788,962.98 | | |
| Estimated Professional Fees | \$1,972,407 | | | | | |
| Right-of-Way | \$0 | | | | | |
| Estimated Property Acquisitie | \$0 | | | | | |
| | | | | | | |
| Estimated Project Cost | | | | \$9,862,037 | | |

Appendix D Interchange Concept Cost Estimate

OR 66 GREEN SPRINGS IAMP

 Concept I-1: Improve Existing Interchange

 Project Sheet:
 I-1

 Note: The Construction Cost Index for 2010 was estimated to be 219

| | Proposed Road Improvements | | | | | |
|---|----------------------------|-----------------|--------------------|----------------|--|--|
| Item | Unit | Quantity | Unit Cost | Total | | |
| Excavation (Cut) | cu. yd. | 5,717 | \$15.00 | \$85,761 | | |
| Embankment (Fill) | cu. yd. | 2,576 | \$20.00 | \$51,523 | | |
| Pavement Rehabilitation | sq. ft. | 174,800 | \$4.00 | \$699,200 | | |
| New Pavement | sq. ft. | 69,625 | \$8.00 | \$557,000 | | |
| New Curb | lin. ft. | 4,600 | \$15.00 | \$69,000 | | |
| New Sidewalk & Concrete Median | sq. ft. | 27,600 | \$5.00 | \$138,000 | | |
| Pavement markings | lin. ft. | 5,570 | \$1.00 | \$5,570 | | |
| Signage | each | 14 | \$500.00 | \$7,000 | | |
| Pavement Removal | sq. ft. | 58,514 | \$2.00 | \$117,028 | | |
| | | Subte | otal A (Roadworks) | \$1,730,082 | | |
| Storm Drainage System | | % of Subtotal A | 20% | \$346,016.38 | | |
| Landscape Improvement | | % of Subtotal A | 5% | \$86,504.09 | | |
| Street Lighting | each | 28 | \$7,000.00 | \$194,950 | | |
| Private Utility Coordination | Lump/Sum | 1 | \$10,000.00 | \$10,000 | | |
| New Traffic Signal | each | 0 | \$250,000.00 | \$0 | | |
| Traffic Signal Modification | each | 0 | \$100,000.00 | \$0 | | |
| Retaining Walls | sq. ft. | 10,640 | \$50.00 | \$532,000 | | |
| Structures | sq. ft. | 0 | \$150.00 | \$0 | | |
| Railroad Crossing & Signalization | each | 0 | \$750,000.00 | \$0 | | |
| | | | Subtotal B (Other) | \$1,169,470 | | |
| Subtotal 1 (Subtotals A + B) | | | | \$2,899,552 | | |
| Mobilization | | % of Subtotal 1 | 10% | \$289,955.23 | | |
| Erosion Control | | % of Subtotal 1 | 5% | \$144,977.62 | | |
| Traffic Control | | % of Subtotal 1 | 5% | \$144,978 | | |
| Subtotal 2 (Mobilization & Traffic Cont | trol) | | | \$579,910 | | |
| Total (Subtotals 1 + 2) | | | | \$3,479,463 | | |
| Plus Contingencies | | % of Total | 30% | \$1,043,838.84 | | |
| Estimated Construction Cost | | | | \$4,523,302 | | |
| Architectural/Engineering | | % of Est. Cost | 15% | \$678,495.25 | | |
| Construction Management | | % of Est. Cost | 10% | \$452,330.17 | | |
| Estimated Professional Fees | \$1,130,825 | | | | | |
| Right-of-Way | \$0 | | | | | |
| Estimated Property Acquisition | \$0 | | | | | |
| | | | | | | |
| Estimated Project Cost | | | | \$5,654,127 | | |

OR 66 GREEN SPRINGS IAMP Revised Concept I-2: Add US 97 NB On-Ramp

Project Sheet: I-2 Note: The Construction Cost Index for 2010 was estimated to be 219

| Proposed Road Improvements | | | | | | |
|--|-------------|-----------------|--------------------|----------------|--|--|
| Item | Unit | Quantity | Unit Cost | Total | | |
| Excavation (Cut) | cu. yd. | 9,575 | \$15.00 | \$143,620 | | |
| Embankment (Fill) | cu. yd. | 3,415 | \$20.00 | \$68,302 | | |
| Pavement Rehabilitation | sq. ft. | 174,800 | \$4.00 | \$699,200 | | |
| New Pavement | sq. ft. | 92,300 | \$8.00 | \$738,400 | | |
| New Curb | lin. ft. | 4,600 | \$15.00 | \$69,000 | | |
| New Sidewalk & Concrete Median | sq. ft. | 27,600 | \$5.00 | \$138,000 | | |
| Pavement markings | lin. ft. | 3,692 | \$1.00 | \$3,692 | | |
| Signage | each | 18 | \$500.00 | \$9,000 | | |
| Pavement Removal | sq. ft. | 58,514 | \$2.00 | \$117,028 | | |
| | | Subte | otal A (Roadworks) | \$1,986,242 | | |
| Storm Drainage System | | % of Subtotal A | 20% | \$397,248.43 | | |
| Landscape Improvement | | % of Subtotal A | 5% | \$99,312.11 | | |
| Street Lighting | each | 37 | \$7,000.00 | \$258,440 | | |
| Private Utility Coordination | Lump/Sum | 1 | \$50,000.00 | \$50,000 | | |
| New Traffic Signal | each | 0 | \$250,000.00 | \$0 | | |
| Traffic Signal Modification | each | 0 | \$100,000.00 | \$0 | | |
| Retaining Walls | sq. ft. | 20,240 | \$50.00 | \$1,012,000 | | |
| Structures | sq. ft. | 0 | \$150.00 | \$0 | | |
| Railroad Crossing & Signalization | each | 0 | \$750,000.00 | \$0 | | |
| | | | Subtotal B (Other) | \$1,817,001 | | |
| Subtotal 1 (Subtotals A + B) | | | | \$3,803,243 | | |
| Mobilization | | % of Subtotal 1 | 10% | \$380,324.27 | | |
| Erosion Control | | % of Subtotal 1 | 5% | \$190,162.13 | | |
| Traffic Control | | % of Subtotal 1 | 5% | \$190,162.13 | | |
| Subtotal 2 (Mobilization & Traffic Con | trol) | | | \$760,649 | | |
| Total (Subtotals 1 + 2) | | | | \$4,563,891 | | |
| Plus Contingencies | | % of Total | 30% | \$1,369,167.36 | | |
| Estimated Construction Cost | | | | \$5,933,059 | | |
| Architectural/Engineering | | % of Est. Cost | 15% | \$889,958.78 | | |
| Construction Management | | % of Est. Cost | 10% | \$593,305.85 | | |
| Estimated Professional Fees | \$1,483,265 | | | | | |
| Right-of-Way | \$0 | | | | | |
| Estimated Property Acquisitie | \$0 | | | | | |
| | | | | | | |
| Estimated Project Cost | | | | \$7,416,323 | | |

OR 66 GREEN SPRINGS IAMP

 Concept I-5: Diverging Diamond Interchange

 Project Sheet:
 I-5

 Note: The Construction Cost Index for 2010 was estimated to be 219

| | Proposed Road Improvements | | | | | |
|--|----------------------------|-----------------|--------------------|----------------|--|--|
| Item | Unit | Quantity | Unit Cost | Total | | |
| Excavation (Cut) | cu. yd. | 27,940 | \$15.00 | \$419,094 | | |
| Embankment (Fill) | cu. yd. | 9,238 | \$20.00 | \$184,760 | | |
| Pavement Rehabilitation | sq. ft. | 0 | \$4.00 | \$0 | | |
| New Pavement | sq. ft. | 284,425 | \$8.00 | \$2,275,400 | | |
| New Curb | lin. ft. | 4,600 | \$15.00 | \$69,000 | | |
| New Sidewalk & Concrete Median | sq. ft. | 27,600 | \$5.00 | \$138,000 | | |
| Pavement markings | lin. ft. | 29,961 | \$1.00 | \$29,961 | | |
| Signage | each | 27 | \$500.00 | \$13,500 | | |
| Pavement Removal | sq. ft. | 283,531 | \$2.00 | \$567,062 | | |
| Median | ft. | 680 | \$30.00 | \$20,400 | | |
| | | Subto | otal A (Roadworks) | \$3,717,177 | | |
| Storm Drainage System | | % of Subtotal A | 20% | \$743,435.38 | | |
| Landscape Improvement | | % of Subtotal A | 5% | \$185,858.84 | | |
| Street Lighting | each | 53 | \$7,000.00 | \$371,980 | | |
| Private Utility Coordination | Lump/Sum | 1 | \$10,000.00 | \$10,000 | | |
| New Traffic Signal | each | 2 | \$250,000.00 | \$500,000 | | |
| Traffic Signal Modification | each | 0 | \$100,000.00 | \$0 | | |
| Retaining Walls (less than 5 feet) | sq. ft. | 20,400 | \$50.00 | \$1,020,000 | | |
| Structures | sq. ft. | 0 | \$150.00 | \$0 | | |
| Railroad Crossing & Signalization | each | 0 | \$750,000.00 | \$0 | | |
| | | | Subtotal B (Other) | \$2,831,274 | | |
| Subtotal 1 (Subtotals A + B) | | | | \$6,548,451 | | |
| Mobilization | | % of Subtotal 1 | 10% | \$654,845.11 | | |
| Erosion Control | | % of Subtotal 1 | 5% | \$327,422.55 | | |
| Traffic Control | | % of Subtotal 1 | 5% | \$327,422.55 | | |
| Subtotal 2 (Mobilization & Traffic Con | trol) | | | \$1,309,690 | | |
| Total (Subtotals 1 + 2) | | | | \$7,858,141 | | |
| Plus Contingencies | | % of Total | 30% | \$2,357,442.39 | | |
| Estimated Construction Cost | | | | \$10,215,584 | | |
| Architectural/Engineering | | % of Est. Cost | 15% | \$1,532,337.56 | | |
| Construction Management | | % of Est. Cost | 10% | \$1,021,558.37 | | |
| Estimated Professional Fees | \$2,553,896 | | | | | |
| Right-of-Way | \$0 | | | | | |
| Estimated Property Acquisition | \$0 | | | | | |
| | | | | | | |
| Estimated Project Cost | | | | \$12,769,480 | | |