FINAL

Construction Phasing Concept Plan
I-5 : Broadway/Weidler Interchange Project

Oregon Department of Transportation
Portland, OR

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Executive Summary

Planning for the Broadway/Weidler Interchange Project has been underway since 2009 when ODOT and the City of Portland collaborated on the N/NE Quadrant and I-5 Broadway/Weidler Plans Project. The N/NE Quadrant Plan and I-5 Broadway/Weidler Plans Project served to update the land use, urban design, and local transportation plan for the N/NE Quadrant of Central City Plan and to evaluate a range of I-5 interchange improvement concepts. The project developed a Facility Plan that described the preferred alternative for the freeway and interchange. The Facility Plan was unanimously approved by the Oregon Transportation Commission and Portland City Council in 2012.

In 2014 ODOT initiated additional work on the freeway and interchange concept to confirm that the project described in the Facility Plan was viable for traffic operations and construction. This report provides an initial assessment of the issues related to constructing the preferred alternative and to prepare a general construction concept plan for phasing and implementing the project while minimizing impacts to motor vehicle traffic, bicycles, pedestrians and transit operations and maintaining access to businesses and to events at the Moda Center, Veterans Memorial Coliseum and the Oregon Convention Center.

This report describes the results of the I-5 Broadway/Weidler Refinement Project’s Construction Phasing Concept Plan in support of refinement of the I-5 Broadway/Weidler Facility Plan. This activity has been timed to take place in advance of conducting an Environmental Assessment (EA) process, where capturing and describing potential impacts, including temporary construction impacts, is necessary. In addition to the physical impacts associated with constructing this project, there are temporary impacts that could potentially disrupt travel by all modes in the area for up to five years. The purpose of this concept plan is to identify strategies for implementing the Facility Plan that would minimize the extent and duration of the disruption and confirm that there is a feasible construction scenario that will be considered during the upcoming environmental review phase of the project.

Project goals that drove the process for developing the construction phasing scenarios include the following:

- **Limit the impacts to freeway and freight mobility**
- **Limit impacts to the surrounding neighborhoods and businesses**
- **Avoid complete local street closures**

Constraints that were applied and considered non-negotiable design sideboards include the following:

- **Freeway full closures (weekday, daytime)**
- **Freeway lane closures**
- **Existing Area of Potential Impact (API)**
- **Existing roadway configuration**
- **Moda Center/Veterans Memorial Coliseum Access/Egress**
- **ADA accommodation during construction**
- **Portland Streetcar system operations**

While this report addresses issues throughout the Project Area, most of the attention is focused on the issues related to constructing the Broadway/Weidler Lid. The Broadway/Weidler Lid is the largest and most complex element of the project. The project team evaluated several different concepts for how and when improvements could be constructed. Their respective consequences also were documented. The process focused on the following elements:

- Evaluating constructability, overall project sequencing, and component phasing to determine if there are reasonable and feasible methods of constructing the project
- Assessing the temporary and permanent motor vehicle traffic, structural, roadway, transit, streetcar, pedestrian, and bicycle modifications needed to complete the project
- Understanding the potential temporary or permanent impacts that could result from project construction
- Maximizing project benefits while minimizing project costs and impacts

The team used a four-step process to evaluate options, to help identify which options were fatally flawed or unreasonable and to evaluate which options presented the most merit. The process is summarized below in Figure 1.

**Figure 1. Process Approach Summary**

**APPRAOCH**

1. Identify Potential Phasing Scenarios
2. Identify Risk and Constraints
3. Evaluate/Compare Scenarios vs Risk/Key Movements
4. Select/Evaluate Feasible Scenarios

**Key Findings**

This report describes the following key findings, under the assumed goals and constraints:

**Construction Phasing**

- **Overall Project Construction Sequencing:** Construction will require multiple construction seasons and could take four to five years to complete. Based on the interdependencies between the various components of the project from the viewpoint of constructability, the construction may generally be sequenced as follows:
  - South Zone I-5 and Broadway/Weidler Lid
- North Lid
- North Zone I-5
- Central Zone I-5
- Clackamas Overcrossing and Moda Center Improvements

Figure 2 shows the project construction phasing zones.

- **Broadway/Weidler Lid Construction Phasing (#1 in Figure 2):** Eight different construction-phasing scenarios were analyzed, and two were identified as the most feasible scenarios that minimized the impacts to the community. The interdependency of existing structure demolition and maintenance of traffic within the confined right-of-way drove the selection process. Planned developments in the study area constrain the ability to detour traffic.

- **North Lid Construction Phasing (#2 in Figure 2):** The construction of the North Lid would likely have fewer impacts to and conflicts among motor vehicle traffic, bicyclists, pedestrians, and transit as compared to the construction of the Broadway/Weidler Lid. However, it was determined that there are limited benefits to sequencing the North Lid before the Broadway/Weidler Lid.

If the goals or constraints change as the project progresses and design is refined, the construction phasing options could potentially be expanded.

**Constructability**

**Constructability Issues:** Construction of the Broadway/Weidler Lid should use accelerated bridge construction methods to minimize the overall duration of impacts. Outside the lid areas, issues include building over the railroad, light rail, and the freeway. Through the duration of construction, there are likely to be a range of issues of concern for the public (area residents, area businesses and employees and through travelers). ODOT and the City of Portland should plan for extensive public outreach during the construction period.

**Technical Analysis**

- **Traffic Analysis:** The analysis of motor vehicle, bicycle, pedestrian and transit operations show that a three-lane couplet option would maintain access to businesses during construction, maintain key movements at intersections in the area, maximize motor vehicle performance, minimize bicycle and pedestrian disruption and minimize impacts to properties near the intersections of NE Broadway and NE Weidler Street with N Williams Avenue, and N Vancouver Avenue. The motor vehicle, bicycle, pedestrian and transit operations on Broadway, Weidler, and Vancouver will be similar to existing conditions. Short-term closures are anticipated to build bridges, but Williams may be closed for a longer duration. During N Williams Avenue closures, a plan would need to be developed to accommodate northbound bicycle traffic. Additional study is needed to determine the best windows for full closures, and a more detailed assessment of impacts will be conducted during the upcoming EA, starting in early 2017.
1 Project Background

Planning for the Broadway/Weidler Interchange Project has been underway since 2009 when ODOT and the City of Portland collaborated on the N/NE Quadrant and I-5 Broadway/Weidler Plans Project. The N/NE Quadrant and I-5 Broadway/Weidler Plans Project served to update the land use, urban design, and local transportation plan for the N/NE Quadrant of Central City Plan and to evaluate a range of interchange improvement concepts. The project developed a Facility Plan that described the preferred alternative for the freeway and interchange. The Facility Plan was unanimously approved by the Oregon Transportation Commission and Portland City Council in 2012.

In 2014 ODOT initiated additional work on the freeway and interchange concept to confirm that the project described in the Facility Plan was viable for traffic operations and construction. This report provides an initial assessment of the issues related to constructing the preferred alternative and to prepare a general construction concept plan for phasing and implementing the project while minimizing impacts to motor vehicle traffic, bicycles, pedestrians and transit operations and maintaining access to businesses and to events at the Moda Center, Veterans Memorial Coliseum and the Oregon Convention Center.

This report summarizes the work done in summer and fall of 2016 to better understand overall project construction sequencing and component phasing. More detailed information can be found in the appendices associated with each topic. While this report addresses issues throughout the Project Area, most of the attention is focused on the issues related to constructing the Broadway/Weidler Lid. The Broadway/Weidler Lid is the largest and most complex element of the project. Issues outside this area were discovered and have also been documented for future resolution.
The purpose of this concept plan is to identify strategies for implementing the Facility Plan that would minimize the extent and duration of the disruption and confirm that there is a feasible construction scenario that will be considered during the upcoming environmental review phase of the project.

1.1 Overview

As part of the overall I-5 Broadway/Weidler Interchange Project, the I-5 Broadway/Weidler interchange (Exit 302A) will require reconstruction of NE Broadway, NE Weidler Street, N Williams Avenue, N Vancouver Avenue, and N Flint Avenue bridges over I-5. The Broadway/Weidler interchange with I-5 is located halfway between the I-405 and I-84 freeway interchanges (Figure 2). The Broadway/Weidler interchange serves high volumes of local and regional industrial, commercial, commuter and residential traffic accessing the Portland central city area, Moda Center/Veterans Memorial Coliseum, the Lloyd District, and to the many surrounding neighborhoods and businesses. The interchange reconstruction and I-5 widening seeks to address the mobility and safety issues of the interstate between I-405 and I-84.

The proposed freeway improvements at the Broadway/Weidler interchange include an additional freeway auxiliary lane and shoulders in each direction, modifications to the freeway entrance and exit ramps, replacement of the existing freeway overcrossing structures (Broadway, Weidler, Williams, Vancouver, Flint) with two, new freeway lid structures, and mobility improvements to the surface streets surrounding the interchange, including a new bicycle and pedestrian overcrossing at NE Clackamas Street.

1.2 Purpose and Need

The primary purpose of the project is to improve safety and operations on a 1-mile section of I-5 and adjacent interchanges in the vicinity of the Broadway/Weidler interchange between I-405 and I-84. Reconstructing the Broadway/Weidler interchange also will provide local street system improvements in the vicinity of the I-5 intersection with Broadway and Weidler. Located in a dense urban environment, the interchange serves large volumes of vehicular, pedestrian, streetcar, bus transit, and bike traffic within a highly physically constrained area. This segment of I-5 has not been improved since it was originally constructed in the 1960s and remains one of the few remaining sections of freeway in the Metro region where there are only two lanes in each direction.

Figure 3. Existing Structures Constrain Widening of Highly
Improvements to this interchange are necessary to address the safety and operational deficiencies of the interstate and the local streets.

1.3 Items Not Covered by this Report

This report is focused on reporting on potential construction phasing strategies and a concept-level assessment of issues related to constructing the project. The Environmental Assessment (EA), scheduled to begin in the spring of 2017, will provide additional documentation of the environmental, social, bicycle, pedestrian, motor vehicle and construction impacts associated with the project. The following aspects of the project are not addressed in detail in this report, but will be addressed either during the EA process or with additional project design:

- Environmental impacts and mitigation
- Right-of-way impacts, costs, schedule
- Determination of construction easements (e.g., for contractor staging areas)
- Engineering and architectural detailed design
- Stormwater design solutions and permitting strategies
- Bike/pedestrian facility design details
- Detailed Americans with Disabilities Act (ADA) temporary pedestrian route strategies during construction
- Final determination of accommodating streetcar operations during construction
- Bottom-up or bid item detailed quantities and cost estimating
- Details for maintaining motor vehicle, pedestrian, bicycle, and transit movement throughout the entirety of construction
- Railroad (Union Pacific Railroad) coordination and design considerations

1.4 Project Status and Schedule

The I-5 Broadway/Weidler Interchange Facility Plan identified the preferred alternative for the project. The project has been designed at a conceptual level and additional design refinements will occur to support the upcoming EA. It is anticipated that project design refinements will be used to further clarify cost, schedule, impacts, and project mitigation requirements. It is anticipated that additional issues will be uncovered, and construction funding has not yet been secured.
2 Overall Project Construction Sequencing

The sequencing of major components of the overall I-5 Broadway/Weidler Interchange project can be arranged and overlapped in different ways to achieve various outcomes such as accelerated schedule, minimized cost, limited budgets, or reduced impacts. The efficient construction sequencing of project components may improve the functionality of the project area, such as relieving traffic congestion. Some project components are entirely dependent upon the completion of other components; for example, demolition of the existing Broadway, Weidler, and Williams overcrossings must be completed to fully widen I-5 below. It is necessary to address the overall sequence of major project components in order to describe how best to phase construction of the Broadway/Weidler Lid.

Availability and timing of funding over the duration of the project will influence final project sequencing. If only partial funding is received, components on which many other components depend would be constructed first. Consideration must be given to the overall project impacts, benefit, and mitigation derived from each project component. The project includes both surface-street and freeway ramp and mainline elements that are interdependent. Project components that provide greater overall benefit and contribute more to the achievement of the project goals would also appear first in the project sequencing.

2.1 Project Improvement Components

For ease of explanation and to support development of approximate construction sequencing, the I-5 Broadway/Weidler Interchange Project was broken down into major components. A major project component is considered a large group of related infrastructure improvements that provide a meaningful benefit. For this work, the major project components include (see also, Figure 2):

- **Broadway/Weidler Lid** (#1 in Figure 2): a new central Broadway-Williams-Weidler overcrossing lid structure, walls, ramps, interchange reconfiguration, and connections that allow I-5 to be widened.

- **North Lid** (#2 in Figure 2): a new Hancock-Dixon-Vancouver overcrossing lid structure, walls, ramps, and connections that allow I-5 to be widened.

- **I-5 Freeway Zones** (Widening and Interchanges):
  - **North Zone** (#2 and 3 in Figure 2): Interstate widening of roadways and structures north of Broadway, including the I-405 interchange, north to the I-405 Fremont Bridge.
  - **Central Zone** (#1 and 4 in Figure 2): Interstate widening of roadway and structures in the Broadway/Weidler Lid and interchange area.
  - **South Zone** (#5 in Figure 2): Interstate widening of roadways and structures south of Weidler, including the I-84 interchange, extending south to before the Burnside Bridge.
- **Clackamas Bicycle and Pedestrian Overcrossing** (#5 in Figure 2): a new pedestrian/bike bridge over I-5 at Clackamas Street to provide east/west connectivity.

- **Moda Center and Veterans Memorial Coliseum Improvements** (#4 in Figure 2): reconfigurations and improvements of the streets around the Moda Center to improve connectivity and flow, compatible with the surrounding surface street improvements.

### 2.2 Project Sequencing Dependencies

The North Zone and South Zone freeway widening is mostly independent from the Broadway/Weidler Lid and interchange with respect to construction sequencing, whereas the widening of the Central Zone of I-5 generally requires removal of the existing Broadway, Williams, and Weidler structures. A summary of the key dependencies is listed in Table 31. If seismic resiliency retrofits of the existing structures are included as part of the project, this work could coincide with the widening of existing structures, which would allow for maximum cost savings and minimal traffic disruptions during construction.

#### Table 1. Project Component Sequencing Key Dependencies

<table>
<thead>
<tr>
<th>Major Project Construction Component</th>
<th>Key Dependencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadway/Weidler Lid</td>
<td>• Must be completed prior to widening I-5 beneath Broadway/Weidler (I-5 Central Zone)</td>
</tr>
<tr>
<td></td>
<td>• Can be sequenced with I-5 widening to the north and/or south.</td>
</tr>
<tr>
<td></td>
<td>• Should be completed prior to the Clackamas Bicycle and Pedestrian Overcrossing bridge.</td>
</tr>
</tbody>
</table>

| South Zone I-5 SB Widening           | • I-5 SB to I-84 EB structure modifications must be made prior to mainline I-5 viaduct widening, due to the I-5 SB to I-84 EB elevated viaduct in the way of widening I-5 SB. Flyover structures straddle I-5 and have columns and foundations in close proximity to the I-5 mainline freeway. |

| North Lid                            | • If the North Lid is constructed after the Broadway/Weidler Lid, it would provide the flexibility to construct the most beneficial project segment first.  |
|                                      | • Building simultaneously with Broadway/Weidler Lid would require a large up-front capital investment, limit funding phasing opportunities, and have more temporary construction traffic impacts than phasing the two lids sequentially.  |
|                                      | • If completed before the Broadway/Weidler Lid, this lid may mitigate traffic congestion as a detour around construction. |

| North Zone I-5 NB and SB Widening    | • Generally independent of other components of the project, but operational improvements can result when complete. |

| Central Zone I-5 SB Widening         | • Heavily dependent on the Broadway/Weidler Lid completion.  |
|                                      | • I-5 entrance and exit ramps to the Broadway/Weidler interchange are heavily dependent on the lid construction. NB I-5 entrance will depend on the north side of the lid. NB I-5 exit ramp will depend on the southern side.  |
|                                      | • The new SB I-5 entrance ramp at Williams/Weidler is dependent on the reconfiguration of the Moda Center access routes.  |
|                                      | • Moda Center connections are dependent on the construction of the southern portion of the Broadway/Weidler Lid. |
### Table 1. Project Component Sequencing Key Dependencies

<table>
<thead>
<tr>
<th>Major Project Construction Component</th>
<th>Key Dependencies</th>
</tr>
</thead>
</table>
| Central Zone I-5 NB Widening          | • Heavily dependent on the Broadway/Weidler Lid completion.  
  • Central Zone I-5 NB widening is restricted by the existing structures over I-5, while I-5 SB does not require removal of the existing Flint and Vancouver bridges or construction of the new North Lid. Widening of the freeway does require modifications to the existing mainline viaducts to the north and south of the central Broadway/Weidler Lid area. |
| Clackamas Bicycle and Pedestrian Overcrossing | • Generally independent of the rest of the project.  
  • Sequenced after the Broadway/Weidler Lid due to the new I-5 ramp configurations (relocation of I-5 SB on-ramp from Winning/Wheeler to Weidler). |
| Moda Center and Veterans Memorial Coliseum Improvements | • Generally independent of the rest of the project.  
  • Sequenced after the Broadway/Weidler Lid due to the new I-5 ramp configurations (relocation of I-5 SB on-ramp from Winning/Wheeler to Weidler). |

I-5 = Interstate 5; SB = southbound; EB = eastbound; NB = northbound

### 2.3 Preliminary Construction Schedule & Sequencing

Figure 4 shows a feasible overall schedule of project components with approximate durations and potential start dates, based on a preliminary arrangement of the overall project and interdependencies. This construction sequencing scenario includes a series of overlapping steps; other approaches to overall project sequencing are feasible. This baseline was used to sequence the project and resulted in an initial version of the concept construction schedule.

The construction schedule assumes a construction start in early 2023, contingent on final design and construction funding. This start date assumption could be adjusted based on funding availability, contracting phasing opportunities, and other factors, but the approximate construction sequencing and durations should be valid under a variety of start dates. Further adjustment is anticipated as design progresses.

A more detailed preliminary construction schedule is provided in Appendix D. The construction will require multiple years and construction seasons and could take four to five years to complete. The schedule assumes the use of accelerated bridge construction methods to minimize impacts to the public, in particular for the Broadway/Weidler Lid. Approximate durations of major project components are shown in 2.
Table 2. Approximate Durations and Start Dates for Major Project Components

<table>
<thead>
<tr>
<th>No.</th>
<th>Major Project Component</th>
<th>Approximate Duration (Months)</th>
<th>Potential Start Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>South Zone I-5 NB Widening</td>
<td>12</td>
<td>Early 2023</td>
</tr>
<tr>
<td>2</td>
<td>Broadway/Weidler Lid</td>
<td>24</td>
<td>Early 2023</td>
</tr>
<tr>
<td>3</td>
<td>South Zone I-5 SB Widening</td>
<td>24</td>
<td>Early 2023</td>
</tr>
<tr>
<td>4</td>
<td>North Lid</td>
<td>18</td>
<td>Late 2024</td>
</tr>
<tr>
<td>5</td>
<td>North Zone I-5 NB Widening</td>
<td>15</td>
<td>Mid 2025</td>
</tr>
<tr>
<td>6</td>
<td>North Zone I-5 SB Widening</td>
<td>14</td>
<td>Mid 2025</td>
</tr>
<tr>
<td>7</td>
<td>Central Zone I-5 SB Widening</td>
<td>6</td>
<td>Mid 2025</td>
</tr>
<tr>
<td>8</td>
<td>Central Zone NB I-5 Widening</td>
<td>6</td>
<td>Mid 2025</td>
</tr>
<tr>
<td>9</td>
<td>Moda Center/Veterans Memorial Coliseum Improvements</td>
<td>24</td>
<td>Early 2026</td>
</tr>
<tr>
<td>10</td>
<td>Clackamas Bicycle and Pedestrian Overcrossing and</td>
<td>24</td>
<td>Early 2026</td>
</tr>
</tbody>
</table>

I-5 = Interstate 5; NB = northbound; SB = southbound
Figure 4. Preliminary Project Construction Timeline

1. Broadway Weidler Lid:
   - South Zone I-5 NB Widening
   - Central Broadway-Weidler Lid
   - South Zone I-5 SB Widening

2. North Lid:
   - Remove existing Vancouver bridge
   - Construct new North Hancock-Dixon Vancouver Lid
   - Remove existing Flint bridge

3. Northcentral Widening:
   - North Zone I-5 SB Widening
   - North Zone I-5 NB Widening
   - Central Zone I-5 SB Widening
   - Central Zone I-5 NB Widening

4. Moda Center/Veterans Coliseum Improvements

5. Clackamas Bicycle and Pedestrian Overcrossing

* See Figure 2, which illustrates the location of each major project component
3 Broadway/Weidler Lid Construction Phasing

A detailed investigation into the construction phasing of the Broadway/Weidler Lid is covered in this section. Several different phasing scenarios were considered during the course of the investigation. The phasing scenarios focused on the construction phasing within the limits of the Broadway/Weidler Lid and interchange, although impacts to the other project components were considered. Each scenario developed consists of a number of phases or steps, which specify the construction sequence to be followed. Some of the construction phases included “options,” or alternate ways of addressing specific issues or opportunities of that particular phase. Additional methods or considerations may be used to mitigate potential impacts and influence construction cost or duration. The objective of this effort was to confirm a feasible construction scenario to be considered during the upcoming EA phase of the project.

3.1 Process for Development of Phasing Scenarios

Phasing scenarios were developed, refined, and compared by considering a number of key inputs, driven by the ability to:

- Achieve the project goals as established in the Facility Plan;
- Be consistent with physical constraints included in the concept designs;
- Accommodate key mobility movements for all modes of transportation;
- Reduce project risks; and
- Reduce impacts to the public and environment.

The details of these key inputs are provided in the following sections.

3.1.1 Project Goals and Constraints for Phasing Scenarios

Project goals that drove the process for developing the construction phasing scenarios include the following:

- **Limit the impacts to freeway and freight mobility:** This includes avoiding total closures and limiting lane reductions on I-5 and ramps. This project is at a major crossroads for three regionally significant freight and commuter freeway routes with some of the highest traffic volumes in the state. Phasing scenarios that would require significant freeway capacity reductions were assumed not feasible.

- **Limit impacts to the surrounding neighborhoods and businesses:** In particular, traffic within and through the Eliot neighborhood should not be significantly increased due to construction activities. In addition, local access to residents and businesses should not be severely impacted.

- **Avoid complete local street closures:** Restrictions were only considered for durations of less than one week for major local arterials; limited impacts were also allowed for low traffic local streets. The existing transportation network
accommodates a wide range of movements, including pedestrian, bicycle, transit, and motorized traffic. The local street network is critical to providing effective access to local businesses and special events. As such, complete street closures during construction are to be avoided or limited to discrete timeframes that could be managed through extensive outreach and traffic management strategies. Mobility for people walking and biking, particularly those headed north-south via Williams and Vancouver/Flint and east-west via Broadway and Weidler, must be maintained via safe detour routes.

**Constraints** that were applied and considered non-negotiable design sideboards include the following:

- **Freeway full closures:** Complete full directional closure of the freeway was not assumed, except for a limited number of pre-determined weekend and nighttime closures. Nighttime and weekend closures would be reserved for high-risk activities (e.g., bridge removal, accelerated construction).

- **Freeway lane closures:** Freeway lane closures were only considered for limited durations and were allowed more generously at late night times and a limited number of pre-determined weekends.

- **Existing Area of Potential Impact (API):** Impacts were assumed to be constrained to only include the previously identified API limits.

- **Existing roadway configuration:** The current roadway configuration from the Facility Plan (and as modified by roadway cross-section changes that occurred subsequent to adoption of the Facility Plan) was assumed as the basis for the analysis.

- **Moda Center:** Access, ingress, and egress from the area must be maintained for the duration of construction for event traffic.

- **ADA accommodation during construction:** Pedestrian facilities must comply with ADA requirements throughout the duration of construction.

- **Portland Streetcar system operations:** Portland Streetcar system operations (inclusive of temporary bus bridges) must continue throughout the duration of construction.

If the goals or constraints change as the project progresses and design is refined, the construction phasing options could potentially be expanded.

### 3.1.2 Key Transportation Modes and Movements

Specific modes of transportation were identified as “key” movements through the Broadway/Weidler interchange. These movements required in-depth investigation to ascertain whether they could be accommodated with minimal impact during each phase of the various phasing alternatives. The key transportation modes and movements included the following:

- **Motor vehicle traffic:**
  - East-west movement on the Broadway/Weidler couplet
o North-south movement on Vancouver and Williams
o Diversion to local neighborhood streets, namely NE San Rafael Street, N Hancock Street, N Flint Avenue, or NE Tillamook Street.

- **Pedestrian and Bicyclist Traffic:**
o East-west through the Broadway/Weidler couplet, NE Multnomah, and NE Tillamook
o North-south, particularly on Flint, Vancouver, and Williams

- **Public transit, including bus and streetcar:**
o East-west streetcar on Broadway/Weidler couplet
o North-south: multiple bus lines on Vancouver and Williams

- **Freeway traffic:**
o Northbound access
o Southbound access
o Through travel
o Lane reductions
o Interchange access

- **Moda Center event ingress and egress:**
o Freeway access
o Access to parking structures

### 3.1.3 Risk Factors for Construction Phasing

Risk factors are the aspects of the project that could change as the project develops further. Risk factors were identified to use as criteria to evaluate and compare the construction phasing scenarios. These risk factors included the following:

- Cost, including the cost of temporary features
- Schedule
- Impacts to travelers driving motor vehicles
- Impacts to travelers riding bikes
- Impacts to travelers walking
- Environmental impacts (including utility impacts and hazardous material impacts)
- Right-of-way impacts
- Area of potential impacts modifications
- Noise and vibration
- Streetcar impacts
3.2 Broadway/Weidler Lid Phasing Scenario Summary

A series of construction phasing ideas, termed “scenarios” and identified as Scenario A through H, were developed and investigated and are briefly described in Table 3. Additional information on these scenarios is provided in Appendix A, including more detailed information on Scenarios C (Close Williams) and H (Weidler Shoofly), which were determined the most reasonable solutions for construction phasing of the Broadway/Weidler Lid based on the goals and constraints. Appendix B includes figures that describe the phasing.

Table 3 provides a high-level determination of the merit of advancing each scenario as the project design advances.

Table 3. Construction Scenarios for the Broadway/Weidler Lid and Interchange

<table>
<thead>
<tr>
<th>ID</th>
<th>Scenario Description</th>
<th>Merit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Widen Weidler, keep couplet, close Williams</td>
<td>Feasible</td>
</tr>
<tr>
<td>B</td>
<td>Close Weidler and Williams</td>
<td>Unreasonable</td>
</tr>
<tr>
<td>C</td>
<td>Close Williams, keep couplet</td>
<td>Reasonable</td>
</tr>
<tr>
<td>D</td>
<td>Close Weidler, not Williams</td>
<td>Feasible</td>
</tr>
<tr>
<td>E</td>
<td>Close everything</td>
<td>Fatally Flawed</td>
</tr>
<tr>
<td>F</td>
<td>Belly-out(^1) East-West</td>
<td>Unreasonable</td>
</tr>
<tr>
<td>G</td>
<td>Diverging Diamond</td>
<td>Fatally Flawed</td>
</tr>
<tr>
<td>H</td>
<td>Weidler Shoofly</td>
<td>Reasonable</td>
</tr>
</tbody>
</table>

Note: See Figure 5 below for more detail.

3.3 Evaluation and Comparison of Broadway/Weidler Lid Phasing Scenarios

A summary-level evaluation and comparison methodology was developed and applied to each of the different phasing scenarios, to filter down and determine the merit of each, based on their performance in the areas described below. An analysis of the traffic impacts, schedule impacts, and temporary feature cost was performed.

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\(^1\) Belly Out is a term used for temporarily widening the East-West roads to the outside to allow for construction on the inside as a means of attempting to consistently maintain movements in the East-West directions. The result looks like each direction has “a belly” to the outside, thus the name.
3.3.1 Phasing Scenario Evaluation Matrix

All of the phasing scenarios for the concept phasing plan were assessed according to their ability to accommodate the key movements and level of impact to risk factors. The results of the assessment are included in the full Phasing Evaluation Matrix, located in Appendix C. A condensed version of this matrix is shown in Figure 5, which summarizes the key movement accommodations and risk factor impacts for each scenario as a whole rather than each phase individually. Specific project schedule information is provided in Appendix D. Traffic analysis is detailed in Appendix E.

![Figure 5. Phasing Evaluation Matrix](image)

3.3.2 Evaluation of Key Movement Accommodations

For each phase of the different scenarios, the ability of the phasing configurations to accommodate key movements identified was assessed and assigned a qualitative scoring corresponding to the level of accommodation:

- **Y – Yes**: the movement is accommodated with minimal relative disruptions.
- **R – Refine**: the movement may or may not be accommodated to the desired level, and additional refinement is required to provide with minimal relative disruptions.
- **N – No**: the movement is not accommodated or is substantially impacted.

The assessment of each scenario was consolidated into an evaluation matrix, described in Section 3.3.1. The following high-level findings were derived from the evaluation of key movements:

- **All Scenarios**:
  - All of the scenarios developed and evaluated provided similar level of performance in terms of accommodating the key movements, with the exception of Scenario E, which was a baseline of closing the structure over the freeway.
The most difficult movements to accommodate were generally north-south movements on Williams, east-west streetcar movements, northbound freeway access (due to limited widths and relative proximity of the existing Williams bridge abutment), and overall freeway lane reductions.

Scenarios that incorporate the use of temporary detour structures will be better able to accommodate motor vehicle traffic navigating the Broadway/Weidler couplet, but have higher temporary structure costs and a longer construction duration and associated impacts.

All scenarios have an impact on streetcar system operations given the existing Williams structure includes streetcar track, signals, and infrastructure, and must be removed first. Future discussions and negotiations will determine the specific details on accommodations required to maintain streetcar service or comparable transit connections during construction. There are two options being considered for providing transit service on the CL Streetcar route during construction; 1) shut down streetcar operations in the project area and replace with a bus bridge for up to 18 months; or 2) accommodate streetcar tracks on a series of temporary structures with intermittent closures and bus bridge service up to a total of 4 – 5 months.

All of the scenarios have challenges in accommodating freeway traffic and lane closures. Traffic impacts are unavoidable, if not required, to complete construction. It is possible, but not reasonable, to demolish and reconstruct significant overcrossings of a major freeway corridor without employing short-term (weekend and night) closures and targeted lane reductions. For this reason, Accelerated Bridge Construction (ABC) methods should be seriously evaluated to reduce time and impacts to the freeway.

Northbound access to I-5 from Broadway and Williams will be a conflict due to the close proximity of the existing Broadway/Williams structure and proposed lid abutments and walls (see additional detail in Section 3.3.4).

- Scenarios A, D, F, and H were the most successful at accommodating bicycle, pedestrian, motor vehicle and transit movements.
- Scenario B would not be able to accommodate peak motor vehicle volumes for long durations.
- Scenario C was able to accommodate key bicycle, pedestrian, motor vehicle and transit movements except for a very short duration, where eastbound traffic on Broadway would be interrupted.
- Scenario D would not be able to accommodate vehicular traffic volumes during all phases.
- Scenario E, which was developed as a baseline, would not accommodate traffic due to complete closures of key movements. These complete closures are considered fatal flaws and justify the need to develop a reasonable construction-phasing scenario.
Scenario F would require significant temporary detour structures that would not fit within the physical constraints of the project, due to currently planned development in the surrounding properties.

Scenario G would have spatial and capacity issues when diverting traffic to the detour structure, due to expected development in the surrounding properties.

Scenario H was able to accommodate all traffic movements reasonably well without significant impacts other than having a higher cost.

### 3.3.3 Evaluation of Risk Factors and Impacts

Each phase of each scenario was evaluated to determine the level of impact to risk factors identified for the project. Qualitative scoring of high, medium, or low impact were assigned to each phase of each scenario according to the potential for each identified risk factor to be impacted under that phasing scenario. The assessment of each scenario was consolidated into the evaluation matrix. The following high-level findings were derived from the evaluation of the identified risk factors:

- **All Scenarios:**
  - All scenarios resulted in a moderate amount of risk regarding environmental impacts, right-of-way impacts, transit impacts, and project API impacts due to the proximity of the existing and proposed structures to the existing gas station property located at the northeast corner of the Broadway/Williams intersection.
  - All scenarios would need to plan for accommodating public and private utilities.
  - Most notable risk is to the streetcar service through the Broadway/Weidler interchange, which is not fully resolved at the completion of this task for any construction-phasing scenario.
  - All scenarios made accommodations (with detours or temporary structures where feasible) to provide for all existing bicycle, pedestrian, motor vehicle and transit movements during construction. TriMet has indicated that they might consider temporarily rerouting bus routes in the area for the duration of construction in order to avoid a series of temporary route changes that would be confusing for riders. Complete closure of travel movements for all modes will be rare and for a limited duration (a few days at most).

- **Scenario C** had relatively low risk overall, and the bicycle, pedestrian, motor vehicle and transit impacts were short in duration. At this point, Scenario C is the preferred method of construction phasing.

- Scenarios A, C, and H, cost and schedule aside, show the most manageable risk factors.

- Scenarios B and D were ultimately proven to be unacceptable due to closure of Weidler and the subsequent traffic impacts.

- Scenarios A, F, G, and H have higher risk in the area of temporary features cost due to the significant quantity of detour structure work required. A trade-off between temporary features cost and accommodating traffic is at the core of this evaluation.
• Scenarios B and D had high impact to vehicular traffic due to the inability to meet volume demands during certain phases.

• Scenario E is fatally flawed due to a number of high risk factors. Scenario E is expected to have unacceptable impact due to the complete closures of key routes, especially I-5, and should not be considered moving forward.

3.3.4 Key Design and Constructability Issues Uncovered

There were a number of issues discovered during the evaluation of the Broadway/Weidler Lid construction phasing. The most notable are the disruptions created by the demolition and construction of the new Broadway/Weidler Lid, the restricted space at the existing gas station and I-5 northbound on-ramp, and the overall vertical grade differential between the west and east side of the lid. A detailed summary of each is shown below:

• Demolition of the existing Broadway, Weidler, and Williams structures drives the phasing of work and will have substantial impacts to all modes of traffic, especially streetcar. The configuration and interconnectedness of the existing freeway overcrossing structures presents a challenge for staging demolition. The Williams structure is a highly skewed, two-span box-beam structure with a fixed central pier and expansion joints at both abutments. This is the primary structure in this interchange. It is prudent to remove the bridge entirely, not in part, to avoid incurring significant temporary costs for shoring over the skewed freeway alignment. The high skew of the structure places a significant portion of Span 2 in the Broadway/Williams intersection. Span 2 of the Williams structure also supports the triangular slab span of the Broadway structure, which further impacts the intersection of these two streets. This complex interaction requires that both the entire Williams structure and the Slab Span of the Broadway structure be removed simultaneously, resulting in temporary closure of Broadway to westbound traffic and limiting or temporarily closing access to I-5 northbound via the on-ramp at Williams and Broadway.

• Limited right-of-way (ROW) near Broadway and Williams results in construction work in proximity to the gas station property on the northeast corner of the Williams/Broadway intersection. This property appears to have underground fuel storage tanks located in the southwest corner (see Figure 6). This proximity creates challenges during both demolition and construction. Excavation for the eastern abutment of the Broadway/Weidler Lid may infringe on the property and may require temporary shoring in order to avoid impacts to underground fuel tanks, the limits of which are currently unknown. Even with temporary shoring reducing the extents of the excavation, the work zone required for construction equipment above the excavation area may extend over the fuel tanks (see Figure 6).

• In addition, the extent of the work zone requires a short-term total closure of the Broadway/Williams intersection and short-term removal of access to the northbound I-5 entrance ramp. The exact duration of short-term impacts is still dependent on the design, but should be mitigated through accelerated construction techniques.
Figure 6. Extents of Demolition and Construction at Williams/Broadway

Plan View

Section View
There is an existing vertical grade differential between local streets on the east and west side of the freeway that will result in design challenges (see Figure 7). The primary design challenge is tying back down to the roads on each side of the freeway in a short distance, which could impact access to the surrounding properties to Broadway, Weidler, Vancouver, or Williams.

The difference in elevation causes an issue with connectivity between the local streets and properties across the Broadway/Weidler Lid. Grade differentials over a structure require long approaches in which to resolve the vertical difference, which increases costs associated with roadway construction, both temporary and permanent. Adjacent properties are also affected, as significant earthwork and/or thin structural solutions are anticipated to match grade. Based on early design concepts, an approximately 8-foot bridge depth was needed for full span of the freeway. However, this structure depth combined with freeway clearances beneath the structure required as much as 7 feet of grade differential compared to the existing grade in areas around the Weidler/Williams intersection. This grade differential became a key constructability challenge. The concept was further advanced to include a pier down the middle of the freeway, allowing shorter spans and shallower structure depths. Through additional design refinements, a structure depth of 6 feet was determined feasible, as shown in Figure 7.

Figure 7. Vertical Grade Differential at Weidler
4 North Lid Construction Phasing

The construction of the North Lid does not impact traffic and non-vehicular movement as significantly as the Broadway/Weidler Lid construction. Fewer impacts and conflicts will reduce the relative complexity, cost, and schedule of the construction phasing of the North Lid. The same goals, constraints, and evaluation criteria apply to the North Lid construction phasing, but the high-level assessment of the North Lid phasing resulted in acceptable performance in most areas regardless of the order in which the elements are constructed. One possible phasing scenario for the North Lid is described in Appendix A and is presented graphically in Appendix B. Future project development should address when and how North Lid construction should be incorporated into the overall project construction sequence.

5 Constructability Issues

The project team uncovered a number of constructability issues that will need to be addressed as the project design advances. Issues include construction access to work areas, conflicts with and maintenance of traffic through the site, contractor work and equipment staging areas, limited space to build bridges and walls, construction over the Union Pacific Railroad and Eastbank Esplanade, and other challenges. If seismic retrofits are included in the final project, additional challenges are likely and would be resolved through design and permitting. More detail on issues uncovered, in addition to those discussed above, is explained in Appendix G.

6 Traffic Analysis

6.1 Temporary Impacts to Freeway and Local Traffic

The temporary traffic impacts during construction involved the balancing of many different transportation user needs, each with its own set of critical constraints. The freeway widening is currently limited by the existing structures. While some minor widening (either permanent or temporary) may be feasible with the existing Vancouver structure in place, both the existing Broadway and Weidler structures would not allow for freeway widening prior to demolition. The remaining freeway work is relatively independent of the Broadway/Weidler Lid or local street work, with the exception of the southbound I-5 entrance ramp. This work will likely need to be completed in conjunction with the Moda Center and Veterans Memorial Coliseum access modifications on Vancouver and NE Wheeler Avenue, south of Weidler. The general construction sequencing of the freeway work is outlined below.

6.1.1 Component F1 – South

This phase involves the widening of southbound and northbound I-5 to the south of Weidler to the southern project limits. This widening may occur prior to the completion of
the Broadway/Weidler Lid. Note that the northbound exit ramp and southbound entrance ramp are not included in this phase.

6.1.2 Component F2 – North
This phase includes the widening of southbound and northbound I-5 north of Flint to the northern project limits. This widening is likely to occur prior to construction of the North Lid.

6.1.3 Component F3 – Central
This phase includes widening of southbound and northbound I-5 between Flint and Weidler. Also included are the modifications to the northbound entrance and north and southbound exit ramps and the replacement and relocation of the southbound entrance ramp. This work must occur after the existing freeway overcrossings have been removed, though does not need to wait for the final lid structures to be in place.

6.2 Travel Demand Overview
The purpose of the travel demand modelling exercise was to understand the impacts of construction on the large volume of traffic in the vicinity of the interchange. The City of Portland Regional Transportation Plan model\(^2\) was used to test construction-phasing concepts for the I-5 Broadway/Weidler Interchange project. The City’s model is used for all Central City projects. Since the study aims to explore the traffic implications of construction, especially traffic diversion impact on local streets, the study area included NE Tillamook Street to the north, NE Multnomah Street to the south, N Larrabee Avenue to the west and NE 3rd Avenue to the east.

The model was refined within the study area to represent the missing street connections in the immediate project area to account for all routes that could be used during construction. The corresponding refinements are provided in Appendix E. Once the model was refined for the project area, the trips were reassigned. Generally, the travel demand model assesses high-level demand movements on a macroscopic level and does not measure congestion at a traffic operations level (e.g., measuring queue length, hours of congestion, and turning movement delay). This analysis does not use traffic signal parameters such as signal phasing, signal timing and corridor progression. The traffic analysis for the EA will utilize Synchro/SimTraffic and VISSIM software that will provide detailed operations modeling to support refined design and determine mitigation needs.

6.3 Event Traffic
Access to the Moda Center and Veterans Memorial Coliseum events is a critical consideration during the construction phasing. With weekly events occurring throughout the year and limited event parking and access options, the ability to maintain timely event

\(^2\) Email from Ningsheng Zhou on Friday, August 12, 2016.
egress for people driving, walking, biking and taking transit is a major objective of this project. The ability to get to and from event parking also will need to be considered in the project phasing strategy. Currently, the Garden Garage has very limited egress options if the existing access to the I-5 southbound entrance ramp is impacted, and maintaining access to the facility will be one of the more difficult challenges.

Generally, most of the Moda Center and Veterans Memorial Coliseum access modifications can occur independently of and in parallel with other construction activities. During construction, traffic patterns on local streets south of Weidler will need to be modified from a series of one-way movements to alternative configurations of two-way and one-way traffic.

The two components in the vicinity of the Moda Center and Veterans Memorial Coliseum improvements that may be contingent on other project activities are the I-5 southbound entrance ramp and the Clackamas Overcrossing. While the Clackamas Overcrossing may not result in a physical impact on Moda Center garage access, the existing street network experiences heavy vehicular and truck traffic trying to access southbound I-5. As a result, utilizing N Ramsay Way, Vancouver, and Wheeler for an alternative bike and pedestrian facility may result in excessive modal conflicts and the need for temporary mitigation measures. Once the I-5 southbound access has been relocated to Weidler, traffic volumes near the Moda Center garage are anticipated to be greatly reduced during non-event conditions.

It is recommended that the City of Portland and the Moda Center prepare an update to the Rose Quarter Traffic Management Plan prior to beginning construction to ensure that a coordinated plan is in place, especially in relation to maintaining access for all modes and avoiding impacts to major events during short term closures.

6.4 Summary of Multi-Modal Impact Findings

Based on accommodating bicycle, pedestrian and motor vehicle access and throughput during construction, the team determined that Scenario C, which provides for a three-lane, one-way couplet, is the preferred staging approach. This staging maintains the majority of primary movements and minimizes construction impact to the system, indicated by low percentages of traffic from Broadway and Weidler diverting through the project area. Residential streets including Hancock, San Rafael, and Tillamook continue to have low relative volumes. Additionally, the operational impact to Moda Center event traffic and out-of-direction travel would be minimized as the connections to freeway and local streets are retained during construction. In addition, this three-lane, one-way couplet geometry minimizes disruption to bicycle, pedestrian, and transit circulation. Depending on how the project is staged and the types of temporary accommodations, it could preserve the existing function of these types of movement for the longest duration as compared to other staging approaches. Bicycle and bus diversions from the demolished Williams structure can be accommodated by minor modifications to N Victoria Avenue.

Other construction staging approaches showed higher amounts of traffic diversion than optimal and had greater impact to local residential neighborhoods, multimodal access, level of roadway geometry modification involved, and construction duration. The options
below were recommended to be dropped from further analysis in favor of the three-lane one-way couplet option. The reasoning behind removing these options from consideration is summarized below:

- A Full Closure of the Broadway/Weidler interchange area (i.e., “the box”) has the highest impact to transportation operation in the project area. Closing Broadway and Weidler simultaneously results in substantial percentage of traffic flow avoiding the project area. These diverted vehicles are pushed to bypass the box through residential streets. Due to the closure of primary surface streets, traffic between local collector roads and I-5 is restricted, which hurts accessibility to businesses.

- The two-lane both direction on the lid staging reduces roadway capacity, causing moderate traffic diversions from Broadway and Weidler to local residential streets. The vehicles staying on Broadway and Weidler have to travel out of direction to access the freeway. In addition, this option limits business accessibility due to lack of left turns to go north and south.

- The diverging diamond approach has no traffic diversions from Broadway and Weidler and operates with low delays at key intersections; however, it severely restricts left and right turning movements on Broadway and Weidler, thereby limiting traffic accessibility to local roads and businesses.

6.4.1 Local Street Summary

The three-lane, one-way couplet is anticipated to provide the best streetcar, bicycle, pedestrian and motor vehicle operation among all the staging approaches during construction. This option maximizes access to businesses, minimizes delay to the maximum extent possible, and avoids major ROW takes to provide temporary multi-modal traffic improvements. It should be noted that diverting regional traffic through Hancock is not acceptable due to safety concerns to the Eliot neighborhood. The three-lane one-way couplet staging approaches have no regional diversion onto Hancock, thereby minimizing necessary physical traffic diversions. Some traffic management planning will be important to develop and vet with the surrounding community in future phases of project development.

6.4.2 Freeway Summary

The study also analyzed full directional I-5 northbound and southbound closures stretching between the I-405 interchange and the I-84 split. The PM Peak Hour freeway evaluation showed a total of 3,500 vehicles diverting from I-5 to the following routes; including southbound and northbound to I-405 (southbound and northbound on I-405 encounters 1,000 more vehicles), I-84 (westbound and eastbound each encounter 500 more vehicles), NE Martin Luther King Boulevard and NE Grand Avenue (southbound and northbound each encounter 500 more vehicles), and Naito Parkway (northbound and southbound each encounter 200 more vehicles). Alternative routes would not be able to accommodate the diverted traffic during weekday day time. However, by only conducting full closures during weekends or nights, the system could function similarly to today and most impacts to motor vehicle operations could be avoided. Night time and weekend closures can be managed with traffic management and
operation strategies, including utilization of future and existing Active Traffic Management Systems. The environmental analysis will address construction impacts to all modes of travel and a full transportation management plan will be prepared in future phases of project development.

7 Conclusions & Recommendations

The following key conclusions were derived from this task:

- Construction of the Broadway/Weidler Interchange project will be extremely complicated and preparation of a detailed construction phasing plan, including clear mitigation plans, should be completed early in the design.
- There are feasible and even reasonable construction scenarios, but significant expenses are anticipated to be required for temporary structures and providing accommodations for bicycle, pedestrian, streetcar and motor vehicle movements.
- All transportation modes (pedestrian, bicycle, motor vehicles, streetcar, buses) and utilities operating in the project area will experience disruption during construction and will require a sequence of temporary accommodations.
- Further design refinement is needed to better quantify the project limits, phasing, sequencing, and subsequent impacts.
- Further investigation is needed on what level of seismic retrofit may be needed for some existing structures.
- Early determination of ROW impacts and securing key properties is essential for developing feasible construction staging scenarios. Further development of surrounding properties will exacerbate construction conflicts, cost, and schedule.
- Noise impacts do not appear significant at this time, but should be reevaluated with further project development as part of the environmental study.

The following key recommendations should be considered moving forward:

- Advance the Broadway/Weidler Lid Construction Scenario C and H in more detail until a preferred construction scenario is determined.
- Investigate Accelerated Bridge Construction methods to reduce overall duration of lid construction.
- Refine the design and scope of the project and when the project is refined, build a more detailed construction schedule. Continue to coordinate with the project stakeholders to understand the changing needs of the local residents and businesses as development occurs around the project.
- Refine the design of the lid structures to further detail out the impacts.
- Determine the desired criteria for seismic resiliency.
- Begin the environmental phase to refine the impacts to the built and natural environment.
• ODOT to coordinate with the Moda Center and Veterans Memorial Coliseum to share information on the exact hours that closures could occur, the durations of the closures, and the timing of regional events and other construction projects that could impact this construction.
Appendix A. Phasing Scenario Details
## Construction Phasing Scenario Summary

<table>
<thead>
<tr>
<th>CONSTRUCTION SCENARIO</th>
<th>SCENARIO DESCRIPTION</th>
<th>PHASE ID.</th>
<th>PHASE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Widen Weidler, Keep the Couplet</td>
<td>1</td>
<td>Construct temporary widening structure south of Weidler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Bi-directional traffic on Weidler, demo Williams, construct Broadway &quot;patch&quot;.</td>
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<tr>
<td></td>
<td></td>
<td>3</td>
<td>Restore Broadway/Weidler couple, construct central 1/3 of LID.</td>
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<td></td>
<td></td>
<td>4</td>
<td>Divert Broadway onto LID, demo Broadway.</td>
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<td></td>
<td></td>
<td>5</td>
<td>Construct northern 1/3 of LID.</td>
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<td></td>
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<td>6</td>
<td>Reopen Broadway, divert Weidler onto LID, demo Weidler.</td>
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<tr>
<td></td>
<td></td>
<td>7</td>
<td>Construct southern 1/3 of LID.</td>
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<td></td>
<td></td>
<td>8</td>
<td>Construct North LID and Clackamas.</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Close Weidler and Williams</td>
<td>1</td>
<td>Demo Williams, construct Broadway &quot;patch&quot;.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Bi-directional traffic on Broadway, demo Weidler.</td>
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<td></td>
<td></td>
<td>3</td>
<td>Construct south 2/3 of LID.</td>
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<td></td>
<td></td>
<td>4</td>
<td>All traffic on LID, demo Broadway.</td>
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<tr>
<td></td>
<td></td>
<td>5</td>
<td>Construct north 1/3 of LID.</td>
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<tr>
<td></td>
<td></td>
<td>6</td>
<td>Construct North LID and Clackamas.</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Remove Williams, Keep the Couplet</td>
<td>1</td>
<td>Demo Williams, construct Broadway &quot;patch&quot;.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct central 1/3 of LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Divert Weidler onto LID, demo Weidler.</td>
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<td></td>
<td></td>
<td>4</td>
<td>Construct south 1/3 of LID.</td>
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<tr>
<td></td>
<td></td>
<td>5</td>
<td>Shift Weidler and Broadway traffic, demo Broadway.</td>
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<td></td>
<td></td>
<td>6</td>
<td>Construct north 1/3 of LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Build North LID and Clackamas.</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>Close Weidler, not Williams</td>
<td>1</td>
<td>Bi-directional traffic on Broadway, demo Weidler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct south 1/3 of LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Divert traffic to LID, demo Williams and Broadway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Construct remaining LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Construct North LID and Clackamas.</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>Close Everything</td>
<td>1</td>
<td>Demo Broadway, Williams, and Weidler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct new LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Construct North LID and Clackamas.</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>New Couplet (Belly Out)</td>
<td>1</td>
<td>Construct North LID and Clackamas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct temporary shoulder, north of Broadway and south of Weidler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Divert traffic to shoulder, demo existing Broadway, Williams, and Weidler structures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Construct central 1/3 of LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Divert traffic onto LID, demo shoulder.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Construct remaining LID.</td>
</tr>
<tr>
<td><strong>G</strong></td>
<td>Diverging Diamond</td>
<td>1</td>
<td>Construct temporary structure south of Weidler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Divert Broadway to temporary structure, demo Broadway and Williams.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Construct northern 1/3 of LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Divert traffic onto LID, demo Weidler and temporary structure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Construct remaining LID.</td>
</tr>
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</tr>
<tr>
<td><strong>H</strong></td>
<td>Weidler Shoofly</td>
<td>1</td>
<td>Construct temporary structure south of Weidler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Divert Broadway to Weidler, demo Williams.</td>
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<td></td>
<td></td>
<td>3</td>
<td>Construct central 1/3 of LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Divert Broadway traffic onto LID, demo Broadway.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Construct northern 1/3 of LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Demo Weidler (leave temporary structure).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Construct LID between central 1/3 and temporary structure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>Divert Weidler onto LID, demo temporary structure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>Construct remaining LID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>Construct North LID and Clackamas.</td>
</tr>
</tbody>
</table>
Phasing Scenario C Details

The following presents the concept phasing for Scenario C. This scenario is part of a larger construction sequence that assumes that the Broadway/Weidler Lid structure and surrounding roadway connections will be constructed prior to and independently from the North Lid and Clackamas Overcrossing structures. While the work required to widen the existing freeway under the Broadway/Weidler Lid is not feasible prior to removing the existing structures, other areas of the freeway and local street improvements could be completed mostly independent of and in parallel to the work on the Broadway/Weidler Lid. The general phasing of this scenario, which is explained in further detail below, begins with construction of the central portion of the lid between NE Broadway Street and NE Weidler Street and continues outward.

Phase 1 – Demolish Williams Structure

Demolition of the Williams structure, which carries northbound traffic on N Williams Avenue over I-5, occurs first. The Williams structure is a highly skewed, two-span box-beam structure with a fixed central pier and expansion joints at both abutments. This configuration requires that the structure be removed in its entirety to avoid incurring significant expenses for temporary shoring over the freeway. The high skew of the structure places a significant portion of Span 2 in the Broadway/Williams intersection. Span 2 of the Williams structure also supports the triangular Slab Span of the Broadway structure, which further impacts the intersection of the two streets.

This complex interaction requires that both the entire Williams structure and the Slab Span of the Broadway structure be removed simultaneously, resulting in temporary closure of Broadway to westbound motor vehicle traffic (limiting or removing freeway access to northbound I-5 and likely detours for people riding bicycles and pedestrians). If the streetcar is to be accommodated on the temporary structures, there would be a limited duration closure and bus bridge required during this period. A temporary structure will be constructed to facilitate continued use of Broadway during this closure. There are two primary options for accommodating this closure.

Option 1 – Accelerated Bridge Construction

Accelerated Bridge Construction (ABC) techniques will be implemented to limit the duration of street closure. Westbound Broadway and northbound freeway access will be completely closed while the existing structure is demolished and the temporary structure is constructed using ABC. The closure would last approximately 2 weeks and would require night and weekend freeway lane reductions to facilitate ABC. Alternatively, the northbound freeway entrance ramp could potentially remain open if detoured around the existing structure through the existing gas station property.

Option 2 – North Lid Detour

The North Lid will be used as a detour route during construction of the Broadway/Weidler Lid. This option would reduce overall traffic impact during all phases, but would require receipt of maximum funding to accommodate the entire project, as the North Lid would
need to be constructed first. See “North Lid Phasing Details” below for a description of the North Lid construction.

Demolition of the existing retaining walls and slopes adjacent to the freeway within the footprint of the new Broadway/Weidler Lid structure is included in this phase. Installation of temporary retaining walls will be required as part of the demolition effort.

Phase 2 – Construct Central Portion of Lid

Westbound traffic will resume on Broadway, including northbound freeway access, utilizing the temporary structure from the previous phase. Eastbound traffic will continue on Weidler. Northbound traffic on Williams will use Weidler to detour around the Broadway/Weidler couplet. The North Lid could continue to be used to mitigate traffic impacts during this and all subsequent phases. The use of N Hancock Street as a temporary diversion would have to take into account increased volume and potential impacts through neighborhood streets. Construction of the central portion of the Broadway/Weidler Lid between Weidler and Broadway will follow.

Phase 3 – Demolish Weidler Structure

The central portion of the Broadway/Weidler Lid can begin to be utilized for traffic. Significant roadway connection work will be required due to a vertical differential of 5 to 7 feet between the existing and proposed grades. Eastbound traffic on Weidler will use the central lid to act as a shoofly to route eastbound traffic around the southern portion of the lid and back onto Weidler. Depending on the streetcar accommodation selected, this could include temporary streetcar or bus bridge operations.

The Weidler structure will be demolished after traffic has been diverted and temporary retaining walls are installed. Northbound traffic along Williams will likely be closed or rerouted between NE Wheeler Avenue and Weidler due to the proximity of the demolition work to the Williams/Weidler intersection.

Phase 4 – Construct Southern Portion of Lid

Construction of the southern portion of the Broadway/Weidler Lid will begin once the existing structure and surrounding roadways within the footprint of the new structure have been demolished. This includes the actual lid structure from Weidler south, modifications to the I-5 northbound exit ramp, and construction of the new southbound entrance ramp. New retaining wall construction will be required as a part of this work. The existing I-5 southbound entrance ramp will be demolished once the new ramp construction has been completed. Traffic circulation will continue as for Phase 3.

Phase 5 – Demolish Broadway Structure

Broadway will be closed and westbound traffic diverted across the Broadway/Weidler Lid. Northbound traffic on Williams between Wheeler and Weidler will resume and be diverted across the new lid structure using Weidler. The Broadway structure will be
demolished and will result in another closure of the northbound I-5 entrance ramp. There are again two primary options for accommodating this closure.

Option 1 – Temporary I-5 Ramp Access

Right-of-way acquisition in the northeast lot at the intersection of Williams and Broadway, which is currently a gas station, will be required. Limited northbound freeway access will continue by routing ramp traffic through the corner of the gas station lot, which also appears to be the location of the existing underground fuel tanks.

Option 2 – Accelerated Bridge Construction

As for Phase 1, ABC techniques will be utilized for the final demolition and construction of the Broadway/Weidler Lid. Freeway lane reductions will be required, and the closure of the I-5 northbound entrance ramp will last approximately 2-3 weeks, but may be able to avoid or minimize physical impacts to the gas station property. This option may require additional operational considerations.

Depending on the streetcar accommodation selected, this could include temporary streetcar or bus bridge operations.

Phase 6 – Complete Lid Construction

The lid structure from Broadway north will be constructed. This will complete the Broadway/Weidler Lid structure construction. Additional roadway and traffic work will also be required. The traffic will continue as for the previous Phase 5 during construction.
Phasing Scenario H Details

The following presents the concept phasing for Scenario H. This scenario is part of a larger construction sequence that assumes that the Broadway/Weidler Lid structure and surrounding roadway connections will be constructed prior to and independently from the North Lid and Clackamas Overcrossing structures. While the work required to widen the existing freeway under the Broadway/Weidler Lid is not feasible prior to removing the existing structures, other areas of the freeway and local street improvements could be completed mostly independent of and in parallel to the work on the Broadway/Weidler Lid. The general phasing of this scenario, which is explained in further detail below, utilizes a temporary detour structure to accommodate east-west traffic while the lid is constructed, beginning with the central portion between Broadway and Weidler.

Phase 1 – Construct Detour Structure

Construction of a detour structure located to the south of Weidler occurs first. The purpose of this structure will be to accommodate bi-directional traffic on Weidler during phases that require closure of Broadway to westbound traffic. This structure will be independent from the existing Weidler structure to provide clearance for future demolition and construction. The structure will ideally be wide enough to carry three traffic lanes and one multi-use lane for bikes and pedestrians. Depending on the streetcar accommodation selected, this could include temporary streetcar or bus bridge operations.

Phase 2 – Demolish Williams Structure

The Williams structure, which carries northbound traffic on Williams over I-5, will be demolished. This structure is a highly skewed, two-span box-beam structure with a fixed central pier and expansion joints at both abutments. This configuration requires that the structure be removed in its entirety to avoid incurring significant expenses for temporary shoring over the freeway. The high skew of the structure places a significant portion of Span 2 in the Broadway/Williams intersection. Span 2 of the Williams structure also supports the triangular Slab Span of the Broadway structure, which further impacts the intersection of the two streets.

This complex interaction requires that both the entire Williams structure and the Slab Span of the Broadway structure be removed simultaneously, resulting in temporary closure of Broadway to westbound traffic and limiting or removing freeway access to northbound I-5. During this closure, a temporary structure would be constructed to facilitate continued use of Broadway. Right-of-way will be acquired in the northeast lot at the intersection of Williams and Broadway, which is currently a gas station. Limited northbound freeway access will continue by routing ramp traffic through the corner of the gas station lot, which also appears to be the location of the existing underground fuel tanks.
Demolition of the existing retaining walls and slopes adjacent to the freeway within the footprint of the new Broadway/Weidler Lid structure is included in this phase. Installation of temporary retaining walls will be required as part of the demolition effort.

Phase 3 – Construct Central Portion of Lid

Westbound traffic will resume on Broadway, including northbound freeway access, utilizing the temporary structure from the previous phase. Eastbound traffic will continue on a combination of Weidler and the temporary detour structure. Northbound traffic on Williams will utilize Weidler to detour around the Broadway/Weidler couplet. Once traffic circulation is re-established, construction of the central portion of the Broadway/Weidler Lid between Weidler and Broadway will begin. Depending on the streetcar accommodation selected, this could include temporary streetcar or bus bridge operations.

Phase 4 – Demolish Broadway Structure

The central portion of the Broadway/Weidler Lid can begin to be utilized for traffic. Significant roadway connection work will be required due to a vertical differential of 5 to 7 feet between the existing and proposed grades. Westbound traffic on Broadway will be shifted onto the new lid profile in this manner. The Broadway structure can be demolished and temporary retaining walls installed once traffic has been diverted. Depending on the streetcar accommodation selected, this could include temporary streetcar or bus bridge operations.

Phase 5 – Construct Northern Portion of Lid

Construction of the northern portion of the Broadway/Weidler Lid will begin once the existing structure and surrounding roadways within the footprint of the new structure have been demolished. This includes the actual lid structure from Broadway north and modifications to the I-5 northbound entrance ramp access. New retaining wall construction will be required as a part of this work. Traffic circulation will continue as for Phase 4.

Phase 6 – Demolish Weidler Structure

Westbound traffic on Broadway will adopt its final configuration across the lid once the northern portion of the Broadway/Weidler Lid has been constructed. Permanent northbound I-5 access will be opened and any temporary access utilizing the gas station will be removed. Eastbound traffic will continue and/or be entirely shifted onto the detour structure from Weidler to allow demolition of the existing Weidler structure. Depending on the streetcar accommodation selected, this could include temporary streetcar or bus bridge operations.
Phase 7 – Construct “Weidler Lid”

The lid structure will be constructed between the central portion (constructed in Phase 3) and the temporary detour structure. Traffic circulation will continue as for the previous phase.

Phase 8 – Demolish Detour Structure

The “Weidler Lid” will now accommodate eastbound traffic on Weidler. The temporary detour structure will be demolished once traffic has been shifted to the new lid.

Phase 9 – Construct Remaining Lid

The lid structure from Weidler south will be constructed. This will complete the Broadway/Weidler Lid structure construction. Additional roadway and traffic work will also be required. The traffic will continue as for the previous phase during construction.
North Lid Phasing Details

The following presents potential concept phasing for construction of the North Lid. It is assumed that the Broadway/Weidler Lid structure and surrounding roadway connections will be constructed prior to and independently from the North Lid and Clackamas Overcrossing structures. The general phasing of the North Lid, which is explained in further detail below, utilizes Flint as the primary temporary detour for north-south traffic movements while the lid is constructed.

Phase 1 – Demolish Vancouver Structure

The N Vancouver Avenue structure, which carries southbound traffic on Vancouver over I-5, will be demolished. Bi-directional traffic will be carried on the existing N Flint Avenue structure. Demolition of the existing retaining walls and slopes adjacent to the freeway within the footprint of the new North Lid structure is included in this phase. Installation of temporary retaining walls will be required as part of the demolition effort.

Phase 2 – Construct Majority of Lid

The North Lid east of Flint will be constructed, which constitutes a majority of the new lid structure. The roadway connections of the North Lid to N Hancock Street and Vancouver will be constructed. The southbound I-5 exit ramp widening will take place. Traffic will continue as for the previous phase.

Phase 3 – Demolish Flint Structure

Demolition of the Flint structure, portions of Flint, and the existing right-turn lane of the southbound I-5 exit ramp will occur once the eastern portion of the North Lid has been constructed. Bi-directional traffic will be diverted from Flint onto Vancouver across the new lid structure.

Phase 4 – Construct Remaining Lid

The remainder of the North Lid adjacent to the previous Flint structure will be constructed. The roadway connections of the North Lid to Dixon will be constructed. Additional roadway and traffic work will also be required. Traffic will continue as for the previous phase.
Appendix B. Phasing Graphics
Scenario C
Phase 3-4

Demolition
Construct Temporary Structure
Temporary Structure (Constructed in Previous Phase)
Construct Sidewalk
Sidewalk (Constructed in Previous Phase)
Temporary Retaining Wall
Retaining Wall
Scenario C
Phase 5-6
Appendix C. Phasing Evaluation Matrix
<table>
<thead>
<tr>
<th>CONSTRUCTION SCENARIO</th>
<th>PHASE ID</th>
<th>PHASE DESCRIPTION</th>
<th>OPTIONS</th>
<th>PHASING</th>
<th>ACOMODATION OF KEY MOVEMENTS</th>
<th>RISK FACTORS (IMPACTS &amp; ISSUES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>Veh. Traffic</td>
<td>Ped/Bikes</td>
<td>Transit</td>
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<tr>
<td>A</td>
<td>1</td>
<td>Close south lane and shoulder on Weidler to provide work zone to widen with temporary structure.</td>
<td>Option A: Only close lane and shoulder at night.</td>
<td>Y Y Y Y Y Y Y Y Y Y Y</td>
<td>L M L L L L L L L L L L H L</td>
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<td></td>
<td>2</td>
<td>Shift Weidler traffic (EB) to temporary structure and divert Broadway traffic (WB) to Weidler. (Maintain 2 lanes each way and bike lane access). Demo Williams structure and slab span of Broadway structure. Construct temporary structure to maintain traffic on Broadway.</td>
<td>Option B: Use existing lane for bldg access accommodations (maintain 2 traffic lanes on Weidler).</td>
<td>Y Y Y Y Y Y Y Y Y Y Y</td>
<td>L M L L L L L L L L L L H L</td>
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<td></td>
<td>3</td>
<td>Reopen Broadway to WB traffic. Construct central 1/3 of new Ld.</td>
<td>Option B: Maintain only 1 sidewalk with diversion for bldg to North Ld or Clackamas.</td>
<td>Y Y R Y Y Y R Y R Y Y</td>
<td>H M L L L M M M L M M M</td>
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<td>4</td>
<td>Divert Broadway traffic onto new Ld profile. Demo Broadway and temporary structure.</td>
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<td></td>
<td>5</td>
<td>Construct northern 1/3 of Ld.</td>
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<td></td>
<td>6</td>
<td>Reopen Broadway to WB traffic and divert Weidler traffic (EB) onto new Ld profile. Demo existing and temporary Weidler structures.</td>
<td>Option A: Divert bikeway slips from Broadway via Vancouver.</td>
<td>Y R R Y Y R Y R Y R Y</td>
<td>M L M M M M M M L M M M</td>
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<td></td>
<td>7</td>
<td>Demo Williams structure and slab span of Broadway structure. Construct temporary structure to maintain traffic on Broadway.</td>
<td>Option A: Temporary closure of WB will and NB freeway access.</td>
<td>Y R Y Y Y Y Y Y Y</td>
<td>M L H M M M M M M H M H</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Construct North Ld and Clackamas.</td>
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</tr>
</tbody>
</table>

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**Temporary structure widening on south side of Weidler:**
- OCTO's staging plan
- Temporary structure for Weidler
- Use partial new construction as detour structure

**Run bi-directional traffic on Broadway:**
- 2 LR staging plan
- Joining Weidler and divert to Broadway
- Use partial new construction as detour structure

---

**CONSTRUCTION PHASING SCENARIOS – I-5 ROSE QUARTER: BROADWAY/WEIDLER LID**

Updated 1/25/2016
<table>
<thead>
<tr>
<th>SCENARIO ID.</th>
<th>SCENARIO DESCRIPTION</th>
<th>PHASE ID.</th>
<th>PHASE DESCRIPTION</th>
<th>OPTIONS</th>
</tr>
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<tbody>
<tr>
<td>C</td>
<td>Demo Williams</td>
<td>1</td>
<td>Demo Williams structure and abutment of Broadway bridge. Construct temporary structure to maintain traffic on Broadway.</td>
<td>Option A: Temporary closure of W8 traffic and NB freeway access. N Y R Y Y R Y R Y R M L H M M M M L H M H L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct central 1/3 of Lid.</td>
<td>Option B: Construct North Lid first and use as primary detour route. R Y R R R Y R R R Y H M M M L H M H L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Shift traffic from Weider to new Lid. Demo Weider structure.</td>
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<tr>
<td></td>
<td></td>
<td>4</td>
<td>Construct south 1/3 of Lid.</td>
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<tr>
<td></td>
<td></td>
<td>5</td>
<td>Shift Weider and Broadway traffic, Demo Broadway structure.</td>
<td>Option A: Divert NB ramp traffic over gas station tank. Y Y R Y Y R Y R Y R Y M L M M M M L H M M M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Construct north 1/3 of Lid.</td>
<td>Option B: Rapid bridge construction with x week closure of NB on ramp. Y Y R Y Y R Y R Y R Y M L M M M M L H M M M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Build North Lid and Centralkams.</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Directional Closure of Broadway/Weider</td>
<td>1</td>
<td>Divert Weider traffic to Broadway, Demo Weider.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct south 1/3 of Lid.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Divert Broadway traffic to new Weider Lid. Demo Williams and Broadway structures.</td>
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<td>4</td>
<td>Construct remaining Lid.</td>
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<td></td>
<td></td>
<td>5</td>
<td>Construct North Lid and Centralkams.</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Simultaneous Closures</td>
<td>1</td>
<td>Close Broadway, Williams, and Weider to traffic.</td>
<td>Option A: Accept temporary closure to traffic with shorter construction duration. N N N R R R N R R R R H L M H M M M M L H M H M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct new Lid and connecting roadways.</td>
<td>Option B: Construct North Lid first and use as primary detour route. R N N R R R N R R R R H L M H M M M M L H M H M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Construct North Lid and Centralkams.</td>
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<tr>
<td>F</td>
<td>Double Stayout</td>
<td>1</td>
<td>Construct temporary stayout structure north of Broadway and south of Weider.</td>
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<tr>
<td></td>
<td></td>
<td>2</td>
<td>Construct temporary stayout structure north of Broadway and south of Weider.</td>
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<tr>
<td></td>
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<td>3</td>
<td>Divert traffic on Broadway and Weider to stayout structures. Demo existing Broadway, Williams, and Weider structures.</td>
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<td>4</td>
<td>Construct central 1/3 of Lid.</td>
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<td></td>
<td>5</td>
<td>Divert traffic onto new Lid. Demo stayout structures.</td>
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<td></td>
<td></td>
<td>6</td>
<td>Construct remaining Lid.</td>
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<tr>
<td>G</td>
<td>Diverging Diamond</td>
<td>1</td>
<td>Construct temporary structure south of Weider.</td>
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<td></td>
<td></td>
<td>2</td>
<td>Divert traffic on Broadway to temporary structure. Demo Broadway and Williams structures.</td>
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<td>3</td>
<td>Construct northern 1/3 of Lid.</td>
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<td>4</td>
<td>Divert traffic onto new Lid. Demo Weider and temporary structure.</td>
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<td>5</td>
<td>Construct remaining Lid.</td>
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<td>6</td>
<td>Construct North Lid and Centralkams.</td>
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</tbody>
</table>
# CONSTRUCTION PHASING SCENARIOS -- I-5 ROSE QUARTER: BROADWAY/WEIDLER LID

**Scenario ID:**

1. Construct temporary structure south of Weidler.
2. Divert Weidler traffic to temporary structure. Divert Broadway traffic to existing Weidler structure. Demo Williams structure and slab span of Broadway.
3. Construct central 1/2 of Lt. Demo existing Broadway structure.
4. Divert Broadway traffic onto new Lt. Demo existing Weidler structure.
5. Construct northern 1/2 of Lt.
6. Shift Broadway traffic to final configuration on Lt. Demo existing Weidler structure.
7. Construct new Lt between central 1/3 and temporary Weidler structure.
8. Divert Weidler traffic to new Lt. Demo temporary Weidler structure.
9. Construct remaining Lt.
10. Construct North Lt and Clackamas.

## PHASING

<table>
<thead>
<tr>
<th>CONSTRUCTION SCENARIO</th>
<th>PHASE ID</th>
<th>PHASE DESCRIPTION</th>
<th>OPTIONS</th>
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<td>1</td>
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<td>Y Y Y Y Y Y Y Y Y Y Y Y H H</td>
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<td></td>
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<td>Y R R R Y Y Y R R R R Y L M L M L M L M L M L M L M</td>
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<td></td>
<td>Y R Y Y Y R R R R Y L L L M M M L H M L L</td>
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<td>4</td>
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<td>Y R Y Y Y R R R Y Y L L L M M M L H M L L</td>
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<td>5</td>
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<td></td>
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<td>Y R Y Y Y R Y Y Y Y Y L M L L L L L H M L L</td>
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<td>Y R Y Y Y R Y Y Y Y Y L M L L L L L H M L L</td>
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## ACCOMMODATION OF KEY MOVEMENTS

- Veh. Traffic
- Ped/Bike
- Transit
- Freeway
- Other

## RISK FACTORS (IMPACTS & ISSUES)

- Overall Schedule
- Overall Budget Impacts
- Environmental
- Social Impacts
- Noise and Vibration
- Utility Interactions
- Site Access

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Updated: 10/28/2016
Appendix D. Concept Construction Schedule
## I-5 Rose Quarter Widening Project

### Concept Construction Schedule

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Predecessors</th>
<th>Successors</th>
<th>Resources</th>
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<tbody>
<tr>
<td>1</td>
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<td>7/1/22</td>
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<td>7/29/22</td>
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<td>10/22/22</td>
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<td>11/20/22</td>
<td>3/20/23</td>
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<td>-</td>
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<td>4/27/24</td>
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<td>1-5 NB Widening over UPRR Widening</td>
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<td>1/13/25</td>
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<td>Construct Southern 1/3 Lid</td>
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<tr>
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<td>Medalist/Old Town/University</td>
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<tr>
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<td>-</td>
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<td>7/1/25</td>
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<td>1-5 NB Entrance Ramp from Broadway Relocation</td>
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<td>31,32</td>
<td>-</td>
<td>1-5 SB to I-5 EB Ramp Column Relocation</td>
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</table>

Note: The construction schedule assumes a construction start in early 2023, contingent on final design and construction funding. This start date assumption could be adjusted based on funding availability, contracting phasing opportunities, and other factors, but the approximate construction sequencing and durations should be valid under a variety of start dates. Further adjustment is anticipated as design progresses.
<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Duration</th>
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<th>Predecessors</th>
<th>Successors</th>
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<td>52</td>
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<td>63</td>
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<td>7/23/25</td>
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<td>64</td>
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<td>6/23/25</td>
<td>7/23/25</td>
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</table>

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<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
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<tbody>
<tr>
<td>65</td>
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<td>Mon 2/16/26</td>
<td>Fri 7/31/26</td>
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<tr>
<td>66</td>
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<td>Mobilize</td>
<td>Site Prep</td>
<td>10 days</td>
</tr>
<tr>
<td>67</td>
<td>Construct Wall C1</td>
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<tr>
<td>68</td>
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<tr>
<td>69</td>
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<td>Fri 6/12/26</td>
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<td>Fri 7/31/26</td>
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<tr>
<td>71</td>
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<td>Mon 8/3/26</td>
<td>Fri 8/14/26</td>
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<tr>
<td>72</td>
<td>Traffic Control</td>
<td>Mobilize</td>
<td>Site Prep</td>
<td>10 days</td>
</tr>
<tr>
<td>73</td>
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<td>Fri 4/23/27</td>
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<td>Mon 4/26/27</td>
<td>Fri 5/14/27</td>
</tr>
<tr>
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<td>Mon 5/17/27</td>
<td>Fri 6/4/27</td>
</tr>
<tr>
<td>76</td>
<td>Demol/Cleanup</td>
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<td>Mon 5/17/27</td>
<td>Fri 6/4/27</td>
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<tr>
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<td>0 days</td>
<td>Fri 6/4/27</td>
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</tr>
</tbody>
</table>

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Appendix E. Traffic Analysis Memo
Memo

Date: Tuesday, January 03, 2017

Project: I-5 Broadway/Weidler Interchange Project

To: Megan Channell, ODOT
   Michael Mason, ODOT

From: Andrew Johnson, HDR
      Ron Higbee, AECOM
      Chengxin Dai, HDR

Subject: I-5 Broadway Weidler: Construction Staging Traffic Operation Analysis

1 Introduction

This memorandum provides documentation for the traffic work performed to support the proposed construction evaluation options for the I-5 Broadway Weidler Project. It outlines the high-level traffic analysis conducted to refine the construction phasing options, which attempts to address where and how much traffic will divert. More detailed options analysis will be conducted at a later stage in the project.

2 Construction Phasing Scenarios and Options

As a part of the construction phasing assessment, scenarios were developed to assess potentially feasible phasing options. Eight construction scenarios were evaluated in the construction phasing analysis and are listed in Table 1.

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<thead>
<tr>
<th>ID.</th>
<th>Scenario Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Widen Weidler, keep couplet, close Williams</td>
</tr>
<tr>
<td>B</td>
<td>Close Weidler and Williams</td>
</tr>
<tr>
<td>C</td>
<td>Close Williams, keep couplet</td>
</tr>
<tr>
<td>D</td>
<td>Close Weidler, not Williams</td>
</tr>
<tr>
<td>E</td>
<td>Close everything</td>
</tr>
<tr>
<td>F</td>
<td>Belly-out* East-West</td>
</tr>
<tr>
<td>G</td>
<td>Diverging Diamond</td>
</tr>
<tr>
<td>H</td>
<td>Weidler Shoofly</td>
</tr>
</tbody>
</table>

* Belly Out is a term used for temporarily widening the East-West roads to the outside to allow for construction on the inside as a means of attempting to consistently maintain movements in the East-West directions. The result looks like each direction has “a belly” to the outside, thus the name.
These construction phasing scenarios are associated with different traffic phasing options. Each one of these scenarios has different traffic impacts, although some are very similar. For example, scenarios A through F generally share four potential methods to maintain traffic operation, and similar types of vehicle movements are maintained across these options. These options are qualitatively assessed in this memorandum for the purpose of fatal flaw concept evaluation and alternative refinement. The seven options (see Attachment A) are as follows:

- Option 1A and 1B: Box Closure
- Option 2A and 2B: Two Lanes Both Directions on the Broadway/Weidler Street Lid
- Option 3A and 3B: Three Lanes on Broadway/Weidler Street
- Option 4: Diverge Diamond Interchange

### 3 Travel Demand Model

The City of Portland Regional Transportation Plan (RTP) model\(^1\) was used to test construction phasing concepts for the I-5 Broadway/Weidler Interchange Project. The city’s model is the Central City Plan 2013 PM peak model used for all central city projects. PTV VISUM software version 14.00-16 was utilized for the analysis.

Since the study aims to explore traffic diversion impact on local streets during construction staging, the study area boundary included N/NE Tillamook Street to the north, N/NE Multnomah Street to the south, N Larrabee Avenue to the west and NE 3rd Avenue to the east (see Figure 1). This diversion study uses the entire city model to investigate overall vehicle impact within the central city and is not cropped for the study area. The model within the study area (see Figure 2) was refined to represent the missing street connections in the immediate project area (see Attachment B - corresponding changes for refinement are provided in also provided in that attachment). Once the model was refined for the project area, the trips were reassigned.

The regional travel demand model uses demographic and travel behavior survey data to assign motor vehicle travel to roadways throughout the region. Regional models have a limited ability to account for congestion at individual intersections and accurately report on queue length, hours of congestion, and turning movement delay at an intersection level.

The initial analyses conducted assumed no turning restrictions in the City of Portland demand model at the intersections of Martin Luther King (MLK) Boulevard and San Rafael Street and MLK Boulevard and Hancock Street. The City model allowed for eastbound to northbound left turns and northbound to westbound left turns. These turning codes were corrected in the final recommended construction scenario analysis to be consistent with current conditions. The existing, proposed, two-lane two-way, and three-lane couplet are updated with correct turning movements to provide more accurate results.

\(^1\) Email from Ningsheng Zhou on Friday, August 12, 2016.
4 Diversion Analysis of Construction Options

Each option was evaluated using the travel demand model previously described. Any assumptions used in the options analysis are described in Attachment C. All analyses were completed on the PM peak hour, no AM or event traffic. The Moda Center assessment was conducted by applying engineering judgment to consider potential scenario fatal flaws. It is assumed these scenarios will be further evaluated in the environmental assessment stage of the project.

4.1 No-Build

Model runs were completed without restrictions on Hancock Street between east of Victoria Avenue and west of MLK Boulevard. The run results show low volumes on Hancock Street and
San Rafael Street, indicating traffic diverters are optional, as there is no or little regional cut-through traffic on the neighborhood streets.

**Figure 2. No-Build Network Model**

No extreme congestion in the No-Build. Construction Options 1-4 have extreme congestion (v/c over 1.2) partially resulting from low capacity assumptions created to reflect the disruption or confusion during construction in the project area.

Congestion levels:
- v/c 0.85-1 for congested (blue)
- v/c >1 for extremely congested (red)
4.1 Option 1: Box Closure

4.1.1 Option 1A – Box Closure Without Hancock Overcrossing

The Option 1A scenario changes include closing Broadway between Vancouver Avenue and Williams Avenue, Weidler Street between Williams Avenue and Victoria Avenue, and Williams Avenue between Broadway and Weidler Street. The model results indicate that with full closure of Broadway and Weidler in the “Box” area, 60 to 70 percent of original Broadway and Weidler Street traffic would divert to other areas. The diverted traffic was shown to spread throughout a wide area and is not overly concentrated within the study area. Study area traffic would divert to low volume, residential streets such as Tillamook Street, and San Rafael Street where volumes are forecast to double. Traffic on the Flint Avenue between NE Russell and NE Broadway are also forecast to double. A summary of the analysis results is provided in Figure 3.
Figure 3. Option 1A Box Closure without Hancock Street Crossing Option

Option 1A: Box Closure without Hancock Crossing

Affect on Moda Center?
Maximum alternate routing

Where are People Diverting?
San Rafael St, Vancouver Ave, and Multnomah St, Interstate St

How Many Vehicles are Avoiding the Box During the PM Peak Hour?
60% (1,000 vehicles) on Broadway St rerouted, 70% (1,000 vehicles) on Weidler St rerouted

Congestion levels:
v/c 0.85-1 for congested (blue), v/c >1 for extremely congested (red).
4.1.2 Option 1B – Box Closure With Hancock Crossing

This option includes staging the Hancock Street extension (see Figure 4) at the onset, meaning the Hancock Street crossing would be in place during the box closure. The model assignments indicate that 45 percent of Broadway traffic and 65 percent of Weidler Street traffic would divert throughout a wide area. With this scenario the Hancock Street volume between I-5 and MLK Boulevard would increase five times the existing volumes. Seventy percent of the increase in westbound Hancock Street volumes divert from NE Broadway and 20 percent divert from southbound MLK Boulevard. Eastbound NE Hancock Street volumes divert from eastbound Dixon Street and southbound and northbound Wheeler Avenue. Dixon Street volume is expected to be over capacity with 600 detoured eastbound Weidler Street vehicles. This option is expected to have a significant impact on Moda Center traffic, as the I-5 northbound connections divert to Broadway and Weidler Street. The result summary from these options is shown in Figure 4.
Figure 4. Option 1B Box Closure with Hancock Street Crossing Option

Option 1B: Box Closure with Hancock Crossing

Affect on Moda Center?
Maximum alternate routing

Where are People Diverting?
Hancock St, Victoria Ave, and Multnomah St

How Many Vehicles are Avoiding the Box During the PM Peak Hour?
45% (800 vehicles) on Broadway St rerouted, 65% (1,000 vehicles) on Weidler St rerouted

Note: Analysis assumes traffic diversion installed on Hancock St. to restrict through movements to limit construction traffic cut-through on neighborhood streets.

Congestion levels:
v/c 0.85-1 for congested (blue), v/c >1 for extremely congested (red).
4.2 Option 2: Two Lanes Both Directions on the Broadway/Weidler Streets Lid

4.2.1 Option 2A – Box Closure 2-Lanes in Both Directions Without Hancock

The Option 2A scenario includes adding a temporary two-lane connection in each direction between Broadway and Weidler Street, closing Broadway between Williams Avenue and Vancouver Avenue, and closing Weidler Street between Williams Avenue and Victoria Avenue, as shown in Figure 5. This model assignment indicates that 30 percent of westbound Broadway would divert, but minimal diversion of Weidler Street traffic would occur. Sizable volumes would divert from southbound MLK Boulevard and freeway Exit 302A to Hancock Street. Broadway, between the northbound on-ramp and Victoria Avenue, and Weidler Street between Vancouver Avenue and Williams Avenue, are expected to experience 200% demand increase.

4.2.2 Option 2B – Box Closure 2-Lanes in Both Directions with Hancock Street Crossing

Option 2B includes staging the Hancock Street Crossing at the outset and closing Flint Avenue between Tillamook Street and Hancock Street, as shown in Figure 6. This model assignment found that 35 percent of Broadway and 10 percent of Weidler Street traffic would divert prior to the Box area. Volumes on Hancock Street would increase significantly, but the demand on the residential segment of Hancock Street’s Street would not exceed its capacity. The westbound volumes on Hancock Street would divert from southbound MLK Boulevard; while the eastbound volumes on Hancock Street would divert from the westbound Hancock Street Crossing. Both Broadway and Weidler Street on or near the lid are extremely congested.
Figure 5. Two Lanes both Directions on the Broadway/Weidler Streets Lid without Hancock Street Crossing Option

Option 2A: 2 Lanes Both Direction on the Lid without Hancock Crossing

Affect on Moda Center?
Moderate alternate routing

Where are People Diverting?
Williams Ave, Dixon St, 2-lane on the lid, Hancock St, and Victoria Ave.

How Many Vehicles are Avoiding the Box During the PM Peak Hour?
30% (500 vehicles) on Broadway St rerouted, 0% on Weidler St rerouted

Congestion levels:
v/c 0.85-1 for congested (blue), v/c >1 for extremely congested (red).
Figure 6. Two Lanes both Directions on the Broadway/Weidler Streets Lid with Hancock Street Crossing Volume

**Option 2B: 2 Lanes Both Direction on the Lid with Hancock Crossing**

- **Affect on Moda Center?**
  - Moderate alternate routing

- **Where are People Diverting?**
  - Wheeler St, Hancock St, and 2-lane on the lid

- **How Many Vehicles are Avoiding the Box During the PM Peak Hour?**
  - 35% (600 vehicles) on Broadway St rerouted, 10% (200 vehicles) on Weidler St rerouted

---

**Congestion levels:**

- v/c 0.85-1 for congested (blue), v/c >1 for extremely congested (red).
4.3 Option 3: Three Lanes on and Weidler Street

4.3.1 Option 3A – 3-Lanes in Both Directions Without Hancock Street Crossing

Option 3A includes closing Williams Avenue between Broadway and Weidler Street, as well as retaining three lanes in each direction on Broadway and Weidler Street, as shown in Figure 7. The model assignment indicates low traffic diversion from Broadway and no Weidler Street traffic diversion. The segment of Hancock Street between Victoria Avenue and Williams Avenue gains sizable diverted traffic. The assigned volumes on Broadway between Williams Avenue and Victoria Avenue would be about 1.5 times the capacity. Vancouver Avenue between Broadway and Weidler Street, and Weidler between Vancouver Avenue and 3rd Avenue would have demand volume about 1.2 times the capacity.

As a refinement of three-lane couplet no Hancock Street option, conditions assuming a westbound Broadway closure with a northbound entrance ramp closure were analyzed. This condition could exist during the removal and replacement of the Broadway structure. The closure would cause approximately 600 vehicles to travel out of direction by using Williams Avenue, Tillamook Street and Flint Avenue, 250 vehicles would divert to Multnomah Street, and 100 vehicles would use MLK Boulevard. An alternative to this approach could be to redirect Broadway westbound traffic onto Weidler Street using a two-lane, two-way traffic configuration and temporary northbound ramp access, which could impact the existing gas station in the northeast quadrant.

Option 3B – 3-Lanes in Both Directions With Hancock Three Lanes with Hancock Street Crossing

With Option 3B, 350 eastbound Weidler Street vehicles would divert to Hancock Street Crossing. Hancock Street, San Rafael Street, and Tillamook Street would not have sizable diverted traffic from Broadway and Weidler Street. This scenario has fewer streets with demand exceeding capacity, especially on the residential streets. Similar to the three-lane without Hancock Street Crossing scenario, Vancouver Avenue between Broadway and Weidler Street, Broadway between Williams Avenue and Victoria Avenue, and Weidler between Vancouver Avenue and 3rd Avenue have demand volume about 1.2 to 1.5 times the capacity.
Figure 7. Three lanes both Directions on the Broadway/Weidler Streets Lid without Hancock Street Crossing Volume

<table>
<thead>
<tr>
<th>Option 3A: 3 Lanes Both Direction without Hancock Crossing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affect on Moda Center?</td>
</tr>
<tr>
<td>Minimal alternate routing</td>
</tr>
<tr>
<td>Where are People Diverting?</td>
</tr>
<tr>
<td>Weidler St, Victoria Ave., MLK Blvd, and Multnomah St</td>
</tr>
<tr>
<td>How Many Vehicles are Avoiding the Box During the PM Peak Hour?</td>
</tr>
<tr>
<td>5% (100 vehicles) on Broadway St rerouted, 0% on Weidler St rerouted</td>
</tr>
</tbody>
</table>

Congestion levels:

- v/c 0.85-1 for congested (blue)
- v/c >1 for extremely congested (red)
Figure 8. Three lanes both Directions on the Broadway/Weidler Streets Lid with Hancock Street Crossing Volume

Option 3B: 3 Lanes Both Direction with Hancock Crossing

- Affect on Moda Center?
  - Minimal alternate routing

- Where are People Diverting?
  - Weidler St, Hancock St, Dixon St, and Multnomah St

- How Many Vehicles are Avoiding the Box During the PM Peak Hour?
  - 5% (100 vehicles) on Broadway St rerouted, 0% on Weidler St rerouted

Congestion levels:
- v/c 0.85-1 for congested (blue), v/c >1 for extremely congested (red).
4.4 Option 4: Diverging Diamond Interchange

Option 4 includes building a diverging diamond interchange on Weidler Street between Williams Avenue and Victoria Avenue, and merging Vancouver Avenue and the I-5 southbound off-ramp with Flint Avenue. The model assignment indicates that no traffic diversion would occur on Broadway and Weidler Street. San Rafael, a residential street, is forecast to experience an increase of about 75 percent of its existing volumes near its existing capacity of 700 vehicles per hour (vph). Weidler Street between Vancouver Avenue and Williams Avenue, Broadway between Ross Avenue and 2nd Avenue, Williams Avenue between Weidler Street and Winning Way will incur new demand about 1.0 to 1.3 times their existing capacity. Based on the analysis, this option would operate with low delay at key system intersections.
Figure 9. Diverge Diamond Interchange Volume

Congestion levels:
\[ v/c \leq 0.85 \] for congested (blue), \[ v/c > 1 \] for extremely congested (red).
Based on the diversion analysis, it was determined the three-lane, one-way couplet option would minimize the potential impact of diverted traffic during construction. This option would maintain the majority of primary movements and would minimize construction impacts, indicated by low percentages of traffic from Broadway and Weidler Street avoiding the project area. Residential street volumes (Hancock Street, San Rafael Street and Tillamook Street), would remain low. Additionally, the operational impact to Moda Center and Veteran’s Memorial Coliseum event traffic would be minimized, as connections to freeway and local streets would be retained during construction. Minimal out-of-direction travel would result with this Option.

The three-lane, one-way couplet (Option 3A and 3B) geometry would minimize disruption to bicycle, pedestrian, and transit circulation. Depending on project staging and temporary accommodations, it could preserve the existing function of these movements for the longest duration, as compared to other options. Bicycle and bus diversions from the removed Williams Avenue could be accommodated by the enhanced Victoria Avenue during periods of closure.

Other construction staging approaches would result in a higher level of diversion and impacts from diverted vehicles on neighborhood streets and on access to the Broadway/Weidler corridor.

- The box closure (Option 1A & 1B) staging approach would have the highest impact to transportation operations in the project area. Closing Broadway and Weidler Street simultaneously would result in a substantial percentage of traffic flow avoiding the project area. Diverted vehicles would bypass the box through residential streets. Due to primary surface street closures, traffic between local collector roads and I-5 cannot be delivered, thus affecting local business access.
- The two-lane both direction (Option 2A & 2B) on the Broadway/Weidler Streets lid staging approach reduces roadway capacities, causing moderate alternative diversions from Broadway and Weidler Street to local residential streets. The vehicles remaining on Broadway and Weidler Street have to travel out of direction to access the freeway. In addition, this option limits business accessibility due to lack of left turns to travel north and south.
- The diverging diamond interchange (Option 4) approach has no traffic diversions from Broadway and Weidler Street and operates with low delays at key intersections. However, it severely restricts left-and right-turning movements on Broadway and Weidler Street, thereby limiting traffic accessibility to local businesses and residences.

The three-lane, one-way couplet (Option 3A and 3B) is anticipated to provide the best operations among the staging approach options during construction.

It should be noted that diverting regional traffic through Hancock Street is unacceptable due to safety and livability concerns to the southern Eliot residential community. The three-lane, one-way couplet with and without Hancock Street Crossing staging approaches anticipate no regional diverted demands on Hancock Street, thereby physical traffic diverting is not required. It is likely the diverters will still be considered, and no substantial traffic impacts are anticipated by including the traffic diverters. Based on this preliminary analysis, diverters should be considered near MLK Boulevard to capture potential cut-through traffic, as the traffic analysis
revealed a desire for traffic to divert from MLK Boulevard through the Eliot neighborhood. Traffic diverters closer to the project study area will be less effective.

The study further analyzed an I-5 northbound and southbound closure that stretches between the I-405 interchange to I-84 split. The 3,500 vehicles from I-5 southbound and northbound will be diverting to I-405 (southbound and northbound totals 1,000 more vehicles), I-84 (westbound and eastbound totals 500 more vehicles each), MLK Boulevard and Grand Avenue (southbound and northbound totals 500 more vehicles each), and Naito Parkway (northbound and southbound totals 200 more vehicles each). Alternative routes would not be able to accommodate the diverted traffic during weekday day time. A full transportation management plan will be prepared in future phases of project development.
Attachment A. Construction Options

Figure A-1. VISUM Model: No build
Figure A-2. VISUM: Box Closure without Hancock Street Crossing
Figure A-3. VISUM: Box Closure with Hancock Street Crossing
Figure A-4. VISUM: Two-lane both Directions on the Broadway/Weidler Streets Lid without Hancock Street Crossing
Figure A-5. VISUM Two-lane both Directions on the Broadway/Weidler Streets Lid with Hancock Street Crossing
Figure A-6. VISUM: Three-lane both Directions without Hancock Street Crossing
Figure A-7. Three-lane both Directions with Hancock Street Crossing
Figure A-8. VISUM Diverge Diamond
Attachment B. No-Build Model Refinements and Modifications

Figure B-1. No Build Added Streets Based on the Raw Model

Note: Red color streets are new links added to the base city RTP model; green color streets already exist in the base city RTP model.
Figure B-2. City RTP Original Link Volume
The following is a summary of the modifications made to the existing city travel demand model for the purposes of this evaluation. These modifications focused on completing the existing street network within the immediate project area, which may potentially result in diversion routes or alternative access roads during construction to improve the model analysis accuracy.

Added local streets in the No-Build model include:

- NE Tillamook Street between N Flint Avenue and NE MLK Boulevard: One lane each direction, capacity 700 vphpl\(^2\), 20 miles per hour (mph)
- NE San Rafael Street between N Williams Avenue and NE MLK Boulevard: One lane each direction, capacity 700 vphpl, 20 mph
- NE Hancock Street between N Williams Avenue and NE MLK Boulevard: One lane each direction, capacity 700 vphpl, 20 mph
- N Ramsey Way between N Larrabee Avenue and N Williams Avenue: Two lanes each direction, capacity 700 vphpl, 20 mph
- N Dixon Street between N Larrabee Avenue and N Wheeler Avenue: One lane each direction, capacity 600 vphpl, 20 mph
- N Benton Avenue between N Dixon Street and N Ramsey Way: One lane each direction, capacity 600 vphpl, 20 mph
- N Ross Avenue between N Dixon Street and NE Broadway: One lane each direction, capacity 600 vphpl, 20 mph
- N Wheeler Avenue between N Tillamook Street and NE Broadway: One lane each direction, capacity 600 vphpl, 20 mph
- N Wheeler Avenue between NE Broadway and NE Weidler Street: One lane northbound, capacity 600 vphpl, 20 mph
- N Flint Avenue between N Russell Street and NE Broadway: One lane each direction, capacity 700 vphpl, 20 mph
- N Victoria Avenue between NE Broadway and NE Hancock Street: One lane northbound, capacity 700 vphpl, 20 mph
- N 1st Avenue between NE Hancock St and NE Weidler Street: One lane each direction, capacity 700 vphpl, 20 mph
- N 2nd Avenue between NE Hancock St and NE Weidler Street: One lane each direction, capacity 700 vphpl, 20 mph
- N 3rd Avenue between NE Hancock St and NE Weidler Street: One lane each direction, capacity 700 vphpl, 20 mph
- N Vancouver Ave north of Broadway: Two lanes, capacity 600 vphpl
- N Vancouver Ave between Broadway and Ramsay: Three lanes, capacity 350 vphpl

Updates on existing links:

- N Larrabee Avenue between Broadway and Multnomah County Facilities driveway: Three lanes southbound, capacity 2100 vph (it was two lanes with capacity 900 vph)

\(^2\) vphpl: vehicle per hour per lane
- NE Weidler Street between NE Victoria Avenue and NE MLK Boulevard: Four lanes eastbound, capacity 2700 vph (it was three lanes with capacity 2700 vph)
- Wheeler between N Ramsey Way and Multnomah Street: Two lanes southbound, capacity 1400 vph (it was two lanes with capacity 600 vph)
- I-5 Northbound from I-84 on-ramp to NE Victoria Avenue off-ramp: Three lanes, capacity 4500 vph (it was two lanes with capacity 4500 vph)

Added intersections in the No-Build model include:

- On N Dixon Street: N Benton Avenue, N Ross Avenue, and N Wheeler Avenue
- On N Broadway: N Benton Avenue, N Ross Avenue, N Wheeler Avenue, N Flint Avenue, N 1st Avenue, N 2nd Avenue, N 3rd Avenue
- On N Weidler Street: N Wheeler Avenue, N Flint Avenue, N 1st Avenue, N 2nd Avenue, N 3rd Avenue
- On Ramsey Way: N Larrabee Avenue, N Benton Avenue, NE Wheeler Avenue
- On NE Hancock Street: N Williams Avenue, NE Victoria Avenue, N 1st Avenue, N 2nd Avenue, N 3rd Avenue, NE MLK Boulevard
- On NE San Rafael Street: N Williams Avenue, NE MLK Boulevard
- On NE Tillamook Street: N Williams Avenue, NE MLK Boulevard
Attachment C. Assumptions

This refined base 2013 no-build model involved assumptions, which include:

- Due to software limitations, the No-Build does not include a bus-only lane at N Williams Avenue and N Ramsey Way due to model limitations.
- The study does not include a bike lane due to model limitations.
- I-5 southbound off-ramp right turn to N Broadway was proposed to move to the N Vancouver Avenue and N Broadway intersection. Construction of this modification is assumed to be completed before this construction staging starts.
- Traffic analysis zones are unchanged. No traffic analysis zones were added, deleted, or split, as the number of zones is typically a function of network geography and increases as an urban area becomes denser. The staging involves neither geography changes nor urban population changes. The current zones sufficient modeling diversion impact of construction staging.
- For the construction phasing models, aggressive link capacities (500 vphpl) in the project area were set. The ramp capacity is left as it is. The other links (North-South: Tillamook-Ramsey Way; East-West: Larrabee Avenue-3rd Avenue) are 500 vphpl.
Appendix F. Proposed Structure Concept Plans
Figure F-1. General Plan and Elevation for Steel Superstructure
Figure F-2. General Plan and Elevation for Precast Superstructure
Figure F-3. General Plan and Elevation for CIP Superstructure
Appendix G. Constructability Challenges
General Constructability Issues

In addition to the key constructability challenges presented above, a number of other challenges were identified. Throughout the project, there are construction access, traffic, contractor staging areas, retaining structures, and other constructability challenges such as seismic retrofit design, if included.

Constructability Issues with Construction Access, Traffic, and Contractor Staging Areas

Access in and around the project site during construction will be very challenging due to the urban project location with limited space and high volumes of traffic. Construction activities and equipment will also be physically constrained in the narrow freeway corridor. Work zones will be contained in the median and shoulders as much as possible, but temporary lane reductions and/or directional closures of I-5 will be needed to facilitate construction and demolition over the freeway. Construction access to build over the freeway from the surface streets will be difficult due to the high traffic volumes experienced in the area, particularly near the Broadway/Weidler Lid. Access to local businesses will need to be maintained. Additional consideration must be given to right-of-way acquisitions and temporary easements that will be needed for equipment and materials staging. The risk of future development will further complicate access challenges during construction and conflicts with traffic operations during construction, particularly at the east end of the project area between NE Broadway Street and NE Weidler Street.

Constructability Issues with Utilities

There are a number of unknown utility relocations that need to be identified and resolved. Some impacts may be reimbursable city utilities, which need to be modified as a result of the reconstruction work or the grade changes along the local city streets. Grade differential is a key aspect of the design that will have repercussions to the utilities. Ongoing development in the surrounding properties will further complicate the future utility relocations.

Constructability Issues with Right-of-Way

There are a couple of key properties assumed to be relocations or acquisitions in order to keep traffic moving and construction phasing through feasible progression. In particular, the property between Broadway/Weidler just east of N Williams Avenue is assumed be a full take for construction to occur. Also, it was identified through this work that the gas station near the Broadway entrance to I-5 north could be directly impacted as well.
Constructability Issues with Retaining Structures

Significant excavation throughout the project limits is required for the freeway widening and necessitates the installation of several retaining walls. The various walls have been preliminarily designated according to the Figure G-1 below.

Figure G-1. Retaining Wall Designations

Walls N1, N3, N4, C1 and C2 are tall with moderate to significant horizontal constraints from adjacent structures and/or properties. These walls require a wall type with a minimal footprint, such as a soldier pile or tie-back wall. The top-down nature of construction for these wall types allows tall walls to be installed with minimal excavation and impact behind the retaining structure.

The remaining walls are those adjacent to the freeway access ramps. The walls are short with relatively low horizontal constraints. Shorter heights and greater flexibility for excavation allow the use of conventional concrete cantilever wall types.

Constructability Issues with Seismic Retrofits

The addition of auxiliary lanes to I-5 will result in widening several freeway structures along the corridor. ODOT may need to implement a seismic retrofit of existing walls and bridges in order to improve resiliency against the anticipated Cascadia Subduction Zone earthquake or other local fault earthquakes. This is an important consideration with the additional superstructure loads expected through widening. Seismic retrofit measures
should be considered and will increase the project cost and schedule. Evaluation of the seismic resiliency improvements needed for this project was outside the scope of this report.

Broadway/Weidler Lid Constructability Issues

The proposed Broadway/Weidler Lid will be a wide and long tunnel-like structure with two openings that span over I-5 with a center pier and extend from north of Broadway to south of Weidler. The purpose of the structure is to accommodate the proposed widening and opening of the freeway clearances, spanning over the freeway and improving the connectivity over the freeway between communities. Refinement of the Broadway/Weidler Lid concept considered structure type, usage, and construction methods.

Constructability Issues with Lid Structure Type and Depth

A key aspect of the Broadway/Weidler Lid is the connecting roadwork tying the new structure back into the existing roadway network. In order to maintain the required clearances over the freeway, a vertical grade differential of approximately 5 to 7 feet occurs at the southwest corner of the structure at Weidler. Minimizing this grade differential to the greatest extent possible is preferred, to reduce costly approach roadway work and earthwork impact to adjacent properties and to improve aesthetics. The magnitude of the grade differential is largely dependent on structure depth, which is in turn dependent on the structure span, type, usage, and construction methods. For this reason, a pier in the middle of the freeway is a prudent decision as it allows reduced span and depth.

There are three general reasonable alternatives for superstructure type for the proposed lid structure: cast-in-place (CIP) concrete, prefabricated concrete, and prefabricated steel. The CIP superstructure option could consist of post-tensioned concrete box girders, which have the greatest potential for decreasing superstructure depth and maintenance costs while providing increased flexibility in structure configuration and aesthetics. However, temporary traffic and overall schedule impacts would result due to spatial and time requirements related to on-site construction. This issue could be resolved by constructing the elements high and lowering into place, or other accelerated fabrication or installation methods.

Prefabricated options could use either precast/pre-stressed concrete or prefabricated steel plate girder superstructures. Both types provide a reduced installation and construction duration compared to CIP superstructures. The steel option has the greater potential for reducing superstructure depth compared to precast concrete girders, but requires more capital and maintenance costs. Details of these structure types can be seen in Appendix F.
Constructability Issues with Uses on Top of the Lid

The superstructure depth is notably impacted by the uses and thereby loading on top of the lid. The 2012 Broadway/Weidler Interchange Facility Plan recommends that a viable lid design be established to address the need for open space and economic development to align with the goals of the N/NE Quadrant Plan.

To achieve a relatively thin structure depth, typical traffic and bike/pedestrian loading would be required. Significant additional atypical loadings, such as small buildings or earthwork for parks, would directly increase the structure depth and could preclude the use of certain superstructure types (e.g., precast). Small buildings can be accommodated on typical beam depths, but at this constrained location that could involve sharper grades on the approaches or complexities tying the roads on the structure to nearby local streets. It is therefore recommended that only minor increases to typical structure loadings be considered to avoid incurring significant costs associated with deeper superstructure sections and impacts to surrounding properties as the grade differentials are resolved.

Constructability Issues with Lid Design Configuration

Construction methods and phasing will influence the superstructure depth. For instance, if the alignment of the girders is normal to the centerline of the freeway and the substructure elements, the result is the shortest span length and shallowest superstructure depth. However, this restricts the extents of the construction of the central portion of the lid, which is bounded by the existing Broadway and Weidler structures, such that it cannot be used as a detour structure during construction of the northern and southern portions of the lid (see Figure G-2). If the girder alignment parallels these structures and is skewed relative to the substructure elements, the superstructure depth must increase due to the increased span length. However, the difference in structure depth is minor, therefore recommending the skewed girder option.

Figure G-2. Normal vs. Skewed Girder Alignment
Constructability Issues with the “Broadway Band-Aid”

The complex interaction between the existing Broadway and Williams structures requires the temporary closure of the Broadway/Williams intersection. A temporary structure (coined the “Broadway Band-Aid”) must be constructed in order to restore traffic on Broadway and to provide northbound freeway access. This structure would likely consist of parallel and splayed steel girders (see Figure G-3) to address the unusual geometric requirements of the structure necessary to reopen the entire intersection. Accelerated Bridge Construction (ABC) techniques would need to be implemented during demolition and construction of the temporary span in order to minimize the duration of closure of the Broadway/Williams intersection. This would increase cost associated with this work, but would limit closure to traffic to approximately 2 weeks.

Figure G-3. Temporary Broadway Band-Aid Structure (a) Plan and (b) Section

Plan View

Section View
North Lid Constructability Issues

The North Lid consists of a wide multi-span bridge structure that spans I-5 and is approximately bounded by Williams and N Flint Avenue. The purpose of the structure is to accommodate the proposed widening of the freeway, to improve north-south connectivity over the freeway along N Vancouver Avenue, and to provide east-west connectivity by creating a new connection between the existing NE Hancock Street and N Dixon Street. Refinement of the North Lid concept considers structure type, usage, and construction methods.

The connecting roadwork between Hancock and Dixon presents a challenge due to the vertical grade differential across the freeway. The critical section or “pinch point” occurs at the southbound I-5 exit ramp (see Figure G-4). A steep grade is required in order to meet the minimum clearance requirement of 17 feet 4 inches, which may present challenges for pedestrian/bike traffic. Reduction in structure depth helps mitigate this issue, though the connection will be steep regardless.

Clackamas Overcrossing Constructability Issues

The purpose of the Clackamas Overcrossing is to establish a bike and pedestrian connection across I-5 that provides convenient Rose Quarter access while reducing at-grade street crossings. A key concern of this structure is its ability to meet clearances over the freeway while maintaining Americans with Disabilities Act (ADA)-compliant pedestrian access. Switchbacks will be needed on the west side of the freeway in order to meet ADA requirements and the minimum vertical clearance of existing and proposed I-5 facilities. Since the bridge depth is a small portion of the vertical clearance envelope, this solution would likely be used regardless of structure type.

The methods for constructing the Clackamas Overcrossing vary depending on the structure type, which has not been finalized. There are several potential structure types that may be used, including prefabricated, cast-in-place, and signature structures. Prefabricated options, such as precast-pre-stressed concrete girders and steel box girders, allow for shorter construction durations due to off-site fabrication. These types of structures also require more frequent supports, which have a greater construction impact.
on the freeway below. CIP structures allow for more complex geometry and greater span lengths, but require significant temporary false-work over I-5 and increase construction durations. Signature structures, such as cable-stayed or arch bridges, provide reduced structure depths, much longer spans, and greater flexibility regarding geometry. Cost and construction duration may be greater for signature structures, but may have a less direct impact on freeway traffic during construction by avoiding intermediate piers.

I-5 Mainline North of Hancock Constructability Issues

The proposed widening of I-5 north of the central lid area (i.e., north of Hancock) will add an auxiliary lane and shoulders to the existing lane configuration in each direction. The widening extends north to the interchange with I-405 in the northbound direction and to the Eliot School Viaduct in the southbound direction.

The northbound I-5 widening will require replacement of an existing retaining wall adjacent to the Harriet Tubman Middle School structure. This location coincides with the Eliot School Viaduct (see Figure G-5) which will require widening on the east side. The structure widening will be a challenge due to its proximity to the school building and the steeply sloping ground line underneath the structure, which currently extends above the soffit of the existing bent cap on the eastern side for a majority of the structure length. Further evaluation of potential impacts to the school facility will be necessary in the EA; required mitigation measures will need to be incorporated into future construction phasing assumptions.

The interchange with I-405 is located over multiple parking areas. Temporary access to these properties would be required in order to construct the freeway widening at this location.
I-5 Mainline South of Weidler Constructability Issues

The proposed widening of the South Zone (I-5 south of the central lid area, south of Weidler) will add an auxiliary lane and shoulders to the existing lane configuration in each direction. The widening extends south to the interchange with I-84. The widening of the freeway at this location requires widening the freeway overcrossing of NE Holladay Street and N Hassalo Street. This structure also crosses over the Rose Quarter Transit Center MAX station. These facilities will require significant coordination to maintain service and traffic circulation during construction.

Southbound I-5 to Eastbound I-84 Constructability Issues

The existing southbound I-5 exit ramp to eastbound I-84 is a combination reinforced concrete girder and steel plate girder bridge. This bridge is a flyover structure that carries vehicular traffic over I-5, I-84, and several tracks owned by the Union Pacific Railroad (UPRR). A portion of the structure also spans over the Willamette River near the shore, including the floating boardwalk that is part of the Eastbank Esplanade, which is a transportation facility for bicycles and pedestrians. All of these underpasses pose construction challenges in terms of access, clearance, and maintenance of traffic. Further evaluation will be necessary in the EA.

Of particular difficulty is the I-5 ramp column immediately adjacent to the western shoulder of southbound I-5, where the flyover structure crosses the freeway (see Figure G-5).
G-6). The proposed widening of this portion of southbound I-5 conflicts with the column at this location. The column must either be relocated or the spans supporting this column replaced to accommodate a different span configuration. This conflict would also occur if southbound I-5 were to be widened between the exit ramp to the Morrison Bridge interchange and the junction with westbound I-84 due to numerous columns supporting the I-84 flyover structure.

A possible method of column relocation would be to construct a “straddle bent.” The bent cap of the straddle bent would support the existing column load, distributing the load to two columns that would straddle the freeway to provide the necessary clearance. There would be a high cost associated with this structure due its size and the construction impacts over the freeway. Physical constraints pose difficulties in temporarily shoring of the existing superstructure during demolition of the existing column and construction of the straddle bent.

Westbound I-84 to Northbound I-5 Constructability Issues

The existing northbound I-5 access ramp from westbound I-84 is a combination reinforced concrete girder and steel plate girder bridge. This bridge is a flyover structure that carries vehicular traffic over NE Lloyd Boulevard to northbound I-5 and to a local connection at the Rose Quarter Transit Center MAX Station. The flyover is to receive a proposed widening along the entire length of the structure to add an additional lane to the I-5 connection.

The structure passes over an existing pump house just north of the diversion from I-84 (see Figure G-7). The clearance to the roof of the pump house from the soffit of the existing steel girder is approximately 1 foot 8 inches. The super-elevation of the structure is such that the proposed widening to the west would not reduce this clearance, but construction access around the building would be restricted. The proximity of the building to the existing bent at this location would also restrict access and clearance for structure widening. Additional restrictions may exist due to the UPRR line that passes under the ramp at a significant skew. Further evaluation will be necessary in the EA.
Figure G-7. I-5 to I-84 Interchange Challenges