



Criterion Performance

Criterion Performance

Criterion 1.2 – Avoid, then minimize adverse impacts to, and where practicable enhance, neighborhood cohesion

(Part of Value 1 – COMMUNITY LIVABILITY AND HUMAN RESOURCES)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • Number of neighborhoods bisected by new construction • Number of significantly impacted neighborhoods (>10% of total area required for new construction) • Number of neighborhoods divided from their identified resources by new construction
◆ Best Performing Package(s) and/or Component(s)
<p>The alternatives with the least physical improvements score the highest on these measures because they would have the least adverse impact to existing neighborhoods. As such, No-Build alternatives (Alternative Packages 1 and 2) rate the highest. However, these packages can do little to enhance access or livability, and do not support the community’s future vision as expressed in local plans.</p> <p>Of the Build alternatives, only Alternative Package 3 completely avoids displacing the only grocery store on Hayden Island. Alternatives with LRT or BRT require more commercial acquisitions than alternatives using BRT-Lite or Express Bus only. Residential acquisitions or relocations range from 5 to 15 floating homes, and vary largely based on interchange configurations at Marine Drive, on Hayden Island, and at SR 500.</p>
◆ Key Findings
➤ River Crossing
<p>No neighborhoods will be bisected by new construction and no neighborhoods will lose more than 10% of their total area for construction. Therefore, the only remaining metric is whether a neighborhood is divided from its resources.</p> <p>Upstream replacement bridges require complete acquisition of Safeway, the only grocery store on Hayden Island and a significant resource for the neighborhood. A downstream replacement bridge and supplemental interstate bridge may require partial or full acquisition of Safeway as well due to interchange improvements. Only a supplemental arterial bridge (Alternative Package 3) would completely avoid direct impact to Safeway. Safeway could likely be relocated on Hayden Island.</p>
➤ Transit
<p>None of the transit options would bisect neighborhoods or affect more than 10% of any neighborhood. Alternative Packages 3 - 5 and 8 - 10 add high capacity transit to downtown Vancouver and Hayden Island, improving residents’ access to resources in these areas.</p>
➤ Roadways North and Roadways South
<p>The interchanges at Marine Drive and on Hayden Island can affect the number of floating homes displaced by the alternatives. A more complex interchange at Marine Drive widens the bridge over the Oregon Slough, impacting additional floating homes. Removing an I-5 interchange on Hayden Island necessitates an arterial crossing over the Oregon Slough which would displace additional floating homes.</p> <p>None of the Roadways North options would bisect neighborhoods or affect more than 10% of any neighborhood. Some interchange designs at SR 500 cause additional residential acquisitions.</p>
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>All build alternatives provide improved bicycle and pedestrian access and connectivity within the BIA.</p>

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Criterion 1.4 – Avoid or minimize residential displacements

(Part of Value 1 – COMMUNITY LIVABILITY AND HUMAN RESOURCES)

◆ Performance Measure(s)
<ul style="list-style-type: none">• How many residential units fall within the design area footprint?
◆ Best Performing Package(s) and/or Component(s)
<p>Note: Identifying necessary property acquisitions and displacements requires substantial design refinement and property analysis that are not included in the alternatives screening phase. For screening purposes, property acquisition estimates are generalized in accordance with the conceptual nature of the current level of design.</p> <p>Alternative Packages 1 and 2 would avoid residential property acquisitions.</p> <p>Based on conceptual designs of Build alternatives, all Build alternatives have fewer than 30 residential acquisitions. Differences occur primarily due to HCT and interchange designs. LRT and BRT require wider bridge crossings over the Oregon Slough and displace more floating homes. A more complex interchange at Marine Drive widens the bridge over the Oregon Slough, impacting additional floating homes. Removing an I-5 interchange on Hayden Island necessitates an arterial crossing over the Oregon Slough, which would displace additional floating homes.</p>
◆ Key Findings
➤ River Crossing
<p>Property acquisitions in the river crossing area (from SR 14 to Marine Drive) are a function of several factors, only one of which is the river crossing option itself. Interchange designs on Hayden Island and at Marine Drive are a major factor. River crossings displace between 5 and 15 floating homes on Hayden Island depending upon interchange designs at Marine Drive and Hayden Island, and on whether the river crossing must accommodate LRT or BRT.</p>
➤ Transit
<p>LRT and BRT have higher potential to affect more floating homes than BRT-Lite or Express Bus because they require dedicated ROW. LRT and BRT necessitate widening river crossings across the Oregon Slough, which requires displacement of approximately 5 additional floating homes for most bridge options.</p>
➤ Roadways North and Roadways South
<p>The interchanges at Marine Drive and on Hayden Island can affect the number of floating homes displaced. A more complex interchange at Marine Drive widens the bridge over the Oregon Slough, impacting additional floating homes. Removing an I-5 interchange on Hayden Island necessitates an arterial crossing over the Oregon Slough, which would displace additional floating homes.</p> <p>Roadways North options would have all likely residential acquisitions. Interchange configurations at SR 500 are the primary contributor to the range of residential acquisitions.</p>
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>Not Applicable.</p>

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Criterion 1.5 – Avoid or minimize business displacements

(Part of Value 1 – COMMUNITY LIVABILITY AND HUMAN RESOURCES)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • How many commercial or industrial properties fall within the design area footprint?
◆ Best Performing Package(s) and/or Component(s)
<p>Note: Identifying necessary property acquisitions and displacements requires substantial design refinement and property analysis that are not included in the alternatives screening phase. For screening purposes, property acquisition estimates are generalized in accordance with the conceptual nature of the current level of design.</p> <p>The approximate number of commercial properties that would be affected (from sliver impacts to full acquisitions) ranges from about 30 to 90 for the Build alternatives. BRT-Lite (Alternative Packages 6 and 11) or Express Bus only (Alternative Packages 7 and 12) require fewer commercial acquisitions than those with LRT or BRT (Alternative Packages 3 - 5 and 8 - 10).</p> <p>No-Build alternatives (Alternative Packages 1 and 2) would affect no commercial properties.</p>

◆ Key Findings
<ul style="list-style-type: none"> ➤ River Crossing
<p>The property acquisitions in the river crossing area (from SR 14 to Marine Drive) are a function of several factors, only one of which is the river crossing option itself. Interchange designs are a major factor, including SR 14, Hayden Island, and Marine Drive interchanges. All river crossing alternatives require partial or full acquisition of approximately 30 commercial parcels. Replacement alternatives (Alternative Packages 8-12), with only one bridge and a smaller interchange footprint, impact less commercial land than Supplemental alternatives.</p>
<ul style="list-style-type: none"> ➤ Transit
<p>LRT and BRT affect approximately 10 to 30 commercial properties. These would mostly be partial acquisitions and would primarily occur in the Hayden Island, Washington Street and McLoughlin Boulevard areas. BRT-Lite (Alternatives 6 and 11) and Express Bus only (Alternatives 7 and 12) impact few or no commercial properties.</p>
<ul style="list-style-type: none"> ➤ Roadways North and Roadways South
<p>Interchange configurations at SR 500 are the primary contributor to the range of residential acquisitions. Potential commercial property acquisitions from Roadways South options are minimal (ranging from 0 to 14) largely depending upon the interchange configuration on Hayden Island. Commercial acquisitions from Roadways North are range from 5 to 15, largely depending upon the impact of different interchanges at SR 14 on downtown Vancouver.</p>
<ul style="list-style-type: none"> ➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>Not Applicable</p>

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Criterion 1.6 – Avoid or minimize adverse impacts to, or where practicable preserve, historic and prehistoric cultural resources

(Part of Value 1 – COMMUNITY LIVABILITY AND HUMAN RESOURCES)

◆ Performance Measure(s)
<ul style="list-style-type: none">• How many acres of land are located in high probability areas for archaeological resources?• How many of these properties are also within the potential noise impact footprint?• What is the total acreage of these properties?• How many historic, archaeological, and cultural properties fall within the design area footprint in the following categories: National Register listed, Potentially Eligible, National Historic Site?
◆ Best Performing Package(s) and/or Component(s)
<p>Alternative Package 3 would likely have the least adverse effects on historic and archaeological resources of the Build alternatives because it has the smallest overall footprint.</p> <p>Alternative Packages 8 through 12 would likely have the greatest adverse effects on historic resources because they would replace the historic northbound bridge with a new crossing rather than reuse the existing bridges.</p> <p>None of the river crossing options would directly affect a known archaeological site. However, the area where the river crossing options are located has the potential to contain archaeological resources. At this time, there is little evidence to distinguish one option from another.</p> <p>Alternative Packages 4 and 7 would likely have the greatest adverse effects on the Vancouver National Historic Site/National Historic Reserve (NHS/NHR). This is due to the easternmost SR 14 WB to I-5 NB ramp’s location east of the cloverleaf ramps.</p> <p>Generally, packages that disturb the least amount of undisturbed native soil within the high probability areas for prehistoric sites would have the lowest potential adverse effects on archaeological resources.</p>
◆ Key Findings
➤ River Crossing
<p><i>Above Ground Built Historic Resources:</i></p> <p>Supplemental bridge options (Alternative Packages 3 - 7) would retain the historic bridges. However, preliminary results from a Seismic Panel convened in August 2006 indicate that major seismic upgrades would likely be required for the bridges to avoid collapse in a major earthquake. These retrofits would likely have an adverse effect on the historic character of the bridges.</p> <p>All of the Alternative Packages may affect the Columbia River levees; this may be reduced to “no adverse effect” and no “use” with appropriate design.</p> <p>Only a supplemental arterial bridge would avoid encroaching upon the historic Apple Tree Park. Downstream replacement bridges cut through or over the parcel more significantly than the others.</p> <p><i>Archaeological Resources:</i></p> <p>None of the river crossing options would directly affect a known archaeological site. However, the area that the river crossing options are located has the potential to contain archaeological resources. At this time, there is little evidence to distinguish one option from another.</p>
➤ Transit
<p><i>Above Ground Built Historic Resources:</i></p> <p>The representative BRT and LRT alignment uses Washington and McLoughlin, traveling through Vancouver’s locally-designated downtown historic district. Conceptual designs do not appear to have a direct effect on any significant historic resources, but they would affect the visual character. Whether such an effect would be adverse or beneficial will depend on whether it is designed with regard to the character of the district. LRT alternatives may have a lower likelihood to pose an adverse effect than BRT. Both LRT and BRT options involving direct downtown access may result in beneficial effects from improved accessibility to the district, which would enhance the viability of the historic downtown area.</p>

Archaeological Resources:

BRT and LRT (Alternative Packages 3, 4, 5, 8, 9, and 10) would likely have the greatest potential to adversely affect historic and prehistoric resources beneath historic downtown Vancouver because they would require excavation into potentially native soils. Transit alternatives running down I-5 (2, 7, 11, and 12) would more likely impact fill or soils already disturbed by highway construction.

➤ **Roadways North and Roadways South**

Above Ground Built Historic Resources:

The SR 14 interchange is a key factor for effects on Fort Vancouver and on the Apple Tree Park. Impacts to these historic resources are largely determined by the design of this interchange. Designs seeking to minimize ROW requirements and include three levels of ramps could cause visual impacts to Fort Vancouver by overshadowing the historic hospital building. Conversely, interchange designs that expand outward and minimize vertical stacking of ramps could encroach on Apple Tree Park.

Archaeological Resources:

The easternmost SR 14 WB to I-5 NB ramp located farthest east in relation to the cloverleaf ramps (Alternative Packages 4, 7, 8, and 12) has the greatest potential adverse effects on archaeological resources within the National Historic Site (NHS).

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Bike/pedestrian striping in the Downtown Historic District or the Fort Vancouver Reserve would need to consider the historic areas. Build outs or other structures that change the visual character of the historic areas need to be designed in consultation with the Department of Archaeology and Historic Preservation and the National Parks Service.

The pedestrian bridge would affect the Fort Vancouver Reserve, but if designed carefully could have “no adverse effect” and could enhance access to and from the Downtown Historic District. It could be considered a positive effect because it would make the Reserve easier to access from the Downtown Historic District.

Criterion Performance

Criterion 1.7 Magnitude and significance of public park and recreation resources crossed by component's conceptual footprint

(Part of Value 1 – COMMUNITY LIVABILITY AND HUMAN RESOURCES)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Number and area of 4(f) public parks that fall within the design area footprint.
◆ Best Performing Package(s) and/or Component(s)
<p>Of the Build alternatives, Alternative Package 3 would have the lowest direct or secondary impacts on recreational or park resources.</p> <p>Alternative Packages 4 and 8 would likely have the greatest impacts as they would affect both the NHS the greatest and Clark College Park. The greatest NHS open space impact is the result of SR 14 interchange options that require additional ROW to the east of the existing interchange; City College Park is impacted by Roadways North options and LRT; East Delta Park impact is associated with Marine Drive interchange choices and LRT; Leverich Park impacts are due to SR 500 and BRT/LRT improvements.</p> <p><i>Considerations:</i></p> <p>Any potential “use” of the NHS/NHR would likely affect the whole resource. This includes land within the Roadways North project segments.</p> <p>Sliver acquisition(s) may be allowable as a de minimis impact. This would need to be confirmed with officials that have jurisdiction over the affected resource.</p>
◆ Key Findings
➤ River Crossing
<p>All new river crossings (Alternative Packages 3 - 12) may temporarily or permanently affect recreational trails underlying the existing and/or new bridges. “Use” would need to be determined based on the location of features such as intermediate bent columns and fill, as well as the extent of potential removal of the existing bridges and transfer of ownership. In this phase of conceptual design, there is no significant difference among the river crossing options.</p> <p><i>Considerations:</i></p> <p>Visual impacts could also be associated with this project. They could affect the historic setting and the recreational value associated with the NHS/NHR cultural landscapes. While visual impacts don’t frequently trigger a “constructive use,” they should be considered, given the importance of the historic cultural landscape.</p>
➤ Transit
<p>LRT and BRT impact Clark College Park slightly as they realign from McLoughlin Boulevard to I-5. This alignment also would affect Leverich Park and Delta Park. The alignment is preliminary and it may be possible to refine the design to avoid any impact. Furthermore, this alignment provides improved access as it brings HCT to this park (and McLoughlin Park that is immediately to the south) with a major transit station by Clark College.</p> <p>All transit modes require a sliver of the easternmost portions of Kiggins Bowl because they necessitate a wider I-5 ROW than existing conditions. BRT-Lite requires the most substantial acquisition of Kiggins Bowl.</p>
➤ Roadways North and Roadways South
<p><i>Roadways North:</i></p> <p>Improvements to the SR 14 interchange that extend east of the existing interchange can impact the Fort Vancouver Historic Reserve. Interchange designs for all Build alternatives except Alternative Package 3 require sliver acquisitions of properties within the NHS. These properties are now under US Army ownership, but will likely be transferred to other ownership, and remain within the NHS. They may become recreational properties in the future.</p> <p>Improvements to the interchange at SR 14 could also impact the historic apple tree. All Build alternatives except Package 3 would require acquisition of part of the parcel with the apple tree. These takes are not likely to directly impact the tree, but could cause substantial indirect effects (encroachment, noise, shading, etc.).</p>

Some of the SR 14 interchange designs would also directly affect the land bridge that is currently under construction, while others would build ramps over or under the land bridge.

Marshall Community Park: Alternative Packages 4, 5, 6, 8, 9, 10, 11, and 12 would require sliver acquisitions along the western edge of the park and may result in a “use.” Impacts to Marshall Community Park resulting from the Roadways North segments and the transit impacts to Clark College Park may need to be considered within the context of the City of Vancouver’s Central Park, which encompasses both of these parks as well as other properties generally extending to the east and to the south (almost to the NHR).

Leverich Park: All Alternative Packages would require sliver acquisitions along the southern and/or western edge of the park, potentially resulting in a “use” of the resources.

Roadways South:

ROW impacts to East Delta Park would involve sliver acquisitions of no more than approximately 5,000 square feet under all Alternative Packages, except for Alternative Package 3, where there would be no ROW impacts.

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

Criterion 1.8 – Support local comprehensive plans and jurisdiction-approved neighborhood plans including development and redevelopment opportunities, consistent with these plans.

(Part of Value 1 – COMMUNITY LIVABILITY AND HUMAN RESOURCES)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • Does the project support/uphold principles of multi-modalism? • Is it in project lists of comprehensive plans? • Are alternatives consistent with the project-specific policies in the Vancouver City Center Vision? • How much developable land will be lost?
◆ Best Performing Package(s) and/or Component(s)
<p>While both BRT and LRT are included in local plans, LRT service (included in Alternative Packages 3, 4, 8, and 9) best supports most local plans.</p> <p>It is difficult to rank the components in terms of land use and impacts to downtown Vancouver, but a dedicated arterial crossing, as provided by supplemental bridge alternatives, would cause significant traffic intrusion through downtown Vancouver.</p> <p>Of the Build alternatives, Alternative Packages 8 and 9 appear to best meet local plans because they uphold principles of multi-modalism (they have LRT) and will not require as much developable land (because they include a replacement bridge). At this point in the analysis, the direct access to Vancouver and ability to support redevelopment opportunities, as called for in the Vancouver City Center Vision, are unknown.</p> <p>Alternative Packages 1 and 2 are the worst performers, as they fail to follow the recommendations of the Bi-State Trade and Transportation Study and do not provide BRT or LRT service.</p>
◆ Key Findings
<p>➤ River Crossing</p> <p>An evaluation of compliance with multi-modal policies and planned project lists does not help to discern between river crossing options. Supplemental downstream and arterial bridges provide arterial and Interstate access. A supplemental arterial would cause significant traffic intrusion through downtown Vancouver.</p> <p>River Crossing components have different land use and ROW impacts. Supplemental bridge options and a downstream replacement bridge would displace portions of the Inn at the Quay. Replacement bridges with LRT will also directly impact the FHWA and Army buildings, and possibly the West Coast Bank building. A supplemental arterial bridge would impact two commercial blocks in the southern portion of downtown Vancouver east of Columbia Street.</p> <p>A replacement bridge provides much better service for LRT or BRT. LRT, and to a lesser extent BRT, support local plan policies encouraging multi-modalism. Replacement bridges also require less land on Hayden Island, particularly compared to Supplemental Interstate bridges that include an interchange on the island, better supporting local goals of redevelopment.</p>
<p>➤ Transit</p> <p>Express buses in general purpose or managed lanes fail to provide HCT, as explicitly called for in local plans. LRT is most consistent with regional plan policies and was called for in recommendations by the Bi-State Trade and Transportation Study that is referenced in numerous plans. Alternative Packages 3, 8, and 9 provide the most reliable LRT service by placing transit on a new fixed span bridge that would eliminate delays in the transit system resulting from bridge lifts.</p>
<p>➤ Roadways North and Roadways South</p> <p>Design options for Roadways North and Roadways South do not have significant differences.</p>
<p>➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)</p>

Criterion Performance

Criterion 2.1 – Reduce travel times and delay in the I-5 corridor and within the Bridge Influence Area for passenger vehicles

(Part of Value 2 – MOBILITY, RELIABILITY, ACCESSIBILITY, CONGESTION REDUCTION, AND EFFICIENCY)

◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]

- Travel times between select points along I-5 in Oregon and Washington
- Determined based on travel demand and traffic operations analysis

◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]

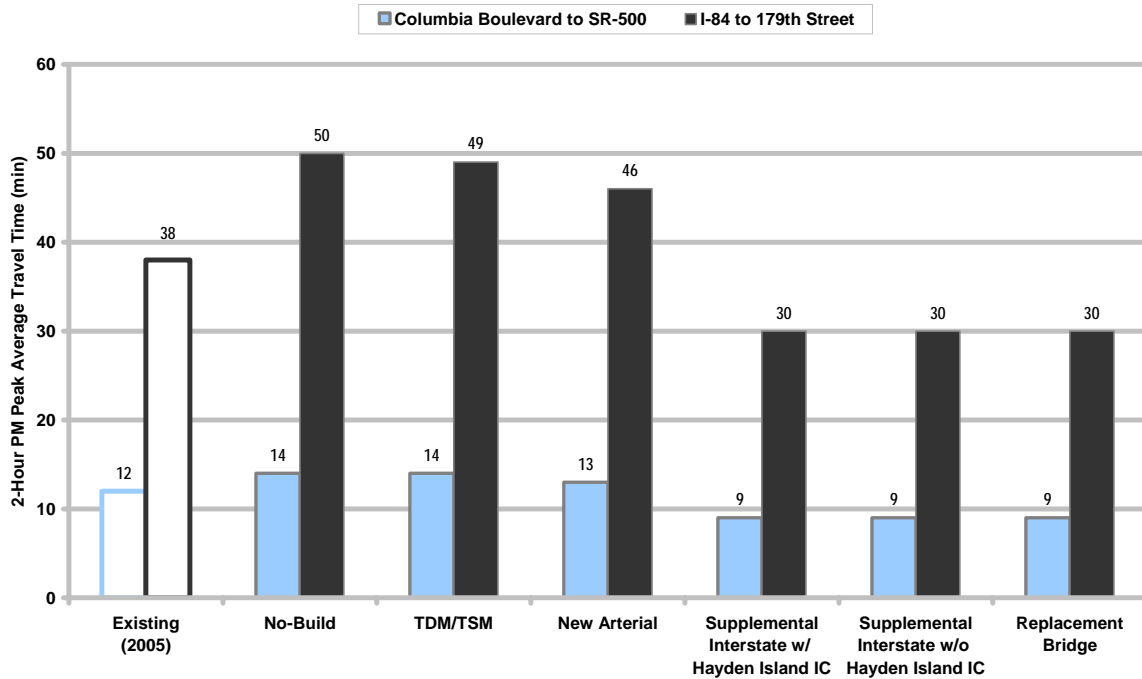
- The Supplemental Interstate and Replacement Bridge alternatives result in the shortest travel times

◆ Key Findings

➤ River Crossing

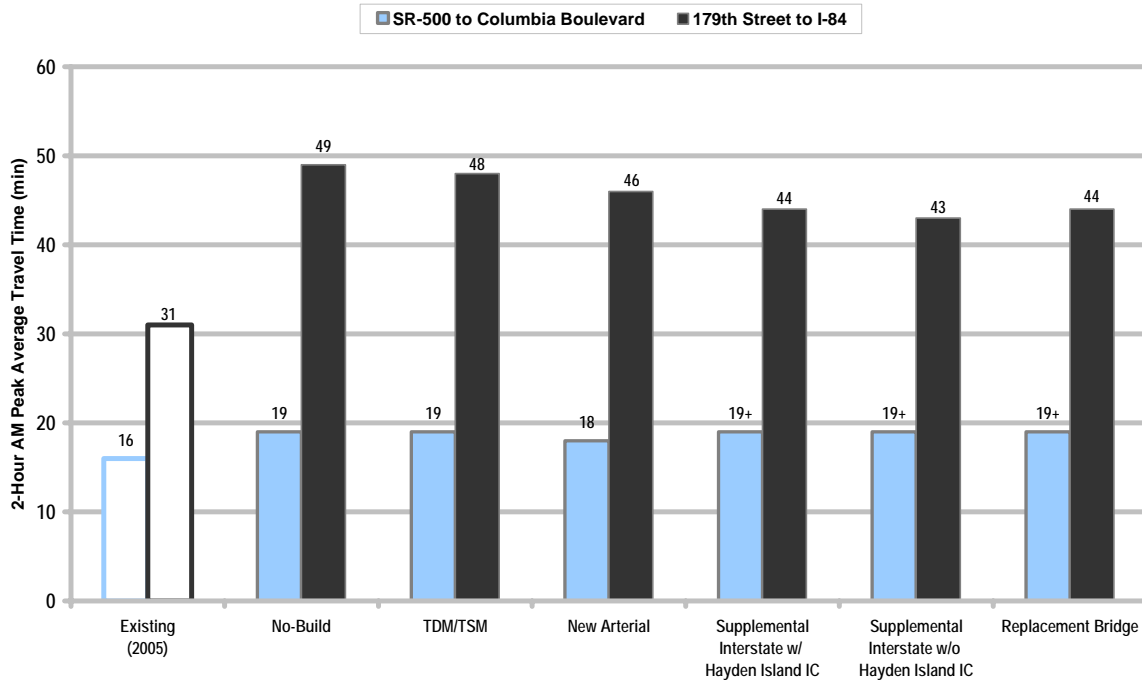
- The TDM/TSM and New Arterial alternatives provide similar travel times along I-5 as the No-Build alternative
- The Supplemental Interstate and Replacement Bridge alternatives reduce northbound I-5 travel times compared to the TDM/TSM and New Arterial alternatives by about 50% or more (e.g., I-84 to 179th Street travel time decreases by 22 to 26 minutes)
- The Supplemental Interstate and Replacement Bridge alternatives result in similar to slightly higher southbound I-5 travel times during the AM peak period compared to the TDM/TSM and New Arterial alternatives due to constraints on I-5 south of the Bridge Influence Area
- *Note: The Supplemental Interstate and Replacement Bridge alternatives accommodate 15% to 25% higher southbound AM peak period traffic volumes and about 35% to 55% higher northbound PM peak period traffic volumes than the TDM/TSM and New Arterial alternatives (see Criterion 2.6)*
- *Note: The Supplemental Interstate and Replacement Bridge alternatives reduce the duration of congestion by about 55% to 60% compared to the TDM/TSM and New Arterial alternatives (see Criterion 2.3)*

Northbound I-5 Travel Times (Year 2030*)



*Except for Existing Conditions (Year 2005)

Southbound I-5 Travel Times (Year 2030*)



*Except for Existing Conditions (Year 2005)

➤ Transit
➤ Roadways North and Roadways South
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)

Criterion Performance

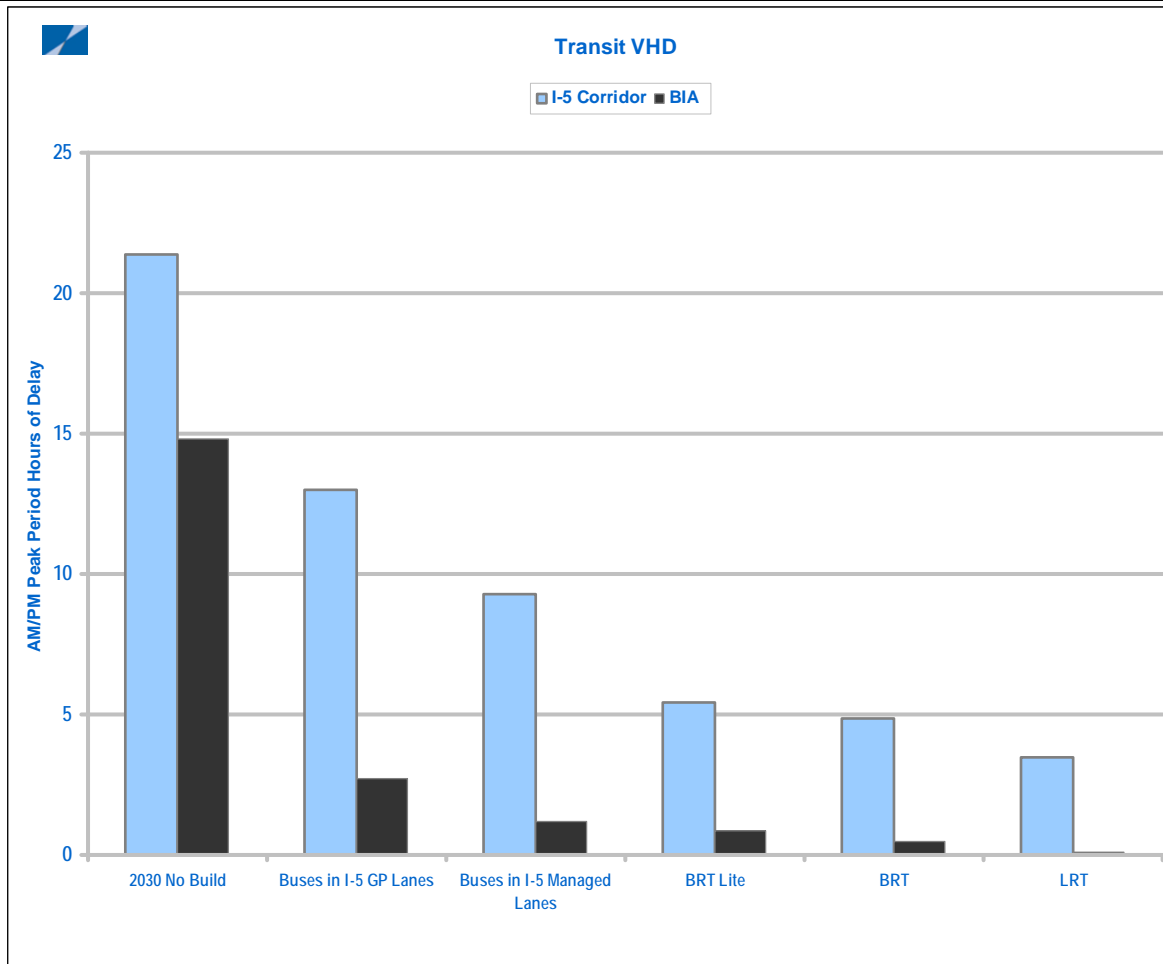
Criterion 2.2 – Reduce travel times and delay in the I-5 corridor and within the Bridge Influence Area for transit modes

(Part of Value 2 – MOBILITY, RELIABILITY, ACCESSIBILITY, CONGESTION REDUCTION, AND EFFICIENCY)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Peak period transit vehicle hours of delay (VHD) within the bridge influence area and the I-5 corridor (from Salmon Creek to downtown Portland).
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> Alternative Packages 4 and 9, with LRT as the high capacity transit mode, would have the fewest transit vehicle hours of delay within the bridge influence area and the I-5 corridor. Alternative Package 9 is the best because it uses a replacement bridge and thus avoids delays from the bridge lifts.

◆ Key Findings
➤ River Crossing
<p>Placing LRT or BRT on the existing bridges (Alternative Packages 4, 5, and 6) introduces delay from the bridge lifts. Currently, a bridge lift causes at least 17 minutes of delay to transit vehicles trying to cross the river during the lift period. This delay would have substantial impacts to LRT because it would cause system-wide schedule disruptions. Therefore, replacement bridges provide less transit VHD than supplemental bridges.</p>

➤ Transit



The above graphic illustrates VHD for the entire transit network (HCT, express buses, and local buses) within the bridge

influence area and the I-5 corridor. For a discussion of transit travel times see criterion 3.2.

With Alternative Package 1, 2030 No Build, in the PM peak direction there would be 26 transit vehicles per hour traveling over the Columbia River on I-5. The transit VHD for both the four hour AM and PM peak period would be 14.8 hours within the bridge influence area and 21.4 hours within the I-5 corridor.

All build alternatives would substantially reduce transit VHD. Of the build alternatives, express buses (Alternative Packages 7 and 12) would have the most transit vehicles operating on I-5 (38 vehicles per hour in the PM peak period) and would have the highest transit VHD in the peak periods. Express buses operating in general purpose lanes on I-5 (Alternative Package 12) would have the greatest transit VHD with 2.8 hours in the bridge influence area and 13 hours in the I-5 corridor for the combined AM and PM peak periods. With Alternative Package 7, where express buses operate in managed lanes, the combined peak period transit VHD would be reduced to 1.2 hours within the bridge influence area and 9.3 hours for the I-5 corridor.

Of the HCT modes, BRT-Lite (Alternative Packages 6 and 11) would have the highest peak period VHD within the bridge influence area at 0.9 hours. This is likely because BRT-Lite operates in general purpose lanes with mixed traffic within portions of the bridge influence area. BRT (Alternative Packages 5 and 10) and LRT (Alternative Packages 4 and 9) would have a similar peak period VHD (0.5 hours and 0.4 hours respectively). BRT buses or the LRT trains would operate in a separate guideway in the bridge influence area.

Combining a HCT mode with express buses increases transit VHD because more vehicles would be operating on I-5 in either general purpose or managed lanes. Alternative Package 8, which has a combination of LRT and express buses has 23 buses per hour on I-5 and 12 LRT trains on a separate track for a total of 35 transit vehicles per hour. Alternative Package 8 would result in a slight increase in the peak period VHD in the I-5 corridor over alternatives that include an HCT mode only; 0.6 hours transit VHD within the bridge influence area and 6.3 hours within the I-5 corridor. Despite this slight increase, combining a HCT mode with express buses represents a reduction in I-5 corridor VHD over Alternatives 7 and 12 which focus on express bus service only.

➤ **Roadways North and Roadways South**

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

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Criterion 2.3 – Reduce the number of hours of daily highway congestion in the I-5 corridor and within the Bridge Influence Area

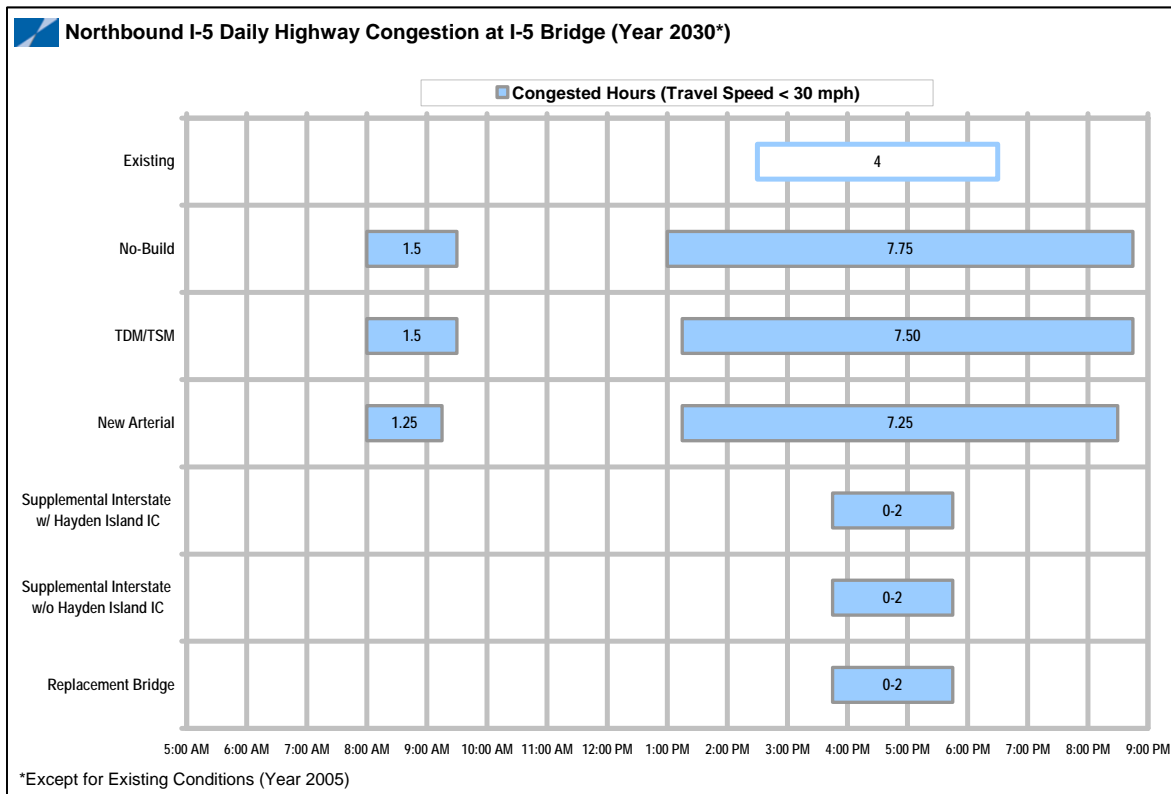
(Part of Value 2 – MOBILITY, RELIABILITY, ACCESSIBILITY, CONGESTION REDUCTION, AND EFFICIENCY)

◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]
<ul style="list-style-type: none"> Total number of hours when travel speeds in each direction on the I-5 Bridge average 30 mph or less Determined based on travel demand and traffic operations analysis
◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]
<ul style="list-style-type: none"> The Supplemental Interstate and Replacement Bridge alternatives provide the fewest hours of daily highway congestion on the I-5 Bridge

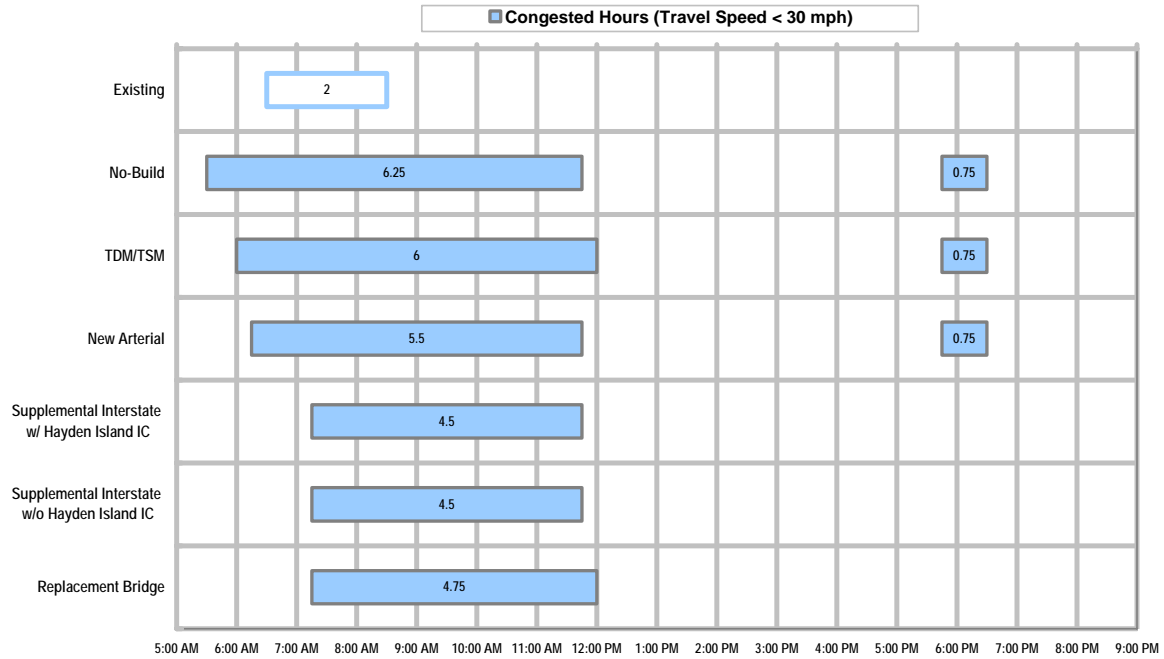
◆ Key Findings

➤ River Crossing

- The TDM/TSM alternative results in a similar duration of congestion at the I-5 Bridge as the No Build alternative
- The New Arterial alternative reduces the duration of daily congestion by about 5% compared to the TSM/TDM alternative
- The Supplemental Interstate and Replacement Bridge alternatives reduce the duration of daily congestion by about 55% to 60% compared to the No Build, TDM/TSM, and the New Arterial alternatives
- Note: The Supplemental Interstate and Replacement Bridge alternatives accommodate 15% to 25% higher southbound AM peak period traffic volumes and about 35% to 55% higher northbound PM peak period traffic volumes than the TDM/TSM and New arterial alternatives (see Criterion 2.6)*



Southbound I-5 Daily Highway Congestion at the I-5 Bridge (Year 2030*)



*Except for Existing Conditions (Year 2005)

➤ **Transit**

➤ **Roadways North and Roadways South**

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

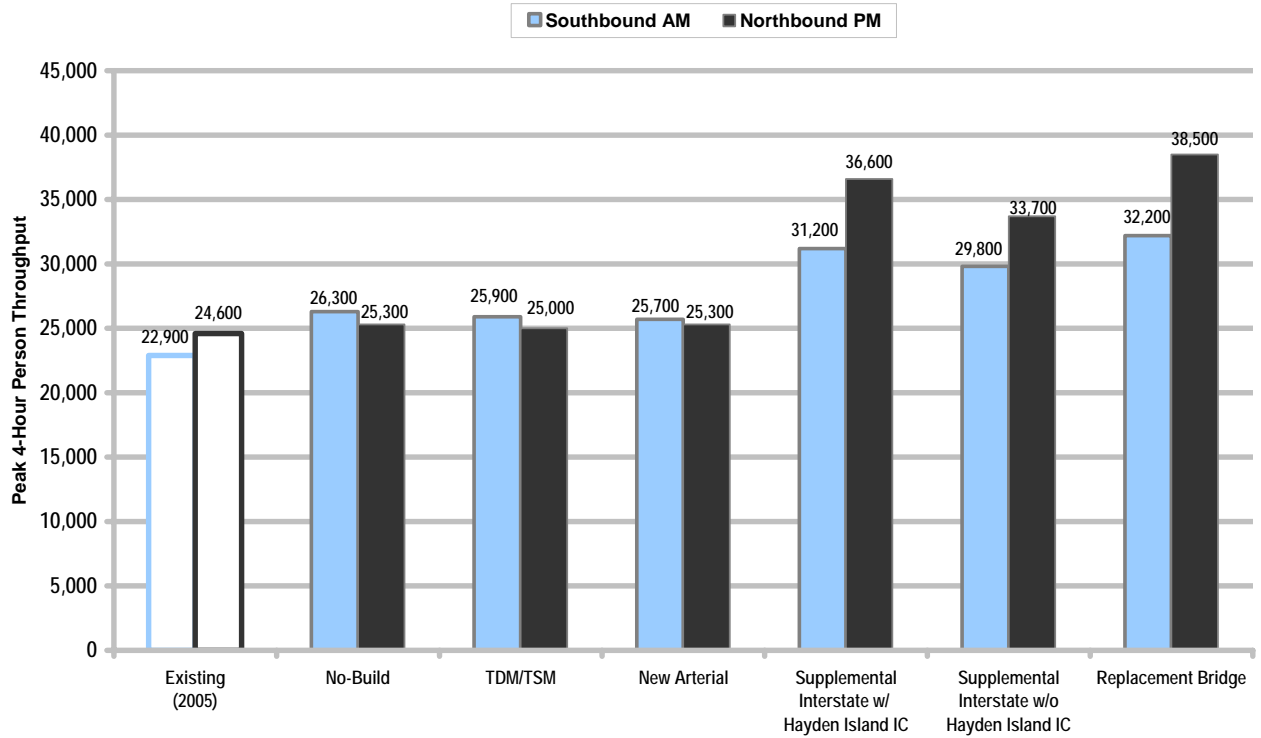
Criterion 2.5 – Improve person throughput of I-5 Columbia River crossing

(Part of Value 2 – MOBILITY, RELIABILITY, ACCESSIBILITY, CONGESTION REDUCTION, AND EFFICIENCY)

◆ Performance Measure(s)
<ul style="list-style-type: none">• Persons served in vehicles across the I-5 Bridge in the peak directions and during the morning and afternoon peak periods• Peak period mode split between SOV, HOV and transit for I-5.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none">• The Supplemental Interstate and Replacement Bridge alternatives proved the highest person (in vehicles) throughput• Alternative Packages 8 with a combined transit service of LRT and express buses would have the greatest annual transit capacity over the Columbia River on I-5 and would have the highest transit percentage of the PM peak period peak direction mode split at 16%.• Alternative Packages 4 and 9, with LRT alone, would have the next highest annual transit capacity and the next highest transit PM peak period peak direction mode split at 15%.
◆ Key Findings
➤ River Crossing
<ul style="list-style-type: none">• The TDM/TSM and New Arterial alternatives provide similar peak period person (in vehicles) throughput across the I-5 Bridge as the No Build alternative• The Supplemental Interstate alternatives accommodate about 15% to 20% higher southbound AM peak period person throughput and about 35% to 45% higher northbound PM peak period person throughput than the TDM/TSM and New Arterial alternatives• The Replacement Bridge alternatives accommodate about 20% to 25% higher southbound AM peak period person throughput and about 50% to 55% higher northbound PM peak period person throughput than the TDM/TSM and New Arterial alternatives• <i>Note: The TDM/TSM and New Arterial alternatives do not accommodate I-5 Bridge travel demands, resulting in substantial congestion and increased travel times (see Criteria 2.1 and 2.3)</i>



Person Throughput (in Vehicles) on I-5 Bridge (Year 2030*)



*Except for Existing Conditions (Year 2005)

➤ **Transit**

With the 2030 No Build, Alternative Package 1, the PM peak period and peak direction mode split is 11% for transit, 61% for SOV and 28% for HOV.

Table 1 lists the forecasted 2030 mode split in the PM peak period, peak direction. Providing both LRT and express bus service would generate the highest transit percentage of the PM peak period, peak direction mode split. This combined transit service, (represented by Alternative 8), would have a mode split of 16% for transit, 55% for SOV and 29% for HOV. LRT alone (Alternative Packages 4 and 9) would have the next highest PM peak period mode split for transit at 15% (56% for SOV and 29% for HOV).

BRT, with Alternative Packages 5 and 10, would have a transit mode split of 14% for the PM peak period peak direction. BRT-Lite and express bus service (Alternative Packages 6, 7, 11 and 12) would have the same PM peak period mode split over the Columbia River at 13% for transit, 58% for SOV and 29% for HOV.

Table 1

Transit Mode:	2030 Forecasted Transit Mode Split
Express Bus	13%
BRT-Lite	13%
BRT	14%
LRT	15%
LRT & Express Bus	16%

➤ **Roadways North and Roadways South**

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

Criterion 2.6 – Improve vehicle throughput of I-5 Columbia River crossing

(Part of Value 2 – MOBILITY, RELIABILITY, ACCESSIBILITY, CONGESTION REDUCTION, AND EFFICIENCY)

◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]

- Traffic volumes served across the I-5 Bridge in the peak directions and during the morning and afternoon peak periods
- Determined based on travel demand and traffic operations analysis

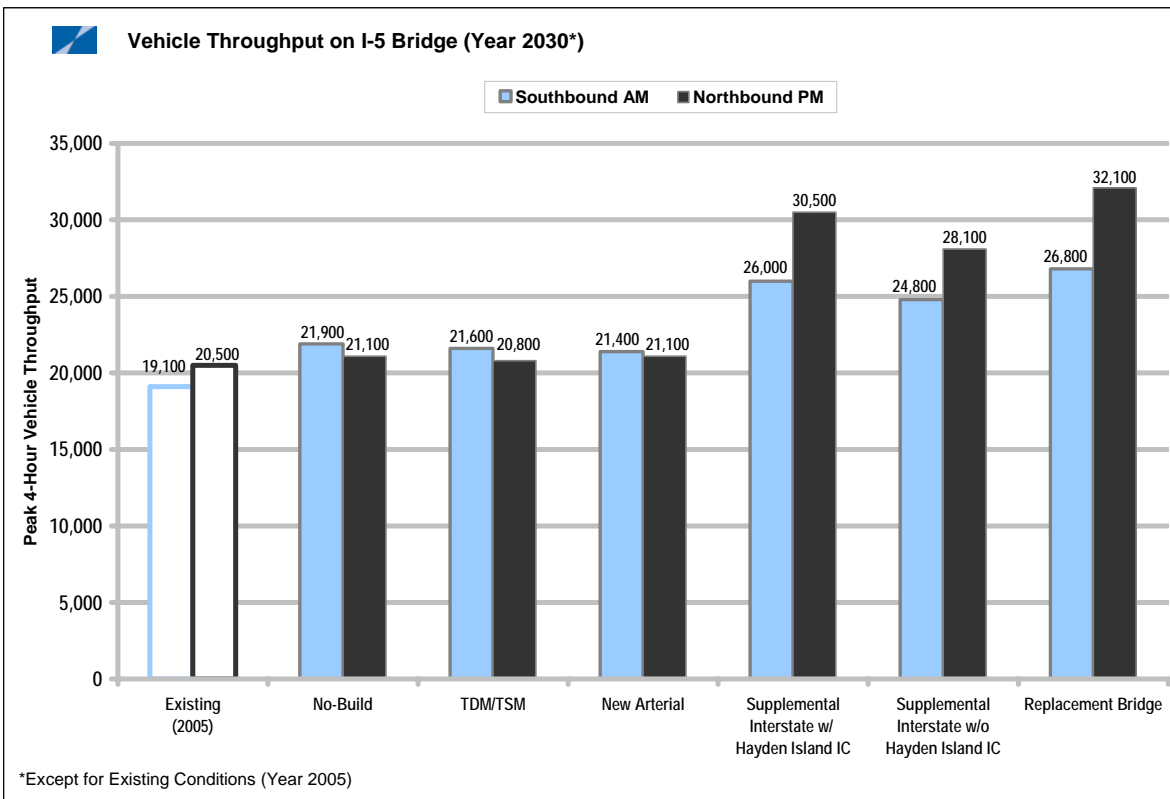
◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]

- The Supplemental Interstate and Replacement Bridge alternatives provide the highest traffic volume throughput

◆ Key Findings

➤ River Crossing

- The TDM/TSM and New Arterial alternatives provide similar peak period throughput across the I-5 Bridge as the No Build alternative
- The Supplemental Interstate alternatives accommodate about 15% to 20% higher southbound AM peak period traffic volumes and about 35% to 45% higher northbound PM peak period traffic volumes than the TDM/TSM and New Arterial alternatives
- The Replacement Bridge alternatives accommodate about 20% to 25% higher southbound AM peak period traffic volumes and about 50% to 55% higher northbound PM peak period traffic volumes than the TDM/TSM and New Arterial alternatives
- *Note: The TDM/TSM and New Arterial alternatives do not accommodate I-5 Bridge travel demands, resulting in substantial congestion and increased travel times (see Criteria 2.1 and 2.3)*



➤ Transit

➤ Roadways North and Roadways South
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)

Criterion Performance

Criterion 3.1 – Provide for multi-modal transportation choices in the I-5 corridor and within the Bridge Influence Area

(Part of Value 3 – MODAL CHOICE)

<p>◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]</p>
<ul style="list-style-type: none"> • Percent of population and employment with access to transit within ¼ mile of bus lines (Local and Express Bus) and within ½ mile of High Capacity Transit (HCT) stations and park and rides.
<p>◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]</p>
<ul style="list-style-type: none"> • The best performing packages include both an HCT mode and Express Bus. • The No Build and the TSM/TDM Alternative Packages (1 and 2) would provide the least amount of access to transit because there would be no new transit facilities within the BIA. Furthermore, by 2030 the proximity of population and employment to the bus network is diminished due to the unchanging nature of bus routes and forecasted changes in regional population growth.
<p>◆ Key Findings</p>
<p>➤ River Crossing</p>
<p>While river crossings do not directly affect modal choice, they can influence the quality of transit service. Replacement bridge alternatives (Packages 8-12) place transit on a new fixed-span crossing. This allows transit to avoid bridge lifts, thus improving travel time and reliability. Thus replacement bridges indirectly enhance multi-modal transportation choices.</p>
<p>➤ Transit</p>
<p>For this measure, the two areas that are closely analyzed are Clark County and the Bridge Influence Area because this is where the bulk of new transit services would be implemented under the build alternatives; including expanded or new park-and-rides with Express Bus service and stations associated with the HCT components.</p> <p>For 2005 Existing Conditions, approximately 67% of the population, and 83% of employment is within ¼ mile of a bus route. For 2030 No Build, approximately 61% of the population and 77% of employment is within ¼ mile of a bus route (both data points given here are on a region-wide basis). The reduction between today and 2030 No Build is largely due to a static transit network and forecasted changes in regional population growth. Approximately 88% of the population in Clark County will be within ¼ mile of a local bus route in 2030.</p> <p>Improvements to the Express Bus service would mostly be seen in Clark County and the Bridge Influence Area; although it would provide improved service to the Portland CBD it would not be accessible to transit in Oregon. Park and ride lots, new or expanded, served by Express Buses would give transit riders more choices as to where to begin their transit trip. Proximity of housing and employment to park-and-ride lots is used to measure usage of Express Bus service (Alternative Packages 3, 7, 8 and 9). In 2030, approximately 17% of the population and 12% of employment in Clark County would be within ½ mile of newly planned or existing park-and-ride lots (a total of 10 park-and-ride lots with 4,500 spaces). Express Bus options would include a local bus network with approximately 88% of the population in Clark County within ¼ mile of a bus route.</p> <p>Population and employment within ½ mile of a HCT (LRT or BRT) station is used to assess to these transit modes. For either LRT or BRT the stations (a total of 6 new HCT stations including one on Hayden Island) are in the same location along the same alignment route to the terminal station at Kiggins Bowl. In 2030, approximately 8% of the population and 12% of employment in Clark County will be within ½ mile of a proposed HCT station. LRT and BRT options would include a local bus network with approximately 88% of the population in Clark County within ¼ mile of a bus route.</p>
<p>➤ Roadways North and Roadways South</p>
<p>➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)</p>

Criterion Performance

Criterion 3.2 – Improve transit service to target markets in the I-5 corridor and within the Bridge Influence Area

(Part of Value 3 – MODAL CHOICE)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Transit travel-times from Clark County transit markets to Oregon transit markets (in vehicle travel times in the AM and PM peak periods for two representative pairs).
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> Due to an exclusive guideway, LRT alternatives have the most reliable overall travel time between downtown Vancouver and downtown Portland. BRT provides similar travel times to LRT through the BIA, but BRT vehicles operate in general traffic south of the BIA. This increases southbound AM peak travel times but decreases northbound PM peak travel times because the BRT makes no stops south of the BIA and the I-5 traffic enhancements improve traffic speeds in the NB direction. Express Bus travel times are 10 to 90% longer than LRT in the AM peak (southbound) and the same as or up to 50% shorter than LRT in the PM peak (northbound). With the I-5 traffic improvements and no stops south of the BIA, northbound Express Buses would travel in improved traffic conditions. BRT-Lite alternatives have the longest travel times due to their use of downtown general purpose lanes and I-5 managed lanes in lieu of an exclusive guideway. Replacement bridge options and the new arterial bridge option provide the best transit travel times and reliability because they allow LRT and BRT to operate on a new, fixed span bridge, thus avoiding delays and increased travel times due to bridge lifts.

◆ Key Findings																												
<p>➤ River Crossing</p> <p>Replacement bridges perform better than Supplemental bridges because the former places transit on a fixed-span crossing. One cause of transit vehicle delay on the river crossing itself is bridge-lifts; raising the lift-span on the I-5 Bridge takes only a matter of minutes, but the resultant transit vehicle delay can be significant. Furthermore, the US Coast Guard has indicated that the current restrictions on bridge lifts (lifts are not allowed during peak travel times) would likely be removed if I-5 traffic were no longer on these bridges. Thus, bridge lifts would likely occur much more frequently than today and would occur during peak travel periods. Bi-state transit service is also affected by traffic incidents/crashes, which randomly occur within the bridge influence area.</p> <p>Traffic crashes have the largest impact on travel-time variability, with about 28 minutes of delay observed in the corridor for a northbound crash on the I-5 Bridge. Each bridge lift resulted in about 17 minutes of delay. Incident delays for fixed-route local buses were even greater than express buses: 45 minutes for bridge lifts and 60 minutes for traffic crashes, primarily because ramp meters constrain arterial access to I-5 under severe traffic conditions. Empirical data shows that congestion, bridge lifts, and incident delay on a portion of a bus route, in this case along I-5, can seriously deteriorate reliability on the entire route.</p>																												
<p>➤ Transit</p> <p>Transit vehicle travel time for northbound PM peak segments and southbound AM peak segments are included in the table below. These travel-time segments do not include any delays that would be associated with bridge lifts, incidents or crashes. The travel time for high-capacity transit operating on the existing lift-span bridge (packages 4, 5 and 6) would be longer than reported below when a bridge lift occurs, as discussed above for River Crossings. For buses that operate on I-5, the travel-times reported here are a high speed and a low speed estimate. Both Table 1 and Table 2 report the travel time estimates.</p>																												
<p>■ Table 1.0 Estimated Travel-Time in Minutes Between Kiggins Bowl and Pioneer Courthouse Square</p> <table border="1"> <thead> <tr> <th rowspan="2">Transit Mode:</th> <th colspan="2">AM Southbound</th> <th colspan="2">PM Southbound</th> <th rowspan="2">Type of Right-of-Way</th> </tr> <tr> <th>Low Speed Estimate</th> <th>High Speed Estimate</th> <th>Low Speed Estimate</th> <th>High Speed Estimate</th> </tr> </thead> <tbody> <tr> <td>Express Bus</td> <td>40</td> <td>49</td> <td>20</td> <td>28</td> <td>I-5 managed lanes without stops</td> </tr> <tr> <td>BRT-Lite</td> <td>48</td> <td>54</td> <td>38</td> <td>43</td> <td>General purpose and managed lanes with station stops</td> </tr> <tr> <td>BRT</td> <td>45</td> <td>49</td> <td>33</td> <td>38</td> <td>44% in exclusive right-of-way and 56% in I-5 general purpose lanes with station stops</td> </tr> </tbody> </table>	Transit Mode:	AM Southbound		PM Southbound		Type of Right-of-Way	Low Speed Estimate	High Speed Estimate	Low Speed Estimate	High Speed Estimate	Express Bus	40	49	20	28	I-5 managed lanes without stops	BRT-Lite	48	54	38	43	General purpose and managed lanes with station stops	BRT	45	49	33	38	44% in exclusive right-of-way and 56% in I-5 general purpose lanes with station stops
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LRT	37	37	37	37	100% in exclusive right-of-way with station stops
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Table 2.0 Estimated Travel-Time in Minutes Between Vancouver CBD and Rose Quarter TC

Transit Mode:	AM Southbound		PM Southbound		Type of Right-of-Way
	Low Speed Estimate	High Speed Estimate	Low Speed Estimate	High Speed Estimate	
Express Bus	30	36	16	22	I-5 managed lanes without stops
BRT-Lite	34	39	21	27	General purpose and managed lanes with station stops
BRT	23	27	14	16	44% in exclusive right-of-way and 56% in I-5 general purpose lanes with station stops
LRT	19	19	19	19	100% in exclusive right-of-way with station stops



➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

Criterion 3.3 – Improve bike/pedestrian connectivity in the I-5 corridor and within the Bridge Influence Area

(Part of Value 3 – MODAL CHOICE)

♦ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]

- Improve bicycle and pedestrian safety along the I-5 corridor and in the Bridge Influence Area
- Provide more direct access to residential, employment and recreational destinations along I-5

♦ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]

- The Supplemental Interstate and Replacement Bridge alternatives would provide the best comprehensive multi-use enhancements, with pathway and connection improvements provided north of, across, and south of the river

♦ Key Findings

➤ River Crossing

RESULTS:

EXISTING CONDITIONS:

- Existing bicycle and pedestrian facilities in the I-5 corridor and within the I-5 Bridge Influence Area are circuitous and consist of nonstandard connections between key residential, employment and recreational locations. Existing pathways lack proper features, are in need of maintenance, and have poor or missing directional signage. The nonstandard existing conditions create a deleterious effect on non-motorized mode choice in the I-5 corridor and within the Bridge Influence Area.

NO-BUILD ALTERNATIVE:

- The No Build alternative would make no improvements to the existing bicycle and pedestrian facilities, other than continued routine maintenance and repair of current infrastructure

TDM/TSM ALTERNATIVE:

- Under the TDM/TSM alternative there would be minor improvements to connections at each end of the bridge but no improvements to the path across the bridge.

NEW ARTERIAL ALTERNATIVE:

- The New Arterial alternative is proposed to contain standardized bicycle and pedestrian facilities including a two-way multi-use separated pathway. This pathway would provide a straight, comfortable and safe connection between downtown Vancouver, Hayden Island and the Marine Drive area.

SUPPLEMENTAL INTERSTATE ALTERNATIVES:

- These options, in addition to carrying arterial traffic and a high capacity transit mode, would include pathway-separated bicycle and pedestrian facilities. These facilities would provide a direct connection between downtown Vancouver, Hayden Island and the Marine Drive area that would follow the current path of I-5, while improving the safety and comfort of bicyclists and pedestrians. Options that use the existing bridges would provide a low-level crossing, compared to crossing on a new mid-level bridge. However, the low-level crossing would be subject to interruptions due to bridge lifts.

REPLACEMENT BRIDGE ALTERNATIVES:

- Any new freeway bridge considered under this option would be equipped with standard bicycle and pedestrian facilities that provide a safe, direct connection between downtown Vancouver, Hayden Island and the Marine Drive area. These new facilities would be separated from the new mainline roadways, improving the safety and comfort of bicyclists and pedestrians.

Note: All results shown above are approximate and subject to change

CONCLUSIONS:

- The TDM/TSM alternative would provide only minor improvements to connections at either end of the bridge.
- A multi-use pathway would be provided as part of the New Arterial alternative connecting to existing pathways on both sides of the bridge
- A new multi-use pathway, with an improved network of paths and connections in the I-5 Bridge Influence Area, would be provided under the Supplemental Interstate and Replacement Bridge alternative

➤ **Transit**

Transit modes do not directly affect bicycle and pedestrian connectivity. However, many bicyclists and pedestrians use transit as part of their commute (e.g. bike to an LRT station and take LRT to downtown Portland). For these commuters, extending LRT through the BIA or adding BRT would improve regional bicycle and pedestrian connections. Therefore, Alternative Packages with LRT or BRT (3, 4, 5, 8, 9, 10) improve bicycle/pedestrian connectivity more than those without high capacity transit.

➤ **Roadways North and Roadways South**

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

Criterion 3.4 – Increase vehicle occupancy in the I-5 corridor and within the Bridge Influence Area

(Part of Value 3 – MODAL CHOICE)

<p>◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]</p> <ul style="list-style-type: none"> • Average vehicle occupancy at the I-5 Bridge for single-occupant and high-occupancy vehicles and trucks • Measured using the regional travel demand model in terms of people per vehicle
<p>◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]</p>
<ul style="list-style-type: none"> • Average combined automobile and truck vehicle occupancy would remain consistent among all alternatives

<p>◆ Key Findings</p>
<p>➤ River Crossing</p>
<p>RESULTS:</p> <p>The preliminary traffic modeling results indicate that average vehicle occupancy across all travel lanes (general purpose plus high occupancy vehicle lanes, if applicable) would be similar (about 1.2 occupants per vehicle) during peak travel periods for all alternatives. However, it should be noted that alternatives with high occupancy vehicle lanes would likely result in increased overall vehicle occupancy.</p> <p>CONCLUSIONS:</p> <p>Average combined automobile and truck vehicle occupancy would remain consistent among all alternatives</p>
<p>➤ Transit</p>
<p>➤ Roadways North and Roadways South</p>
<p>➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)</p>

Criterion Performance

Criterion 4.1 – Enhance vehicle/freight safety

(Part of Value 4 – Safety)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Highway improvements to I-5 that specifically improve vehicle/freight safety within the Bridge Influence Area.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> As designed, Alternative Packages 4, 5, and 10 would provide the most improvements to vehicle/freight safety within the Bridge Influence Area by (1) providing full shoulders on I-5; (2) removing three short weaving sections (at Marine Drive, Hayden Island, and SR 14); (3) operating transit in a separated guideway; and (4) adding freight bypass lanes at difficult merge locations. It’s important to note that all of these safety factors could be included with any of the river crossing Build options, except the new arterial bridge. All of these safety factors, except item 3 – separated guideway – could be paired with any of the transit modes. Only LRT and BRT would incorporate the “separated guideway” safety factor.
◆ Key Findings
➤ River Crossing
<p>No investment in I-5 would occur with Alternative Package 1, 2030 No Build, and therefore it would not improve vehicle/freight safety over the Columbia River. Alternative Package 2 would include minor improvements to correct some geometric deficiencies at SR 14, which may improve vehicle and freight safety at this interchange but would leave most of the river crossing’s substandard design features in place.</p> <p>A new supplemental bridge, with arterial traffic separated from I-5 traffic would allow the Hayden Island interchange on I-5 to be removed. This would improve vehicle and freight safety over the river by eliminating points of conflict and reducing the amount of vehicle weaving. Alternative Package 3 would replace the existing Hayden Island interchange on I-5 with a new supplemental arterial bridge connection. Alternative Packages 4 and 5 would provide a new supplemental bridge for I-5 that would also eliminate the interchange on Hayden Island. The arterial connection to Hayden Island would be via the existing Columbia River bridges plus a new local access bridge across the Oregon Slough,</p> <p>With a replacement bridge, access to Hayden Island from an interchange off of I-5 would be maintained. To improve vehicle and freight safety at this location on I-5, an interchange option (as included in Alternative Packages 8, 10, and 11) provides braided ramps to remove a short weave section from the I-5 main line between Hayden Island and Marine Drive. This would improve safety compared to other interchange options, though to a somewhat lesser degree than removing the interchange. This design feature could be used with any of the replacement bridge options (upstream or downstream).</p> <p>Vehicle and freight safety would be further improved with either a new supplemental or replacement bridge for I-5 (Alternative Packages 4 - 12) because a new bridge would include full highway shoulders and lanes in both the northbound and southbound direction.</p>
➤ Transit
<p>Vehicle and freight safety would be improved with those modes of transit that would operate in a separated guideway, which would reduce the number of buses on I-5 and in general purpose lanes. Therefore, Alternative Packages 3, 4, 5, 8, 9, and 10 that include LRT or BRT as the transit mode would improve vehicle/freight safety within the Bridge Influence Area. Introducing a new mode, such as LRT or BRT, to city streets creates potential conflicts at at-grade crossings. However, lower speeds and signal controls for at-grade crossings reduce the risk.</p>
➤ Roadways North and Roadways South
<p>North or south of the river crossing, within the Bridge Influence Area, improvements specifically for vehicle/freight safety would not be provided with Alternative Packages 1, 2, and 3.</p> <p>Operating I-5 on a new supplemental or replacement bridge (Alternative Packages 4 – 12) would improve vehicle and freight safety north and south of the river crossing because full shoulders would be provided along I-5 through the whole length of the Bridge Influence Area, from SR 500 in the north to Victory Boulevard in the south. Operating I-5 on a new supplemental or replacement bridge also allows a short weaving section at SR 14 to be removed. Between SR 14 and Mill Plain Boulevard, Alternative Packages 4 – 12 include either a braided ramp or a collector/distributor road, which would improve vehicle and freight safety on the I-5 mainline.</p>

South of the Columbia River, safety would be improved with the removal a short weaving section from Marine Drive to southbound I-5 by adding a braided ramp between the Marine Drive and the Interstate Avenue/Denver Avenue interchange. This improvement is included in Alternative Packages 4, 5, 8, 10, and 11; it could be included as an option with either a new supplemental or a replacement bridge for I-5.

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Vehicle and freight safety would be improved with the addition of freight bypass lanes in locations where trucks currently have difficulty entering and exiting I-5. This improvement is included in Alternative Packages 4, 5, 9, and 10; it could be included as an option with either a new supplemental or a replacement bridge for I-5.

Outside of the Bridge Influence Area, re-striping I-5 (in both directions) to add a managed lane network between 139th Street and SR 500 is included in Alternative Packages 4 – 11. Re-striping to add a managed lane would reduce the width of the shoulders in this section of I-5, which may impact vehicle and freight safety.

Criterion Performance

Criterion 4.2 – Enhance bike/pedestrian facilities and safety

(Part of Value 4 – Safety)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Qualitative assessment of improved bicycle and pedestrian pathways provided within an alternative package.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> Alternative Packages 3 - 12 provide similar improvements to bicycle and pedestrian facilities that best enhance safety.

◆ Key Findings
➤ River Crossing
<p>A new replacement bridge or the supplemental arterial bridge would construct on the new bridge, a two-way bicycle path and a two-way pedestrian path and improved connections to North Portland, Hayden Island, and downtown Vancouver. By providing separated facilities meeting current standards Alternative Packages 3 and 8 - 12 best enhance bicycle and pedestrian safety. Alternatives 4-7 would include widened bike and ped paths on the existing bridges, which would also be a substantial improvement over the No-build or TDM/TSM alternatives.</p>
➤ Transit
N/A
➤ Roadways North and Roadways South
N/A
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>New bicycle and pedestrian facilities would not be constructed with Alternative Package 1, 2030 No Build, and therefore bicycle and pedestrian safety would not be enhanced.</p> <p>A new replacement bridge or the supplemental arterial bridge would construct on the new bridge, a two-way bicycle path and a two-way pedestrian path and improved connections to North Portland, Hayden Island, and downtown Vancouver. By providing separated facilities meeting current standards Alternative Packages 3 and 8 - 12 best enhance bicycle and pedestrian safety. Alternatives 4-7 would include widened bike and ped paths on the existing bridges, which would also be a substantial improvement over the No-build or TDM/TSM alternatives.</p>

Criterion Performance

Criterion 4.3 – Enhance or maintain marine safety

(Part of Value 4 – Safety)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • Quality of marine navigation channel geometrics to accommodate ship movements, considering necessary tug and barge turning maneuvers and hazards of additional lift restrictions.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> • A replacement bridge, with Alternative Packages 8 - 12, provides the most benefit to marine safety because the new bridge piers could be located to ease maneuvers between the I-5 bridge and the downstream railroad bridge and there would be no bridge lifts.

◆ Key Findings
<p>➤ River Crossing</p> <p>Alternative Packages 1 and 2 would maintain the existing Columbia River channel geometrics between the existing I-5 bridges and the downstream railroad bridge.</p> <p>If I-5 traffic continued to operate on the existing bridges, as would occur with Alternative Packages 1, 2, and 3, the bridge lift restriction periods, and associated marine hazards, would remain and likely increase with future increases in congestion on I-5. As congestion on I-5 increases, more restrictions on bridge lifts would negatively impact marine navigation.</p> <p>For marine navigation and safety, a new supplemental bridge would have to be constructed so that the new piers would be in line with the piers of the existing bridges. Even with the piers in line, a new downstream supplemental bridge would reduce the available distance for ships to maneuver between the supplemental bridge and the downstream railroad bridge. Therefore, Alternative Packages 3 - 7, because they increase the number of obstructions in the water, would negatively impact marine maneuvers and safety.</p> <p>Operating I-5 on a new supplemental bridge and using the existing bridges for arterial traffic, as is proposed with Alternative Packages 4 - 7, could reduce the bridge lift restriction period. This aspect would benefit marine safety.</p> <p>A replacement bridge would allow the new bridge piers to be located to ease ship maneuvers between the I-5 bridge and the downstream railroad bridge, would reduce the number of obstructions in the water, and would eliminate bridge lifts. Alternative Packages 8 - 12 would provide the greatest improvements to marine safety.</p>
<p>➤ Transit</p>
<p>➤ Roadways North and Roadways South</p>
<p>➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)</p>

Criterion Performance

Criterion 4.4 – Enhance or maintain aviation safety

(Part of Value 4 – Safety)

◆ Performance Measure(s)
<ul style="list-style-type: none">• Ability to accommodate Federal Aviation Administration (FAA) clearance zone for Pearson Airpark.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none">• Alternative Packages 8, 9, and 11, which include a downstream replacement bridge that would increase the distance between the I-5 bridge and Pearson Airpark, would best accommodate the FAA clearance zone for Pearson Airpark and therefore best enhance aviation safety.

◆ Key Findings
➤ River Crossing
<p>The towers of the existing I-5 bridges encroach 55 feet into the approach slope to Pearson Airpark. This impact to the FAA clearance zone would continue with those alternatives that would keep the existing bridges (Alternative Packages 1 - 7).</p> <p>A new supplemental bridge would be constructed at a lower elevation than the existing bridge towers; however, they would still have a slight impact on the desirable clearance zone for Pearson Airpark. In addition to the supplemental bridge, the existing bridges (which encroach into the airspace) would remain. Therefore, Alternative Packages 3 - 7 would result in two structures within the airspace that may impact aviation safety.</p> <p>A replacement bridge would enhance aviation safety because, as with a new supplemental bridge, they would be constructed at a lower elevation than the existing bridge towers and the existing bridges would be removed. Alternative Packages 8, 9, and 11 would provide the greatest benefit to aviation safety because the replacement bridge would be downstream from the existing bridges, which would increase the distance between the I-5 bridge and Pearson Airpark. Under Alternative Packages 10 and 12 the replacement bridge would be upstream from the existing bridges, which would slightly reduce the distance between the I-5 bridges and Pearson Airpark. With Alternative Packages 10 and 12, aviation safety would be enhanced but, because of the reduced distance between the bridge and Pearson Airpark, to a slightly lesser degree than with a downstream replacement bridge.</p>
➤ Transit
➤ Roadways North and Roadways South
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)

Criterion Performance

Criterion 4.5 – Provide sustained life-line connectivity

(Part of Value 4 – Safety)

◆ Performance Measure(s)
<ul style="list-style-type: none">Ability to accommodate life-line connections in the I-5 corridor across the Columbia River to be maintained in an earthquake.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none">All of the Build alternatives (3-12) would create a life-line connection across the river. Alternative Packages 8 - 12, with a new replacement bridge, would provide the best sustained life-line connectivity in the I-5 corridor across the Columbia River in the event of an earthquake because they would be built to current seismic standards and would carry and maintain travel for all transportation modes (traffic, transit, and bicycle/pedestrian). While the existing bridge could be seismically upgraded, it is unlikely that such an upgrade would provide the same level of seismic safety as would a new bridge.
◆ Key Findings
➤ River Crossing
<p>Alternative Packages 1 and 2 would not include seismically retrofitting the existing bridges. Without being retrofitted, the existing bridges would be significantly more vulnerable to earthquake damage, which would mean a life-line connection would not be provided in the I-5 corridor across the Columbia River.</p> <p>With Alternative Package 3, the new supplemental arterial bridge would be constructed to current seismic standards and would maintain a connection across the Columbia River. However, the arterial bridge would have less capacity than I-5 and would not provide a direct connection through the I-5 corridor. I-5 would continue to operate on the existing bridges which could be retrofitted to current seismic standards. Unless the existing bridges are retrofitted, they may not withstand an earthquake event and a life-line connection with adequate capacity in the I-5 corridor would not be provided.</p> <p>Operating I-5 on a new supplemental or replacement bridge (Alternative Packages 4 – 12), constructed to current seismic standards, would provide a more effective life-line connection across the Columbia River in the event of an earthquake. Replacement bridge options, because they place all modes on the new bridge (Alternative Packages 8 - 12) – provide the most comprehensive life-line connection through the I-5 corridor.</p>
➤ Transit
<p>Transit service, which connects people to their homes, jobs, and other services, is part of the life-line connection in the I-5 corridor. The vulnerability of transit to an earthquake is less a function of the mode and more a function of the structures on which the mode operates. Operating transit on the existing bridges without seismic upgrade (No-Build and TSM/TDM only) provides the highest vulnerability; transit on a seismically upgraded bridge greatly reduces vulnerability; transit on a new bridge provides the highest likelihood for maintaining a life-line connection for transit. Any of the transit modes can be placed on the new structure. However, those packages that place LRT on the existing bridge would not have the flexibility to reroute it to the new bridge following earthquake damage.</p> <p>With Alternative Packages 3, 7, and 8 – 12, the proposed transit service would operate on the new supplemental or replacement bridge which would be constructed to current seismic standards and would likely maintain this connection across the Columbia River and in the I-5 corridor in the event of an earthquake.</p>
➤ Roadways North and Roadways South
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>The bicycle and pedestrian connection across the Columbia River would be on the existing bridges with Alternative Packages 1, 2, and 4 - 7. Unless the existing bridges are seismically retrofitted, this life-line connection across the Columbia River would not be maintained.</p> <p>With Alternative Packages 3 and 8 – 12, the bicycle and pedestrian connection across the Columbia River would be on a new supplemental or replacement bridge which would be constructed to current seismic standards and would maintain this life-line connection across the Columbia River and in the I-5 corridor in an earthquake event.</p>

Criterion Performance

Criterion 4.6 – Enhance I-5 incident/emergency response access within the Bridge Influence Area

(Part of Value 4 – Safety)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Ability to accommodate incident/emergency service access to incidents on I-5 in the Bridge Influence Area.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> Alternative Packages 5 and 10 would provide the greatest amount of access and capacity improvements to I-5 (such as a new supplemental or replacement bridge for I-5, HCT in a separated guideway, and interchange improvements) that would best enhance emergency response access to incidents on I-5 in the Bridge Influence Area.
◆ Key Findings
➤ River Crossing
<p>If I-5 continued to operate on the existing bridges (Alternative Packages 1 - 3), emergency service access to incidents on I-5 would continue to be impacted by bridge lifts and by the substandard width of the bridges, which do not include shoulders.</p> <p>With Alternative Package 2, the interchange improvements at SR 14 and Hayden Island, which would improve capacity and congestion, may slightly enhance emergency service access. However, the river crossing would still impact existing emergency response due to substandard shoulders.</p> <p>A new supplemental or replacement bridge for I-5 would provide additional capacity over the Columbia River, include full shoulder widths, and not require bridge lifts. Therefore, Alternative Packages 4 - 12 would enhance emergency response and access on I-5 in the Bridge Influence Area.</p> <p>A new supplemental or replacement bridge for I -5 (Alternative Packages 4 – 12) would also allow for improvements at SR 14 and Hayden Island that would better manage congestion on I-5 and enhance emergency service to incidents.</p>
➤ Transit
<p>N/A</p>
➤ Roadways North and Roadways South
<p>South of the river crossing, improvements to the Marine Drive interchange may improve emergency response on I-5. This improvement is proposed with Alternative Packages 4, 5, 8, 10, and 11; it could be included as an option with a new supplemental or replacement bridge for I-5.</p> <p>North of the river crossing, ramps to and from the north at SR 500 would be provided with either a new supplemental or replacement bridge for I-5 (Alternative Packages 4 – 12). Adding these ramps at SR 500 would increase access points to I-5, which would improve emergency service and access to incidents on I-5 in the Bridge Influence Area.</p> <p>Eliminating northbound ramps on I-5 at 39th Street (included as an option with Alternative Packages 4, 7, 8, and 12) would result in out-of-direction travel that may impact emergency service and access.</p>
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>A managed lane network on I-5 through the Bridge Influence Area (included with Alternative Packages 4 – 11) would provide options to increase traffic efficiency, which may enhance emergency service access to incidents on I-5.</p>

Criterion Performance

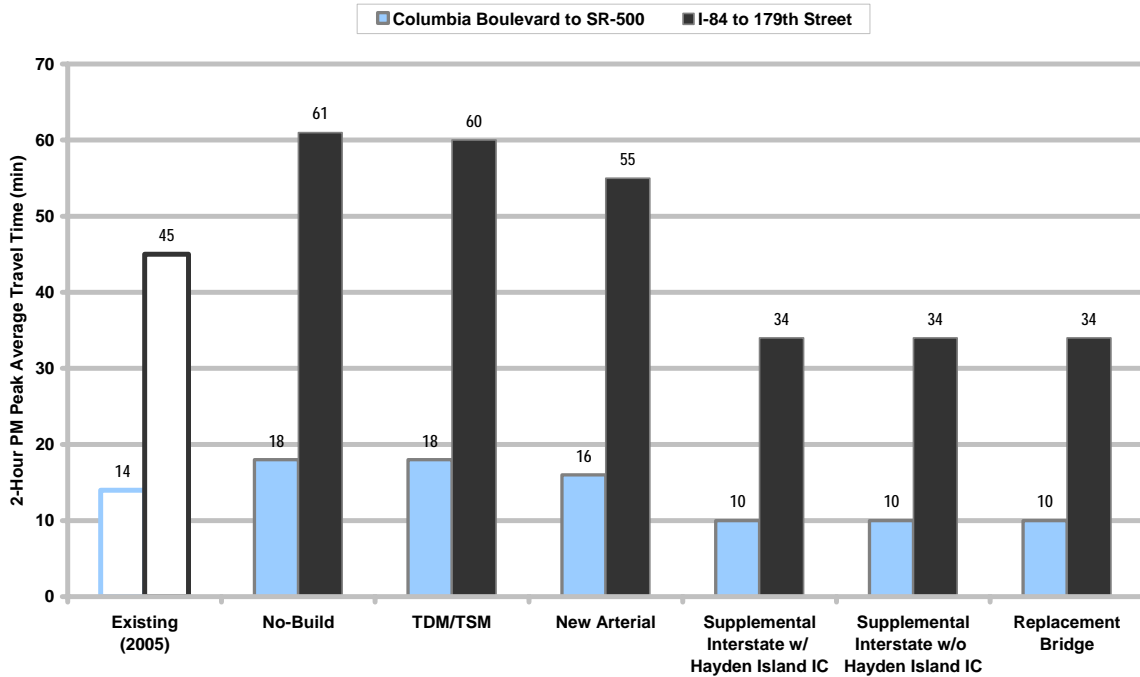
Criterion 5.1 – Reduce travel times and reduce delay for vehicle-moved freight on I-5 within the Bridge Influence Area

(Part of Value 5 – Regional Economy; Freight Mobility)

◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]
<ul style="list-style-type: none">• Truck travel times on I-5 in the Bridge Influence Area (between SR-500 and Columbia Blvd.)• Determined based on travel demand and traffic operations analysis
◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]
<ul style="list-style-type: none">• The Supplemental Interstate and Replacement Bridge alternatives result in the shortest truck travel times

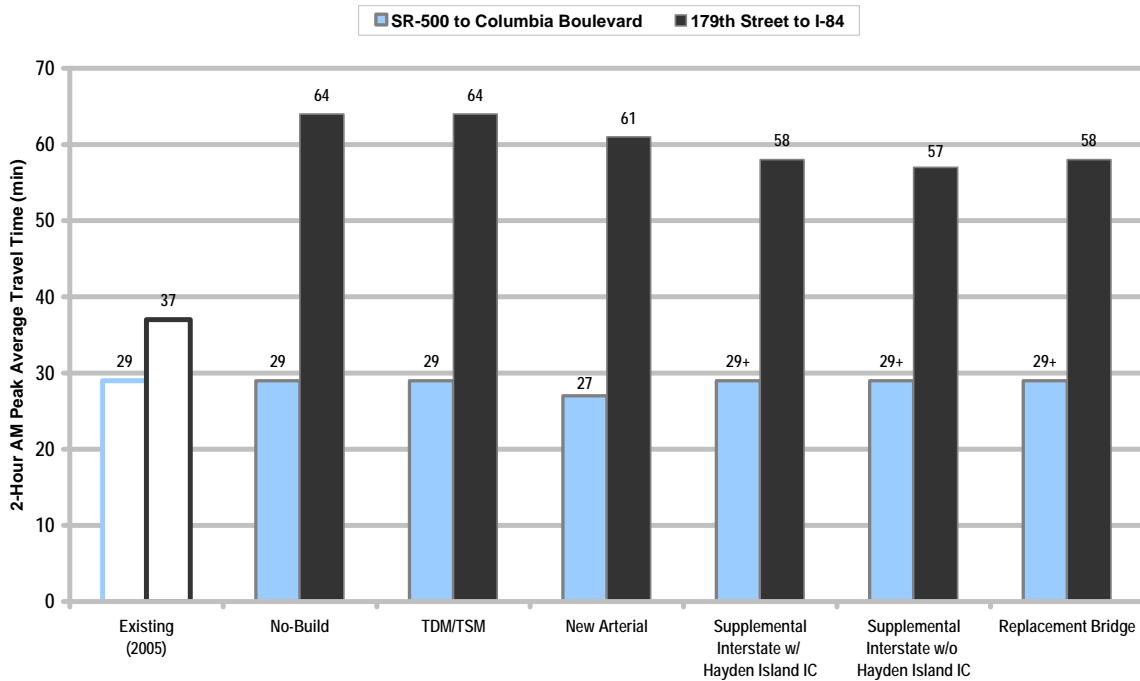
◆ Key Findings
➤ River Crossing
<ul style="list-style-type: none">• The TDM/TSM and New Arterial alternatives provide similar truck travel times along I-5 as the No-Build alternative• The Supplemental Interstate and Replacement Bridge alternatives reduce northbound I-5 truck travel times compared to the TDM/TSM and New Arterial alternatives by 50% to 60%• The Supplemental Interstate and Replacement Bridge alternatives result in similar to slightly higher southbound I-5 travel times during the AM peak period compared to the TDM/TSM and New Arterial alternatives due to constraints on I-5 south of the Bridge Influence Area• <i>Note: The Supplemental Interstate and Replacement Bridge alternatives accommodate about 20% to 25% higher southbound AM peak period truck traffic volumes and about 30% to 50% higher northbound truck traffic volumes than the TDM/TSM and New Arterial alternatives (see Criterion 5.4)</i>• <i>Note: The Supplemental Interstate and Replacement Bridge alternatives reduce the duration of congestion by about 55% to 60% compared to the TDM/TSM and New Arterial alternatives (see Criterion 2.3)</i>

Northbound I-5 Truck Travel Times (Year 2030*)



*Except for Existing Conditions (Year 2005)

Southbound I-5 Truck Travel Times (Year 2030*)



*Except for Existing Conditions (Year 2005)

➤ **Transit**

➤ **Roadways North and Roadways South**

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

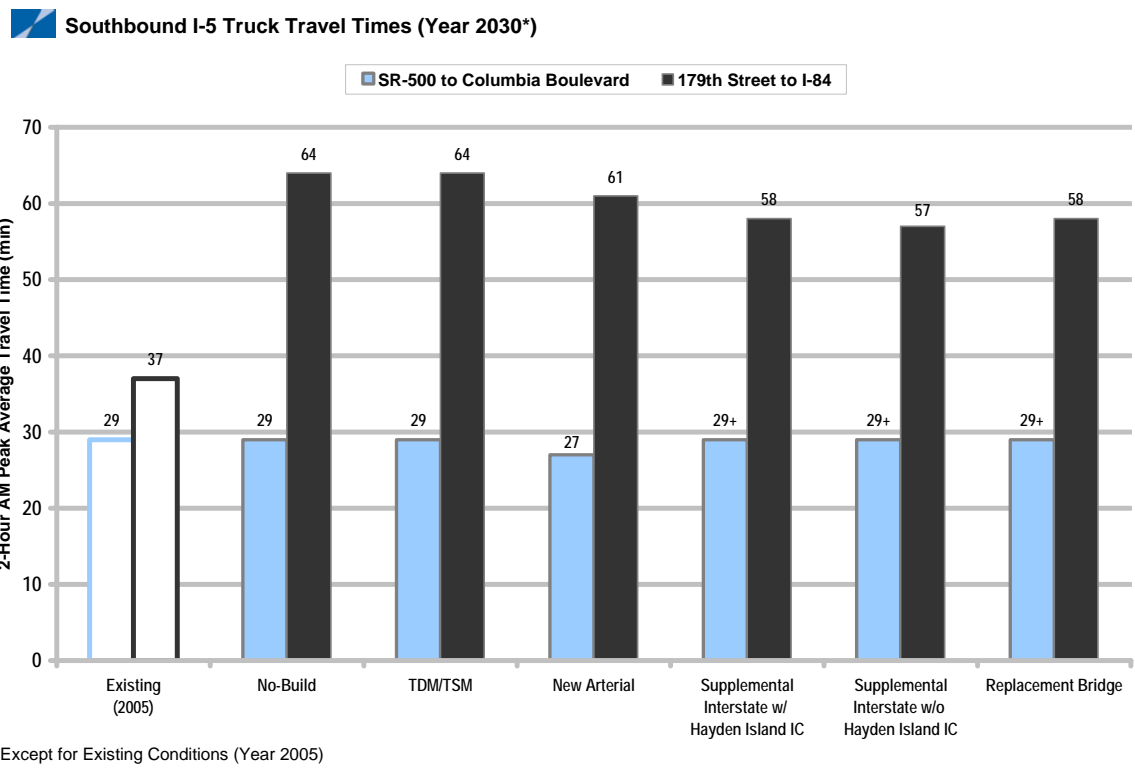
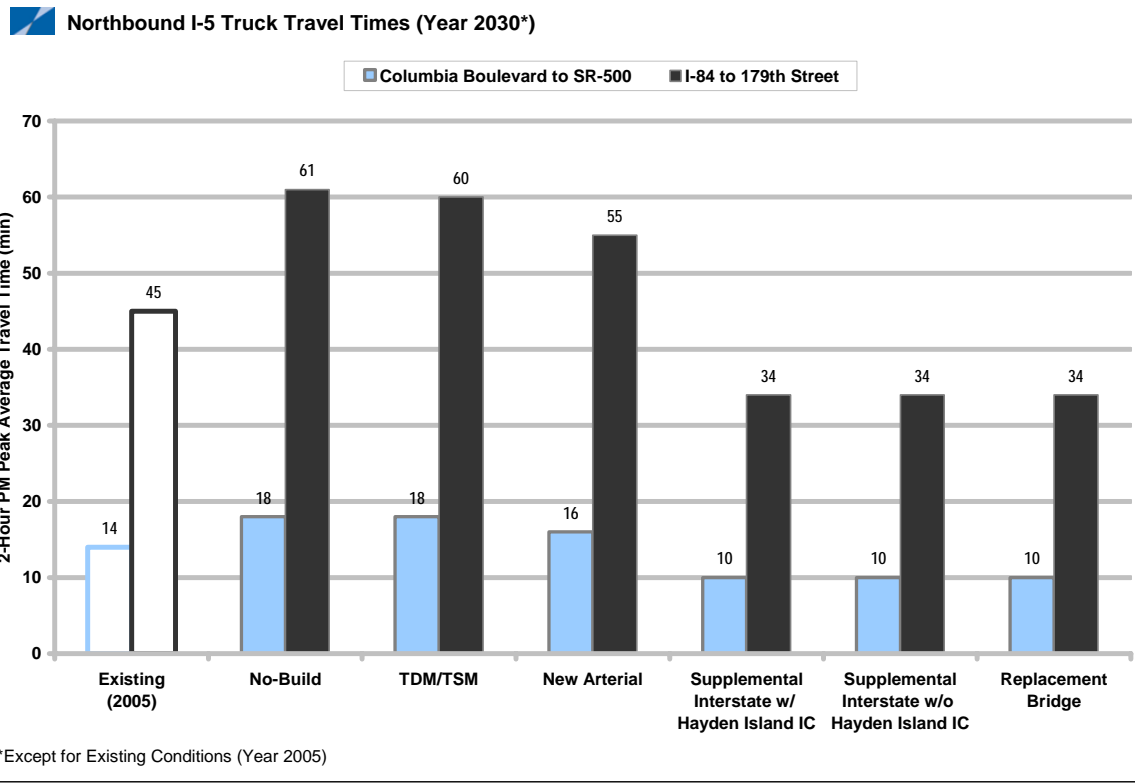
Criterion Performance

Criterion 5.2 – Reduce travel times and reduce delay for vehicle-moved freight in the I-5 corridor

(Part of Value 5 – Regional Economy; Freight Mobility)

◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]
<ul style="list-style-type: none">• Truck travel times between 179th Street and I-84• Determined based on travel demand and traffic operations analysis
◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]
<ul style="list-style-type: none">• The Supplemental Interstate and Replacement Bridge alternatives result in the shortest truck travel times

◆ Key Findings
➤ River Crossing
<ul style="list-style-type: none">• The TDM/TSM and New Arterial alternatives provide similar truck travel times along I-5 as the No-Build alternative• The Supplemental Interstate and Replacement Bridge alternatives reduce northbound I-5 truck travel times compared to the TDM/TSM and New Arterial alternatives by about 50% or more• The Supplemental Interstate and Replacement Bridge alternatives reduce southbound I-5 truck travel times during the AM peak period by 5% to 10% compared to the TDM/TSM and New Arterial alternatives• <i>Note: The Supplemental Interstate and Replacement Bridge alternatives accommodate about 20% to 25% higher southbound AM peak period truck traffic volumes and about 30% to 50% higher northbound truck traffic volumes than the TDM/TSM and New Arterial alternatives (see Criterion 5.4)</i>• <i>Note: The Supplemental Interstate and Replacement Bridge alternatives reduce the duration of congestion by about 55% to 60% compared to the TDM/TSM and New Arterial alternatives (see Criterion 2.3)</i>



- **Transit**
- **Roadways North and Roadways South**
- **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

Criterion 5.3 – Enhance or maintain efficiency of marine navigation

(Part of Value 5 – Regional Economy; Freight Mobility)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Potential for an alternative to avert extension of “no bridge lift” periods tied to I-5 congestion.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> The greatest benefit to the efficiency of marine navigation would be with Alternative Packages 8 - 12, which include a replacement bridge, because (1) this would eliminate the existing liftspan bridge, thus eliminating the “no bridge lift” period and (2) it would have fewer piers (approximately 5 versus 14) in the water, resulting in fewer obstructions to the navigation channel.
◆ Key Findings
➤ River Crossing
<p>As congestion on I-5 increases, it is likely that bridge lift restrictions could be increased, thereby further impacting river navigation. Continuing to operate I-5 on the existing bridges (Alternative Packages 1 - 3) would decrease the efficiency of marine navigation because the “no bridge lift” period would be extended.</p> <p>A new supplemental bridge for I-5 (Alternative Packages 4 - 7) would remove the limitations that I-5 traffic places on bridge lifts. The existing bridges would be used for arterial traffic and the “no bridge lift” period may decrease, which would enhance marine navigation. However, there would be approximately three times as many piers in the water.</p> <p>Providing a replacement bridge for I-5 and removing the existing bridges (Alternative Packages 8 – 12) would eliminate the “no bridge lift” period, remove the existing bridge and its navigation obstructions, and provide the greatest benefit to marine navigation.</p>
➤ Transit
<p>None of the transit modes would have a meaningful impact on marine navigation efficiency. However, marine navigation needs would likely impact reliability for some transit mode and river crossing combinations.</p> <p>With a supplemental bridge for I-5, the “no bridge lift” period could be reduced since there would be no direct impact to I-5 traffic. Operating the transit service on the existing bridges (Alternative Packages 4 – 6), which may be subjected to additional bridge lifts, could impact transit schedules but would enhance marine navigation.</p> <p>With a replacement bridge that would also carry transit service (Alternative Packages 8 – 12), the “no bridge lift” period would be eliminated and there would be no impacts to transit service.</p>
➤ Roadways North and Roadways South
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>These elements would have no meaningful impact on river navigation efficiency.</p>

Criterion Performance

Criterion 5.4 – Improve freight truck throughput of the Bridge Influence Area

(Part of Value 5 – Regional Economy; Freight Mobility)

◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]

- Truck volumes served across the I-5 Bridge in the peak directions during the morning and afternoon peak periods
- Determined based on travel demand and traffic operations analysis

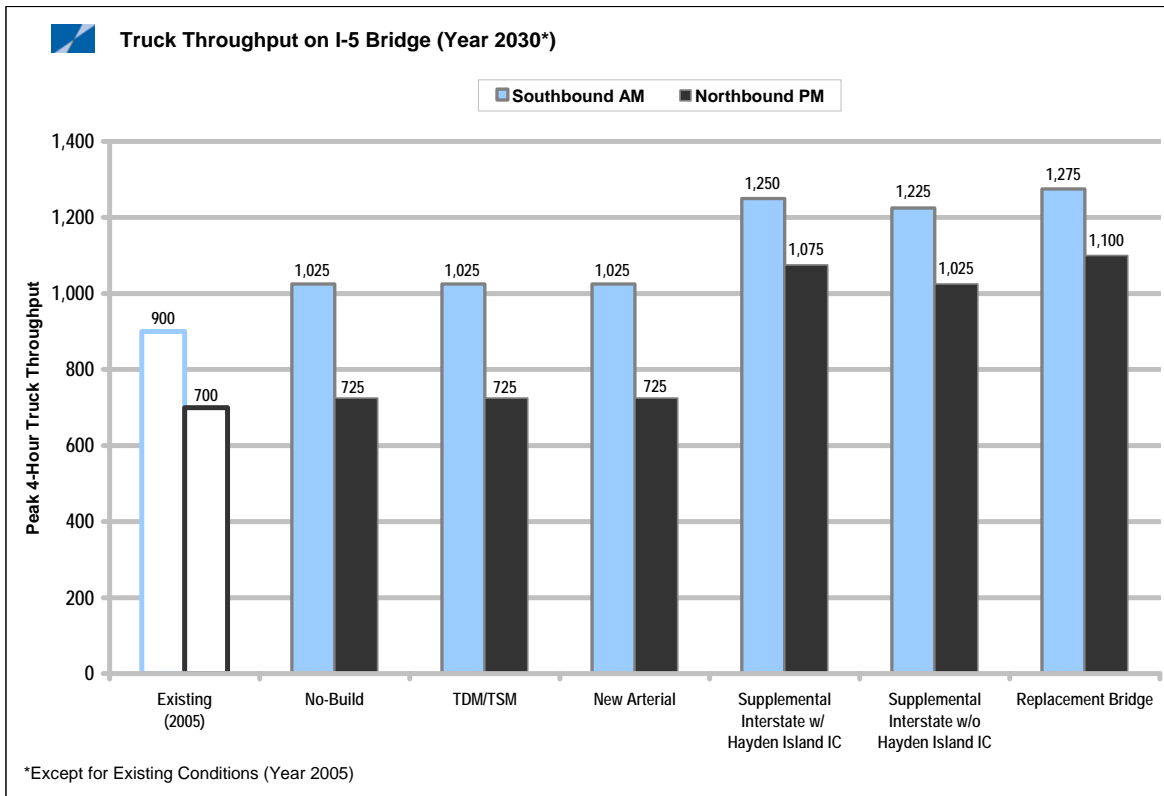
◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]

- The Supplemental Interstate and Replacement Bridge alternatives proved the highest truck traffic throughput

◆ Key Findings

➤ **River Crossing**

- The TDM/TSM and New Arterial alternatives provide similar peak period truck throughput across the I-5 Bridge as the No Build alternative
- The Supplemental Interstate alternatives accommodate about 20% higher southbound AM peak period truck traffic volumes and about 30% (with no Hayden Island interchange) to 50% (with a Hayden Island interchange) higher northbound PM peak period truck traffic volumes than the TDM/TSM and New Arterial alternatives
- The Replacement Bridge alternatives accommodate about 25% higher southbound AM peak period truck traffic volumes and about 50% higher northbound PM peak period truck traffic volumes than the TDM/TSM and New Arterial alternatives
- *Note: The TDM/TSM and New Arterial alternatives do not accommodate I-5 Bridge travel demands, including truck traffic, resulting in substantial congestion and increased travel times (see Criteria 2.1 and 2.3)*



➤ **Transit**

➤ Roadways North and Roadways South
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)

Criterion Performance

Criterion 5.5 – Avoid or minimize adverse impacts to the parallel freight rail corridor

(Part of Value 5 – Regional Economy; Freight Mobility)

<p>◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]</p>
<ul style="list-style-type: none"> • Peak period traffic congestion experienced on east-west arterial roadways within the Bridge Influence Area with at-grade crossings of the north-south BNSF railline • Determined based on travel demand analysis
<p>◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]</p>
<ul style="list-style-type: none"> • An examination of the twelve alternatives reveals that they would each result in similar traffic levels at the at-grade crossings and therefore each alternative would result in similar impacts on freight rail operations.

<p>◆ Key Findings</p>
<p>➤ River Crossing</p>
<ul style="list-style-type: none"> • An examination of the twelve alternatives reveals that they each would result in similar traffic levels at the at-grade intersections and would therefore result in similar impacts on freight rail operations. • Note that the closest, at-grade BNSF rail crossing in the Bridge Influence Area is located about 900 feet east of the W 39th Street/NW Fruit Valley Road intersection in Vancouver. This intersection is located about 1.3 miles west of I-5. • An examination of the twelve alternatives reveals that they each would result in similar traffic levels at the at-grade crossings and would therefore result in similar impacts on freight rail operations.
<p>➤ Transit</p>
<p>➤ Roadways North and Roadways South</p>
<p>➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)</p>

Criterion Performance

Criterion 5.6 – Enhance or maintain access to port, freight, and industrial facilities

(Part of Value 5 – Regional Economy; Freight Mobility)

<p>◆ Performance Measure(s) [list the metrics used to assess the degree to which the established criteria are satisfied.]</p>
<ul style="list-style-type: none"> • Improved accessibility between I-5 and typical freight centers •
<p>◆ Best Performing Package(s) and/or Component(s) [Summarize your findings regarding the components and combination of components that perform best on this criterion.]</p>
<ul style="list-style-type: none"> • The Supplemental Interstate and Replacement Bridge alternatives would provide the greatest accessibility to port, freight, and industrial facilities

<p>◆ Key Findings</p>
<p>➤ River Crossing</p>
<p>EXISTING CONDITIONS, NO-BUILD ALTERNATIVE, TDM/TSM ALTERNATIVE, AND NEW ARTERIAL ALTERNATIVE:</p> <ul style="list-style-type: none"> • These alternatives will provide no to minimal accessibility improvements to I-5 Bridge Influence Area interchanges <p>SUPPLEMENTAL INTERSTATE ALTERNATIVE AND REPLACEMENT BRIDGE ALTERNATIVE:</p> <ul style="list-style-type: none"> • These alternatives would provide accessibility improvements to most or all I-5 Bridge Influence Area interchanges, thereby improving accessibility to nearby freight centers
<p>➤ Transit</p>
<p>➤ Roadways North and Roadways South</p>
<p>➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)</p>

Criterion Performance

Criterion 6.1 – Avoid, then minimize adverse impacts to, and where practicable enhance, threatened or endangered fish or wildlife habitat

(Part of Value 6 – Stewardship of Natural Resources)

◆ Performance Measure(s)

- What is the total area of critical and native habitat for threatened and endangered species within the design area footprint?
- What is the relative quality of the habitat?

◆ Best Performing Package(s) and/or Component(s)

Replacement bridge options perform better than supplemental bridge options.

Express Bus and BRT-Lite options have less direct impact than LRT or BRT, although any transit options that increase transit mode share and better support growth management would likely reduce long-term, indirect impacts to threatened and endangered species.

Alternative Package 12 has the smallest impact on threatened and endangered species; however, the differences are relatively minor.

◆ Key Findings

➤ River Crossing

Supplemental downstream bridge:

Supplemental bridges will add new piers into Columbia River and Oregon Slough (critical habitat for salmonid species), and disturb the (already disturbed) riparian area along the Columbia River and the Oregon Slough. Construction of the supplemental bridge may cause disturbance to peregrine falcons and will disturb salmonid species. Seismic retrofitting of the existing bridge will impact salmonid species, disturb peregrine falcons, and temporarily remove peregrine falcon habitat. Demolition of the existing Oregon Slough Bridge will also impact salmonid species. A supplemental interstate bridge (Alternative Packages 4 – 7) combined with the existing bridges would have approximately 10-20 percent more deck area over the Columbia River, compared to Replacement options. These areas are used as surrogates for the actual area/volume of piers in the water because that information is not yet available. It is assumed that the larger the bridge area, the larger the piers that would be needed. Bridges will also indirectly impact designated critical habitat by shading the river. Supplemental bridge options will also have more (about 14 piers) compared to replacement bridge options (about 5 piers)

Replacement downstream or upstream bridge:

Replacement bridges will remove peregrine falcon habitat, add new piers to the Columbia River and Oregon Slough (critical habitat for salmonid species), and disturb the riparian area along the Columbia River. Construction of the replacement bridge and demolition of existing bridges will cause disturbance to salmonid species. The replacement bridge options (Alternative Packages 8 through 12) would have approximately 18 to 24 acres of area over water. These areas are used as surrogates for the actual area/volume of piers in the water because that information is not yet available. It is assumed that the larger the bridge area, the larger the piers that would be needed. Bridges will also indirectly impact designated critical habitat by shading the river.

Supplemental arterial bridge:

Seismic retrofitting of the existing bridge will impact salmonid species, disturb peregrine falcons, and potentially remove peregrine falcon habitat. The new arterial bridge will add new piers into the Columbia River (critical habitat for salmonid species) and disturb the riparian area along the Columbia River. Construction of the arterial bridge may cause disturbance to peregrine falcons and will disturb salmonid species. The arterial bridge will have an approximate area of 18 acres over the Columbia River and Oregon Slough. The supplemental arterial bridge will also have more piers (about 14) compared to replacement bridge options (about 5 piers)

All river crossing options will impact peregrine falcons and salmonid species through habitat loss and disturbance. A replacement bridge performs better for threatened and endangered salmon in the long term. Building a supplemental or a replacement bridge will both require new piers in the Columbia River. Demolition of the existing bridges in the replacement option will cause additional disturbance to salmonid species, but once those piers are removed only the replacement bridge piers will remain. Building a supplemental bridge will require additional piers in the river, along with larger piers on the existing bridge due to seismic retrofitting. Short-term disturbance is likely greater for the supplemental options. In the long

term, a replacement bridge will have fewer piers in the water, and therefore have a smaller impact. A supplemental arterial bridge (Alternative Package 3), combined with the existing bridges, would have the least total area over water. The new arterial bridge is a smaller supplemental bridge so will have fewer impacts than the supplemental interstate bridge.

➤ **Transit**

LRT and BRT options in Alternative Packages 8, 9, and 10 have a separate bridge for the transit component over the Oregon Slough. This could add more piers into the Oregon Slough (critical habitat for salmonid species) and cause disturbance to salmonids during construction. It could also clear span the Slough.

LRT or BRT require a wider river crossing, increasing area over water.

All LRT and BRT options impact the riparian habitat of Burnt Bridge Creek, which is native habitat for salmonid species.

Express Bus and BRT-Lite components have little direct impacts on threatened and endangered species. On the down side, because they provide less support to growth management goals, compared to LRT or BRT, they could have greater indirect impacts on wildlife and fish.

➤ **Roadways North and Roadways South**

Roadways North have no direct impact on threatened or endangered species.

The Marine Drive Flyover Access has an arterial crossing and an on-ramp from MLK crossing the Oregon Slough. This could add piers (if not clear spanned) into the Oregon Slough (critical habitat for salmonid species) and cause disturbance to salmonids during construction. This option impacts about 1.85 acres of salmonid critical habitat.

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

Criterion 6.2- Avoid, then minimize adverse impacts to, and where practicable enhance, other fish or wildlife habitat

(Part of Value 6 – Stewardship of Natural Resources)

◆ Performance Measure(s)
<ul style="list-style-type: none">• What is the total area of fish and wildlife habitat within the design area footprint?• What is the range of different habitat types within the design area footprint?• What are the impacts to wildlife crossings/passage?• What is the type and quality of habitat within the design area footprint?
◆ Best Performing Package(s) and/or Component(s)
<p>Replacement bridge options perform better than supplemental bridge options. Express Bus and BRT-Lite options have less direct impact than LRT or BRT, although any transit options that increase transit mode share and better support growth management would likely reduce long-term, indirect impacts to fish and wildlife.</p> <p>Alternative Package 12 has the smallest direct impact on fish and wildlife habitat; however, the differences are relatively minor.</p>

◆ Key Findings
<p>➤ River Crossing</p> <p><i>Replacement, downstream or upstream, bridge</i> The replacement bridge options will remove a section of the riparian area (already disturbed) along the Columbia River, but would also provide the opportunity to restore riparian vegetation where the existing bridges are located. New piers will be added within the Columbia River, but the existing piers will be removed. This construction has the potential to impact native fish species, such as lamprey and sturgeon. Demolition of the existing bridge will remove habitat for bridge-nesting species; this can be replaced with the new bridge.</p> <p>Demolition of the existing Oregon Slough Bridge and construction of the new bridge will cause disturbance to native fish species and bridge-nesting species. Construction of the new bridge will also remove (already disturbed) riparian area along the slough, and will add piers in to the slough.</p> <p><i>Supplemental, downstream, bridge</i> A supplemental bridge will remove a section of the riparian area along the Columbia River and will add new piers in the Columbia River, which has the potential to impact native fish species, such as lamprey and sturgeon. Seismic retrofitting of the existing bridge may also disturb native fish species in the Columbia River, along with bridge-nesting species using the existing bridges. Supplemental bridge options will also have more (about 14 piers) compared to replacement bridge options (about 5 piers)</p> <p>Demolition of the existing Oregon Slough Bridge and construction of the new bridge will cause disturbance to native fish species and bridge-nesting species. Construction of the new bridge will also remove (already disturbed) riparian area along the slough, and add piers in to the slough.</p> <p><i>New arterial bridge</i> Seismic retrofitting of the existing bridge will impact native fish species and bridge-nesting species using the bridge. The new arterial bridge will add new piers into the Columbia River and disturb a section of the riparian area along the Columbia River. Construction of the arterial bridge will cause disturbance to native fish species and bridge-nesting species. Demolition of the existing Oregon Slough Bridge and construction of the new bridge will cause disturbance to native fish species and bridge-nesting species. Construction of the new bridge will also remove (already disturbed) riparian area along the slough, and add piers in to the slough.</p> <p>All river crossing options impact City of Portland Environmental Zones (conservation zones), Metro Goal 5 habitat zones, and Clark County Sensitive and Critical lands. Impacts occur in the Burnt Bridge Creek area and along the Columbia River. In Portland, this would also include the Oregon Slough, Delta Slough, and the forested areas at the southwestern edge of the Marine Drive interchange. Alternative Package 3 has the smallest impact on these zones. The only habitats identified during field surveys that are impacted by the river crossings are the open water of the Columbia River and Oregon Slough. Overall, Alternative Package 3 has the smallest impact on these habitats, followed by Alternative Packages 9 and 12.</p>

All river crossing options have the potential to impact native fish in the Columbia River and Oregon Slough, bridge-nesting species using the existing bridges, and riparian habitat along the Columbia River and Oregon Slough. All options are likely to have the same impact on wildlife passage.

➤ **Transit**

The LRT and BRT options in Alternative Packages 8, 9, and 10 have a separate bridge for the transit component over the Oregon Slough. This could add additional piers into the Oregon Slough, alter the riparian area, and cause disturbance to native fish and bridge-nesting species during construction. This bridge may instead clear span the Slough and therefore add no additional piers.

All LRT and BRT options impact the riparian habitat of Burnt Bridge Creek, which is habitat for native fish, migratory birds, and other wildlife species, and is a WDFW Priority Habitat and Clark County Sensitive and Critical Lands. LRT and BRT options also impact City of Portland Environmental Zones, Metro Goal 5 zones, and habitats identified during field surveys. These habitats are generally low to medium quality.

With two exceptions, Express Bus and BRT-Lite options have no direct impacts on fish and wildlife habitat. Alternative Packages 7 and 11 transit components impact roughly 1 acre of Clark County Sensitive and Critical Lands.

Transit components that increase transit mode share and better support growth management would likely help reduce long-term, indirect impacts to fish and wildlife habitat.

➤ **Roadways North and Roadways South**

Roadways North alternatives have an impact on WDFW Priority Habitats in the Burnt Bridge Creek riparian area and Urban Open Space, and on Clark County Sensitive and Critical Lands. The SR 500 Flyover Access has a greater impact on these habitats than the SR 500 Tunnel Access, and also impacts more of the habitats identified during field surveys. These habitats are of low to medium quality.

The Hayden Island Access option has no impacts to the Oregon Slough and very small impacts to City of Portland Environmental Zones, Metro Goal 5 zones, and on habitats identified during field surveys.

The Hayden Island Arterial Access option has an arterial crossing and an on-ramp from Martin Luther King Boulevard crossing the Oregon Slough. This could add additional piers into the Oregon Slough, alter the riparian area, and cause disturbance to native fish and migratory birds during construction. The Hayden Island Arterial Access has the largest impact on City of Portland Environmental Zones, Metro Goal 5 zones, and on habitats identified during field surveys (Westside Riparian Wetland habitats). These habitats are of low to medium quality.

The Full Standard option has a split off-ramp south from Hayden Island and a Martin Luther King Boulevard crossing over the Oregon Slough. This could add additional piers into the Oregon Slough, alter the riparian area, and cause disturbance to salmonids during construction. The Hayden Island Full Standard component has the second highest impacts to City of Portland Environmental Zones, Metro Goal 5 zones, and habitats identified during field surveys (Westside Riparian Wetland habitats). These habitats are of low to medium quality.

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Criterion Performance

Criterion 6.3 - Avoid, then minimize adverse impacts to, and where practicable enhance, rare, threatened, or endangered plant species

(Part of Value 6 - Stewardship of Natural Resources)

◆ Performance Measure(s)
<ul style="list-style-type: none">• What is the total area of rare plant habitat within the design area footprint?
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none">• All packages and components perform the same. There is no rare plant habitat impacted by any packages and/or components.

◆ Key Findings
➤ River Crossing
No impacts to rare plant habitat.
➤ Transit
No impacts to rare plant habitat.
➤ Roadways North and Roadways South
No impacts to rare plant habitat.
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
No impacts to rare plant habitat.

Criterion Performance

Criterion 6.4 - Avoid, then minimize adverse impacts to, and where practicable enhance, wetlands

(Part of Value 6 – Stewardship of Natural Resources)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • What is the total area of wetlands within the design area footprint? • What are the types and quality of different wetlands within the design area footprint?
◆ Best Performing Package(s) and/or Component(s)
<p>None of the Alternative Packages or components directly impact wetlands. The BRT and LRT components come within 3 feet of a wetland along Burnt Bridge Creek and the Hayden Island Arterial and Full Standard access options come within 40 feet of a wetland southwest of the Marine Drive interchange.</p> <p>The differences among all alternatives are minor.</p>
◆ Key Findings
➤ River Crossing
<p>There are no impacts to wetlands from river crossing options.</p>
➤ Transit
<p>The Express Bus and BRT-Lite options are farthest from the Burnt Bridge Creek wetland, while BRT and LRT options come within about 3 feet of the Burnt Bridge Creek wetland. None of the transit options has any direct impacts to wetlands.</p> <p>Any transit options that increase transit mode share and better support growth management would likely reduce long-term, indirect impacts to other wetlands.</p>
➤ Roadways North and Roadways South
<p>Roadways North components have no impacts on wetlands.</p> <p>The Hayden Island Access and Hayden Island Folded Diamond components are the farthest from the wetland near the Marine Drive interchange, while the Hayden Island Arterial access and the Full Standard components are the closest (within 40 feet).</p>
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>There are no impacts to wetlands under any of these components.</p>

Criterion Performance

Criterion 6.5 - Avoid, then minimize adverse impacts to, and where practicable enhance, water quality

(Part of Value 6 – Stewardship of Natural Resources)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • How much area of additional impervious surface would be introduced by this alternative? • How much existing impervious surface would remain?
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> • The supplemental arterial bridge (package 3) has the smallest design area footprints. The replacement bridge options have smaller total deck area (by about 10% to 20%) than the equivalent supplemental bridge options. • It will generally be easier to treat stormwater runoff from a new bridge than from the existing bridges. However, existing upland space for providing extensive treatment facilities is limited. • The Replacement bridges would have fewer permanent piers in the water and likely less in-water work during construction.
◆ Key Findings
➤ River Crossing
<p>The new arterial bridge (Alternative Package 3) has the smallest footprint. The replacement bridge options have less total impervious surface area than the supplemental bridge options (by approximately 10-20%).</p> <p>Replacement Alternative Packages 8 - 12 will generally perform better than supplemental alternative because they have less total impervious surface area and are more conducive to full stormwater collection, conveyance, and treatment. They would also have fewer permanent piers in the water and likely less in-water work during construction.</p> <p>No-Build has the least impervious surface area but would not include any treatment of stormwater runoff.</p>
➤ Transit
<p>The BRT and LRT options have the largest footprints, while Express Bus has no additional footprint (unless it includes a managed lane). All of the transit options would likely allow storm water treatment.</p>
➤ Roadways North and Roadways South
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)

Criterion Performance

Criterion 6.7 - Avoid, then minimize adverse impacts to, and where practicable enhance, waterways

(Part of Value 6 – Stewardship of Natural Resources)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • What are the removal/fill impacts to waterways?
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> • Replacement bridges (downstream or upstream) have the fewest piers in the water, and would leave less in-water structure than alternative packages with a supplemental bridge; Express Bus and BRT-Lite options have no impacts to waterways. • Of the Build options, Alternative Package 12 has the smallest impact on waterways.
◆ Key Findings
➤ River Crossing
<p><i>Replacement, downstream or upstream, bridge</i> New piers will be added into the Columbia River and Oregon Slough but the existing piers would be removed. This option would include about 5 piers in the Columbia River compared to the Supplemental options with about 14 piers in the water. The replacement bridges would have about 10% to 20% less deck area over water, compared to the supplemental bridge options..</p> <p><i>Supplemental downstream bridge</i> New piers will be added into the Columbia River and Oregon Slough. Seismic retrofitting of the existing bridges will increase the footprint of the existing piers.</p> <p><i>New arterial bridge</i> New piers will be added into the Columbia River and Oregon Slough. This bridge, combined with the existing bridges, will have a total area over water of about 18 acres. Seismic retrofitting of the existing bridges will increase the footprint of the existing piers.</p> <p>All river crossing options will require new piers to be put in the Columbia River and Oregon Slough. Replacement bridges are bigger than supplemental bridges and therefore would require bigger piers; however, supplemental bridge crossings will require seismic retrofitting of the existing bridges. With the information currently available, we expect all river component options to have similar areas of fill in the water, although supplemental options would have about three times as many piers as the replacement options.</p>
➤ Transit
<p>Express Bus and BRT Lite options have no impacts on waterways.</p> <p>LRT or BRT require a wider river crossing, increasing area over water. Furthermore, pairing BRT or LRT with a downstream replacement bridge uses a separate structure over the Oregon Slough in order to connect with the existing Expo MAX station.</p>
➤ Roadways North and Roadways South
<p>Roadways North have no impacts to waterways.</p> <p>The Hayden Island Arterial Access option has an arterial bridge over the Oregon Slough and an MLK on-ramp, both of which could require additional piers in the Oregon Slough.</p> <p>The Hayden Island Folded Diamond Access option has a split off-ramp heading south and an MLK crossing, both of which could require additional piers in the Oregon Slough.</p>
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)
<p>There will be no impacts to waterways under these components.</p>

Criterion Performance

Criterion 7.1 – Avoid or minimize disproportionate adverse impacts on, and where practicable, improve conditions for low income & minority populations

(Part of Value 7 – Distribution of Benefits and Impacts)

<p>◆ Performance Measure(s)</p> <ul style="list-style-type: none"> 7.1.1 Do potential acquisitions and noise impacts cluster in areas considered high-minority or low income? (noise impacts have not been modeled) 7.1.2 Is traffic diverted to census tracts considered high-minority or low income? (not evaluated at this time)
<p>◆ Best Performing Package(s) and/or Component(s)</p> <ul style="list-style-type: none"> All of the river crossing options and all of the transit options perform similarly on this criteria. According to current census data* residential acquisitions and displacements do not cluster in areas with notable low-income and/or minority populations. It is not yet known if displacements would have a direct impact on low income or minority individuals. <p><i>* Other demographic data will need to be reviewed to update or validate the census data.</i></p>

<p>◆ Key Findings</p>																														
<p>➤ River Crossing</p> <p>The river crossings would displace approximately 5 to 15 floating homes on the Oregon Slough, with no significant difference between the different crossing options. The greatest variability in displacements is due to the interchange configurations for roadways north and south and the transit mode (see below).</p>																														
<p>➤ Transit</p> <p>LRT and BRT have higher potential to affect residential properties than BRT-Lite or Express Bus because they necessitate wider structures across the Oregon Slough, which may displace approximately 5 floating homes for most bridge options. According to current census data, residential acquisitions and displacements do not cluster in areas with notable low-income and/or minority populations.</p>																														
<p>➤ Roadways North and Roadways South</p> <p>The majority of residential displacements from this project would occur in the vicinity of the Oregon Slough, immediately east and west of I-5. This area is split by three Census block groups, all of which are in Oregon:</p> <p style="margin-left: 40px;"> Tract 72.01, BG 1 – West of I-5, Hayden Island and Oregon Slough (north side of Slough) Tract 72.01, BG 2 – East of I-5, Hayden Island and Oregon Slough (north side of Slough) Tract 72.02, BG 1 – Portland, southern bank of the Oregon Slough, east and west of I-5. </p> <table border="1" style="margin-left: 40px; width: 100%;"> <caption>Demographic Summary of Census Tracts Potentially Affected by Alternative Packages*</caption> <thead> <tr> <th>Tract Number</th> <th>Percent Minority</th> <th>Percent Hispanic</th> <th>Median HH Income</th> <th>Percent Below Poverty</th> </tr> </thead> <tbody> <tr> <td>Tract 72.01, BG 1</td> <td>11</td> <td>5</td> <td>\$30,778</td> <td>10</td> </tr> <tr> <td>Tract 72.01, BG 2</td> <td>4</td> <td>1</td> <td>\$50,938</td> <td>6</td> </tr> <tr> <td>Tract 72.02, BG 1</td> <td>24</td> <td>1</td> <td>\$49,256</td> <td>9</td> </tr> <tr> <td><i>City of Portland</i></td> <td><i>22</i></td> <td><i>7</i></td> <td><i>\$40,146</i></td> <td><i>13</i></td> </tr> <tr> <td><i>City of Vancouver</i></td> <td><i>16</i></td> <td><i>6</i></td> <td><i>\$41,618</i></td> <td><i>12</i></td> </tr> </tbody> </table> <p><i>*Data is according to current census data</i></p> <p>Under most Alternative Packages, the majority of residential displacements would occur in Census Tract 72.01, Block Group 1 (north side of Oregon Slough).</p> <p>The interchanges at Marine Drive and on Hayden Island will affect how many floating homes may be displaced. A more complex interchange at Marine Drive widens the structures over the Oregon Slough, impacting additional floating homes. Removing an I-5 interchange on Hayden Island necessitates an arterial crossing over the Oregon Slough, which would displace floating homes. Total displacements would be approximately 0 to 15 for the Roadways South options. Residential acquisitions and displacements do not cluster in areas with notable low-income and/or minority populations.</p>	Tract Number	Percent Minority	Percent Hispanic	Median HH Income	Percent Below Poverty	Tract 72.01, BG 1	11	5	\$30,778	10	Tract 72.01, BG 2	4	1	\$50,938	6	Tract 72.02, BG 1	24	1	\$49,256	9	<i>City of Portland</i>	<i>22</i>	<i>7</i>	<i>\$40,146</i>	<i>13</i>	<i>City of Vancouver</i>	<i>16</i>	<i>6</i>	<i>\$41,618</i>	<i>12</i>
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<p>➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)</p>																														

Criterion Performance

Criterion 7.2 – Provide for equitable distribution of benefits to low income and minority populations

(Part of Value 7 – Distribution of Benefits and Impacts)

◆ Performance Measure(s)	
	<ul style="list-style-type: none"> • 7.2.1 Which block groups experience improved access to the freeway, downtown, or other resources? • 7.2.2 Which block groups experience the greatest improvements in transit service?
◆ Best Performing Package(s) and/or Component(s)	
	<ul style="list-style-type: none"> • The Supplemental and Replacement bridge options offer similar access improvements. The exception would be Supplemental Bridge options that do not include an interchange on Hayden Island (packages 3, 4 and 5) would provide poorer access to jobs, housing and retail businesses, and poorer access by Hayden Island residents to other locations. • Transit options that provide either LRT or BRT, combined with Express Bus, offer the greatest improvements in transit service to all populations. There is no notable difference in the distribution of benefits.
◆ Key Findings	
➤	River Crossing
	<p>The Replacement bridge options and some of the Supplemental Bridge options (packages 6 and 7) offer similar access improvements to a wide range of populations.</p> <p>Supplemental Bridge options with no Hayden Island interchange (packages 3, 4, and 5) would remove the existing I-5 interchange on Hayden Island. This would provide poorer access to jobs, housing and retail businesses on the island, and poorer access by Hayden Island residents to jobs, housing and other destinations off the island. It is unclear whether this would differentially affect low income or minority populations.</p> <p>The Replacement bridges provide the greatest benefit to transit service. The Supplemental Bridge options placing LRT or BRT on the existing bridges (Alternative Packages 4, 5, and 6) provide substantially less reliable service than on the new, fixed span bridge. Bridge lifts cause transit service interruptions, increase travel time and reduce reliability. Currently, a bridge lift causes at least 17 minutes of delay to transit vehicles trying to cross the river during the lift period. This delay would have substantial impacts to BRT and even more so to LRT because it would cause system-wide schedule disruptions. Placing auto users on the new fixed span bridge and transit users on the older lift span bridge could have transportation equity implications. Analysis of the demographics of transit users and auto users would be required to evaluate the effect on the distribution of benefits.</p>
➤	Transit
	<p>Transit options that provide either LRT or BRT, combined with Express Bus, offer the greatest improvements in transit service to all populations. Analysis of the demographics of transit users and auto users would be required to evaluate the effect on the distribution of benefits.</p>
➤	Roadways North and Roadways South
➤	Other (Bike/Ped, Freight, TSM/TDM, Tolling)

Criterion Performance

Criterion 8.1 – Minimize the cost of construction

(Part of Value 8- Cost Effectiveness and Financial Resources)

◆ Performance Measure(s)
<ul style="list-style-type: none"> Estimated total capital costs for each alternative package.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> Information pending for river crossing options. Using national averages, Express Bus and BRT have the lowest capital costs.

◆ Key Findings															
➤ River Crossing															
Information pending.															
➤ Transit															
<p>Until the CRC transit capital cost estimates are developed, the project is reporting the national average capital cost ranges (cost per mile in 2006 dollars) per mode. All costs include some measure of right-of-way acquisitions and percentage additions for environmental mitigation, erosion control, mobilization, traffic control during construction, unmeasured items, preliminary studies and engineering, contractor’s cost, and construction management owners cost. The high end of the cost range for BRT reflects the cost to build a BRT guideway so that it could be more readily converted to LRT in the future (“rail ready”).</p> <p>Per-Mile Transit Capital Costs</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr style="border-top: 1px solid black; border-bottom: 1px solid black;"> <th></th> <th>LRT</th> <th>BRT</th> <th>BRT-Lite</th> <th>Express Bus</th> </tr> </thead> <tbody> <tr> <td>Low</td> <td>\$60 million</td> <td>\$25 million</td> <td>\$20 million</td> <td>\$10 million</td> </tr> <tr style="border-bottom: 1px solid black;"> <td>High</td> <td>\$120 million</td> <td>\$110 million</td> <td>\$40 million</td> <td>\$30 million</td> </tr> </tbody> </table> <p>For LRT (included in Alternative Packages 3, 4, 8 and 9) on the representative HCT alignment, for the construction of an exclusive guideway from Kiggins Bowl to the Exposition Station, is 4.5 miles. For LRT the estimated capital cost range per mile is \$60-\$120 million. This estimate includes the cost to construct the trackway, trackway electrification and signalization, signal communication and substation buildings, trains, a maintenance facility, signage, structures over land, retaining walls, stations with full amenities, park-and-ride structures and surface spaces, bus transfer stations, utility relocations, full streetscape rebuild on city streets, traffic signal changes, environmental mitigation, and connecting roadways and pedestrian facilities where needed.</p> <p>For BRT (Alternative Package 5 and 10) the representative HCT alignment for the construction of an exclusive guideway is 5 miles; the additional alignment length for BRT is because the guideway would connect farther south to the Delta Park/PIR station. For BRT the estimated capital cost range per mile is \$25-110 million. BRT has similar costs to LRT, with the exception that BRT does not require electrification and signalization and the accompanying buildings, and the vehicle purchased would be buses instead of trains. In addition, the guideway for BRT is paved; it does not include tracks. Stations and amenities would be the same as LRT.</p> <p>A future conversion of BRT to LRT would place the total capital cost at least 25% higher than building LRT alone. The conversion costs would include removing the guideway paving and adding tracks, updating the HCT signaling system, re-mobilizing, creating temporary stations on adjoining roadways, buying two transit fleets and constructing new LRT maintenance facilities. The conversion would also disrupt transit service.</p> <p>For BRT-Lite (Alternative Packages 6 and 11) the estimated capital cost range per mile is \$20-40 million. BRT-Lite travels in general purpose and managed lanes and so does not include the cost of a guideway; for downtown Vancouver BRT-Lite would include the cost to construct street signal changes or re-striping. BRT-Lite would also have smaller passenger stations with fewer amenities than LRT or BRT. BRT-Lite would require park-and-ride structures and surface spaces, similar to LRT and BRT, and it would require direct access ramps from park-and-rides. The costs for BRT-Lite would also include the vehicles and a maintenance facility.</p>		LRT	BRT	BRT-Lite	Express Bus	Low	\$60 million	\$25 million	\$20 million	\$10 million	High	\$120 million	\$110 million	\$40 million	\$30 million
	LRT	BRT	BRT-Lite	Express Bus											
Low	\$60 million	\$25 million	\$20 million	\$10 million											
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For express bus the estimated capital cost range per mile is \$10-\$30 million. In Alternative Packages 7 and 12 express bus provides the main transit service. The estimated capital cost range includes the construction of a maintenance facility, vehicle costs, signage changes to the Portland Transit Mall and bus bypass lanes on several I-5 on-ramps. With Alternative Packages 7 and 12 the capital cost for express bus service would also include the cost to construct the park-and-ride facilities. In Alternative Package 7, where express buses would operate in managed lanes the cost to construct a direct access ramp would also be included.

Alternative Packages 3 and 8 combine express bus service is combined with LRT. With these Alternative Packages, in addition to the capital cost requirements for LRT, express bus service would require costs for the bus vehicles and a bus maintenance facility. This would be less than simply adding the Express Bus capital costs listed above to the LRT costs, due to existing complementary infrastructure.

➤ **Roadways North and Roadways South**

Information pending.

➤ **Other (Bike/Ped, Freight, TSM/TDM, Tolling)**

Information pending.

FORM A: Criterion Performance

Criterion 8.3 – Ensure transportation system maintenance and operation cost effectiveness

(Part of Value 8– Cost Effectiveness and Financial Resources)

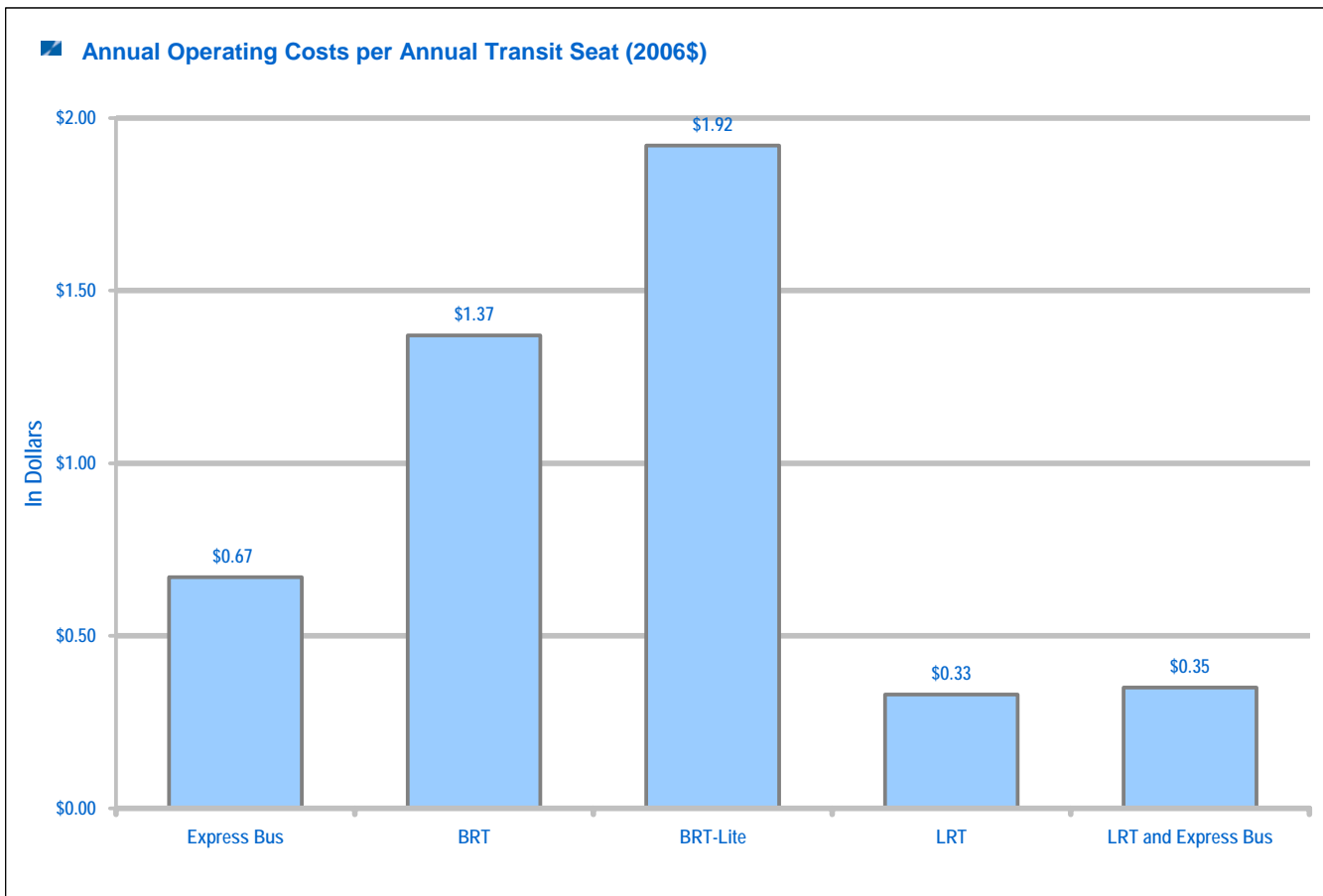
◆ Performance Measure(s)
<ul style="list-style-type: none"> • Facilities maintenance cost rates. • Total HCT and Transit System operating costs as defined by operating cost per vehicle mile traveled.
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> • Alternative Package 12 would have the lowest annual operating cost because it would include a replacement bridge and express bus and local bus transit service only (no high capacity transit (HCT) service). • For an Alternative Package that would include HCT service, the lowest annual operating cost would be with Alternative Package 9 that includes LRT and a replacement bridge. • A newly constructed bridge over the Columbia River would have much lower annual operating costs than the existing I-5 bridges.

◆ Key Findings
➤ River Crossing
<p>Build alternatives that reuse the existing bridges (packages 3-7) have an estimated operation and maintenance (O&M) cost of approximately \$3 million/year. Replacement alternatives would have an estimated O&M cost of \$35,000/year.</p> <p>O&M costs for the existing bridges are estimated at \$2.9 million per year. This includes the cost of staffing the lift structure (all day, every day) as well as annual maintenance of the structures. Also included is the annualized cost of capital improvements that would be necessary during the planning period (2035) such as re-painting and resurfacing the bridges.</p> <p>A newly constructed bridge over the Columbia River would have minimal O&M cost for the project design-life period (through 2035). Using the O&M costs of the I-205 Glenn Jackson Bridge as a representative example, the estimated annual cost to maintain a new bridge would be approximately \$35,000 (in 2006 dollars).</p>
➤ Transit
<p>The transit annual operating costs were estimated using the total daily vehicle miles traveled (VMT) for the transit system. Each of the transit modes would have different operating costs, based on the frequency and route length. The operating cost estimates provide an order of magnitude estimate to compare the alternatives and are not intended to be final. LRT, BRT and BRT-Lite would operate approximately 352 days per year and would operate continuous for about 18 hours a day. An express bus system would primarily operate only during the AM and PM peak periods and only on weekdays (approximately 255 days out of the year).</p> <p>The LRT service proposed with the CRC project is an extension of the TriMet Yellow Line from the existing Exposition LRT station to Kiggins Bowl. In essence, much of the cost of operating the Yellow line to the Exposition Station is already funded by TriMet. Because what the CRC project proposes is a shorter length the total daily VMT proposed with the CRC project is less for LRT; 1,453 daily VMT for LRT plus 2,818 daily VMT for express/local buses for a total daily VMT of 4,271. With LRT only (Alternative Packages 4 and 9) the annual operating cost is estimated to be \$5.1 million for LRT and \$3.6 million for a supporting express/local bus service, for a total of \$8.7 million. When LRT is combined with express bus service, as it is in Alternative Packages 3 and 8, the total daily VMT would increase to 5,791 (1,453 daily VMT for LRT and 4,338 for express/local buses). The annual transit operating cost would increase to \$10.6 million with an estimated annual cost for the bus service of \$5.5 million (the annual operating cost for the LRT service remains at \$5.1 million).</p> <p>The BRT service proposed with the CRC project would operate from Kiggins Bowl to downtown Portland. BRT (Alternative Packages 5 and 10) does not have an existing funded line segment in Portland. For BRT the estimated annual operating cost is a total of \$13.3 million (\$9.7 million for BRT and \$3.6 million for express/local bus service). The daily VMT for BRT would be 2,543 miles and 2,818 miles for express/local buses for a total transit daily VMT of 5,361 miles.</p> <p>BRT-Lite (Alternative Packages 6 and 11) would have the highest estimated total annual transit operating cost, with an estimated cost of \$17 million to operate the BRT-Lite system and \$1.7 million to operate the local buses, for a total</p>

annual operating cost of \$18.7 million. BRT-Lite has a higher annual operating cost because the service proposed with the CRC project would extend north to 219th Street, whereas in the other HCT modes service ends at Kiggins Bowl, and as a result the daily VMT would be higher. For BRT-Lite the daily VMT would be 4,824 miles plus an additional 1,350 miles for express/local buses for a total of 6,174 miles. Although BRT-Lite travels farther north in the I-5 corridor to provide greater coverage, the peak period mode split for transit is less than LRT or BRT which both end service at Kiggins Bowl. See criterion 2.5 for further details.

Alternative Packages 7 and 12 use only express buses and local buses to serve the I-5 transit market. Express buses would have relatively low annual operating costs since an express bus system would primarily operate only during the AM and PM peak periods and only on weekdays (approximately 255 days out of the year). The total daily VMT would be 5,456 miles and the estimated annual operating cost would be \$7 million.

The figure below presents the annual operating cost in 2006 dollars divided by the amount of transit capacity provided (or seats in buses and trains). Overall, annual operating cost per annual transit seat varies substantially across the modes. Express bus alternatives have moderate operating costs per seat due to their AM and PM peak period operation and lower bus capacity. The BRT and BRT-Lite alternatives have higher operating costs per seat, reflecting a full, all day operation between downtown Portland and Kiggins Bowl. The LRT alternatives have lower operating costs per seat due to the large LRT train capacity and the already funded Yellow Line in Portland.



➤ Roadways North and Roadways South

The O&M costs for I-5 and other structures associated with roadways north and south of the Columbia River are similar for all of the build alternatives (Alternative Packages 3 through 12). In addition, both Oregon and Washington have an annual maintenance program to cover the cost to maintain the highway; therefore, the cost difference to maintain a new highway compared to the existing highway would be minimal.

➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)

Criterion Performance

Criterion 9.1 – Support adopted regional growth management and comprehensive plans

(Part of Value 9- Bi-State Cooperation)

◆ Performance Measure(s)
<ul style="list-style-type: none"> • Does the package support/ uphold principles of multi-modalism and compact growth? • Which package options are included in the RTP and MTP, project lists, and modeling? • Is the package consistent with other plan policies in regional plans listed in the land use MDR?
◆ Best Performing Package(s) and/or Component(s)
<ul style="list-style-type: none"> • Alternatives with LRT are most consistent with regional plans. HCT, and specifically LRT, is included in regional plans, such as the Bi-State Trade and Transportation Study. • Packages that include a balance of transit and highway improvements are generally more likely to support multi-modalism and compact growth (Alternative Packages 3, 4, 8, and 9). • Medium performing packages include Alternative Packages 5, 6, 10, and 11 (HCT). • Low performing packages include Alternative Packages 1, 2, 7, and 12 (no HCT mode/stations).
◆ Key Findings
➤ River Crossing
<p>River crossings that require less ROW acquisitions on Hayden Island and in downtown Vancouver will better support regional economic development goals. The supplemental arterial bridge appears to have the least impacts to downtown Vancouver. The replacement bridge options provide the most reliable LRT service and are therefore more supportive of regional plans and policies that call for improved HCT service.</p>
➤ Transit
<p>Components with Express Bus fail to provide HCT as explicitly called for in regional plans. Only the LRT component is consistent with plan policies that speak to the regional transit network and with the recommendations of the Bi-State Trade and Transportation Study which are referenced in numerous plans (including the Regional Transportation Council’s Metropolitan Transportation Plan and Metro’s Regional Transportation Plan.)</p>
➤ Roadways North and Roadways South
<p>There is no discernable difference between packages for this criterion.</p>
➤ Other (Bike/Ped, Freight, TSM/TDM, Tolling)