

## Public Open Houses

Public open houses and hearings will be held in Portland and Vancouver in at the following dates and locations:

May 28, 2008  
5 p.m.–8 p.m.  
Red Lion at the Quay  
100 Columbia Street  
Vancouver, WA 98660

May 29, 2008  
5 p.m.–8 p.m.  
Portland Metropolitan Exposition Center  
2060 North Marine Drive  
Portland, Oregon 97217

## Subsequent Environmental Review

Comments on the Draft EIS will be accepted May 2, 2008 through July 1, 2008.

Following the Draft EIS comment period and public open houses, the project sponsors, which include WSDOT, ODOT, RTC, Metro, C-TRAN, TriMet, and the cities of Vancouver and Portland, will identify a locally preferred alternative. Identifying an LPA will allow the project team to advance with the engineering design and environmental analysis that will inform the Final EIS, anticipated to be released in Summer 2009. This will be followed by a Record of the Decision that is anticipated in Fall 2009.

## Anticipated State and Federal Permits and Approvals

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### Water Quality, Wetlands and Shoreline

Clean Water Act (CWA) Section 404 Permit  
Oregon Removal and Fill Permit  
Washington Hydraulic Project Approval  
CWA Section 401 Water Quality Certification  
CWA National Pollutant Discharge Elimination System Permit  
Rivers and Harbors Act Section 9 Bridge Permit  
Rivers and Harbors Act Section 10 Waterway Structures Permit  
Sole Source Aquifer protection review  
Washington Shoreline Management Act Substantial Development Permit  
Floodplain Construction Permit

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### Fish and Wildlife

Endangered Species Act Section 7 Consultation  
Marine Mammal Protection Act  
Magnuson-Stevens Fishery Conservation Management Act  
Migratory Bird Treaty Act  
Oregon Endangered Species Act  
Washington Aquatic Lands Act

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**Air Quality**

Air Quality Conformity Determination

Indirect Source Permits

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**Hazardous Waste**

Voluntary Cleanup Program Approval

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**Archaeological and Historic Resources**

Section 106 Memorandum of Agreement

Oregon Archaeological Excavation Permit

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**Section 4(f)**

Section 4(f) Evaluation

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**Public Utilities**

Use and occupancy agreements (if relocated)

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**Federal Highways Administration Approvals**

Several different approvals necessary for I-5 freeway improvements

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**Federal Land Acquisitions**

Federal Land Transfer

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# PREFACE

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The Columbia River Crossing project co-leads for the federal National Environmental Policy Act (NEPA) process are the Federal Transit Administration (FTA), Federal Highway Administration (FHWA), Oregon Department of Transportation (ODOT), Washington State Department of Transportation (WSDOT), Southwest Washington Regional Transportation Council (RTC), Metro, Clark County Public Transportation Benefit Area (C-TRAN), and Tri-County Metropolitan Transportation District (TriMet). The co-leads prepared this draft environmental impact statement (Draft EIS) for the Interstate 5 (I-5) Columbia River Crossing Project pursuant to the National Environmental Policy Act (NEPA), the Washington State Environmental Policy Act (SEPA), and the guidelines of the U.S. Department of Transportation, Federal Highway Administration (FHWA) and Federal Transit Administration (FTA).

The Draft EIS: 1) describes project alternatives along with their potential impacts in the context of the existing conditions and foreseeable future conditions in the project area; 2) provides transportation, community and environmental information to assist the public and decision-makers; 3) identifies potential mitigation measures that could reduce or eliminate impacts; 4) assesses project costs, institutional issues, and potential revenue options; and 5) encourages agency and public comments during the review period and at public open houses.

In 2001, the governors of Oregon and Washington formed a bi-state partnership to study transportation problems and possible solutions for the I-5 corridor from the Interstate 205 interchange north of Vancouver to the Interstate 84 interchange in Portland. The I-5 Transportation and Trade Partnership recommended fixing three bottlenecks in its 2002 Strategic Plan; one bottleneck was I-5 at the Columbia River.<sup>1</sup> Staff from the Oregon and Washington departments of transportation began initial work to refine the work of the I-5 Transportation and Trade Partnership and plan for on-the-ground projects to reduce congestion in the project area. A Task Force was established in early 2005 to advise the transportation departments on key decisions and decision-making criteria. The 39-member Task Force is composed of leaders from a broad cross section of Washington and Oregon communities, including public agencies, civic organizations, neighborhoods, and freight, commuter, and environmental groups. Through discussion with the Task Force and community, the CRC project staff studied alternatives proposed for improving the river crossing and public transportation. A set of 23 initial river crossing ideas were eventually reduced to four and a set of 14 initial public transportation ideas were reduced to five over a period of months, using the evaluation criteria developed through consultation with local agency sponsors (WSDOT, ODOT, RTC, Metro, TriMet, C-TRAN, the City of Vancouver, and the City of Portland), the CRC Task Force, state and federal permitting agencies which, on the CRC project, have been brought together in the Interstate Collaborative Environmental Process Group (InterCEP), and extensive public input. Further packaging and analysis of river crossing and public transportation ideas was conducted before the best-performing alternatives were moved forward for further evaluation in this Draft EIS.

The wide range of alternatives evaluated in this Draft EIS is in part response to nearly 4,500 comments received and community participation at 11 open houses, 350 public events, along with responses to written information sent to a mailing list with nearly 3,000 email addresses and over 10,000 mailing addresses.

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<sup>1</sup> The other two bottlenecks identified were I-5 at Salmon Creek in Clark County and I-5 at Delta Park in Portland. The project to address the Salmon Creek bottleneck was completed in 2006, and construction to improve the Delta Park bottleneck is expected to begin this year (2008).

To comply with NEPA and SEPA requirements, this Draft EIS focuses on the most pertinent information regarding the project purpose, impacts from evaluated alternatives, and proposed mitigation measures. The level of detail is intended to inform the public and project sponsors with relevant information in order to identify a locally preferred alternative. The Final EIS will further refine the impacts and potential mitigation measures of the locally preferred alternative.

The Draft EIS is organized as follows:

The **Summary** briefly describes key information and findings of the overall document. It describes the Columbia River Crossing project, project co-leads, studies that preceded the project, and problems the project is seeking to fix. It discusses the different alternatives for addressing these problems, the advantages and disadvantages of these alternatives, and the next steps for identifying a locally preferred alternative. It concludes with a brief discussion of the currently unresolved issues, next steps and methods by which the public can get involved in the project.

Chapter 1, **Project Purpose and Need**, describes the parameters for project development and decision-making as based on defined problems and issues. It outlines the significance of the Columbia River Crossing corridor, the project purpose, the need for the project, and reviews the principles used to frame the physical limits and alternatives of the project. It concludes with a discussion of the project's vision and values as outlined by the project team, sponsoring agencies and project Task Force.

Chapter 2, **Description of Alternatives**, describes the alternatives evaluated in this Draft EIS. It describes the proposed river crossing, highway and transit improvements, as well as bicycle, pedestrian, transportation system and demand management, and tolling scenarios. It describes likely construction duration, techniques and approaches, and concludes with an explanation of how the alternatives in this Draft EIS were developed through an iterative process of public input, agency input, and analysis of a wide range of alternatives. It also includes a description of alternatives which were not brought forward and why.

Chapter 3, **Existing Conditions and Environmental Consequences**, describes the likely temporary and long-term effects of the project alternatives on the area's existing and future transportation system, community, and environment. Each section of chapter 3 outlines existing conditions in the project area, and analyzes the impacts of project alternatives. It describes potential mitigation strategies to reduce or eliminate impacts and concludes with a discussion of the cumulative effects of this project and other past, present, and reasonably foreseeable actions. This chapter includes the following disciplines:

- Transportation
- Aviation and Navigation
- Property Acquisitions and Displacements
- Land Use and Economic Activity
- Neighborhoods and Environmental Justice
- Public Services and Utilities
- Parks and Recreation
- Historic and Archaeological Resources
- Visual and Aesthetic Qualities
- Air Quality

- Noise and Vibration
- Energy
- Electric and Magnetic Fields
- Ecosystems
- Wetlands and Jurisdictional Waters
- Hydrology and Water Quality
- Geology and Soils
- Hazardous Materials
- Cumulative Effects

Chapter 4, **Financial Analysis**, provides an assessment of project costs, institutional issues, and potential revenue options, along with highway and transit financial plan scenarios.

Chapter 5, **Draft Section 4(f) Evaluation**, identifies the potential impacts of project alternatives on federally protected historic, park, and recreational resources. It evaluates alternatives that could avoid these resources, including whether such alternatives are prudent and feasible. It also identifies potential measures to minimize harm to these resources, and evaluates whether these measures are reasonable.

The **Appendices and Supplemental Materials** to this Draft EIS provide additional detail on the project and the Draft EIS process. They include summaries of agency and tribal coordination, and public involvement, as well as an index and glossary. The appendices also list references, and identify project staff and report recipients. Additional information can be found in the Draft EIS supporting documents included on a CD-ROM at the back of this document. These include the following technical reports and memoranda:

- Acquisitions Technical Report
- Air Quality Technical Report
- Archaeology Technical Report
- Aviation Technical Report
- Conceptual Stormwater Design Report
- Cost Risk Assessment Final Report
- Cumulative Effects Technical Report
- Economics Technical Report
- Ecosystems Technical Report
- Electromagnetic Fields (EMF) Technical Report
- Energy Technical Report
- Environmental Justice Technical Report
- Geology and Soils Technical Report

- Hazardous Materials Technical Report
- Historic Built Environment Technical Report
- Hydrology and Water Quality Technical Report
- Land Use Technical Report
- Navigation Technical Report
- Neighborhoods and Population Technical Report
- Noise and Vibration Technical Report
- Parks and Recreation Technical Report
- Public Services Technical Report
- Stacked Transit/Highway Bridge Technical Memorandum
- Traffic Technical Report
- Transit Alignment Options Maps
- Transit Technical Report (includes the Final Definition of Transit Alternatives)
- Utilities Technical Report
- Visual and Aesthetics Technical Report
- Wetlands and Jurisdictional Waters Technical Report

# ACRONYMS

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AC	Alternating current
ACGIH	American Conference of Governmental Industrial Hygienists
ADA	Americans with Disabilities Act
ADT	Average daily traffic
APE	Area of Potential Effect
AQMA	Air Quality Management Area
BIA	Bridge influence area
BNSF	Burlington Northern Santa Fe Railroad
BRT	Bus rapid transit
Btu	British thermal unit
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CMAQ	Congestion Management Air Quality
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CPI	Consumer Price Index
CRC	Columbia River Crossing
dB	Decibel
dBA	A-weighted decibel
DAHP	Washington Department of Archaeology and Historic Preservation
DC	Direct current
DDE	Dichloro-diphenyl-dichloroethylene
DDT	Dichloro-diphenyl-trichloroethane
DEIS	Draft Environmental Impact Statement
DEQ	Oregon Department of Environmental Quality
DMV	Department of Motor Vehicles
DPS	Distinct population segment
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EJ	Environmental Justice
EMF	Electromagnetic field
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily significant unit
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FFGA	Full Funding Grant Agreement
FHWA	Federal Highway Administration

ft	feet/foot
ft/NM	feet/nautical mile
FTA	Federal Transit Administration
FVNHS	Fort Vancouver National Historic Site
FY	Fiscal year
G	Gauss
GARVEE	Grant Anticipation Revenue Vehicle
HBC	Hudson's Bay Company
HCT	High-capacity transit
HfL	Highways for Life
HOV	High-occupancy vehicle
Hz	Hertz
IBRD	Innovative Bridge Research and Deployment
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IM	Interstate Maintenance
IMD	Interstate Maintenance Discretionary
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transportation Systems
kV	Kilovolt
lbs	Pounds
Ldn	Day-night equivalent sound level
LEED	Leadership in Energy and Environmental Design
Leq	Equivalent sound pressure level
Lm	Maximum noise level
LOS	Level-of-service
LPA	Locally Preferred Alternative
LRT	Light rail transit
LWCFA	Land and Water Conservation Fund Act
mG	milliGauss
MOS	Minimum operable segment
MP	Milepost
Mph	Miles per hour
MSAT	Mobile source air toxics
MSFCMA	Magnuson-Stevens Fishery Conservation Management Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NHS	National Highway System
NHTSA	National Highway Traffic and Safety Administration
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places



O & M	Operations and maintenance
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OTIA	Oregon Transportation Investment Act
PAH	Polyaromatic hydrocarbon
PCB	Polychlorinated biphenyls
PM	Particulate matter
PPM	Parts per million
PPP	Public private partnership
PTBA	Public Transportation Benefit Area
ROD	Record of Decision
ROW	Right-of-way
RTC	Regional Transportation Council
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SEPA	State Environmental Policy Act
SHPO	State Historic Preservation Office
SOV	Single-occupancy vehicle
SR	State Route
STHB	Stacked Transit/Highway Bridge
STIP	State Transportation Improvement Program
STP	Surface Transportation Program
SWCAA	Southwest Washington Clean Air Agency
TBD	Transportation Benefit District
TCP	Traditional cultural property
TCSP	Transportation, Community, and System Preservation Program
TDM	Transportation demand management
TMDL	Total Maximum Daily Load
TOD	Transit-oriented development
TSM	Transportation system management
TSS	Total suspended solids
U.S.C.	United States Code
USDOT	U.S. Department of Transportation
V	volt
VdB	Vibration decibel
VHD	Vehicle hours of delay
VMT	Vehicle Miles Traveled
VNHR	Vancouver National Historic Reserve
VOC	Volatile organic compounds
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

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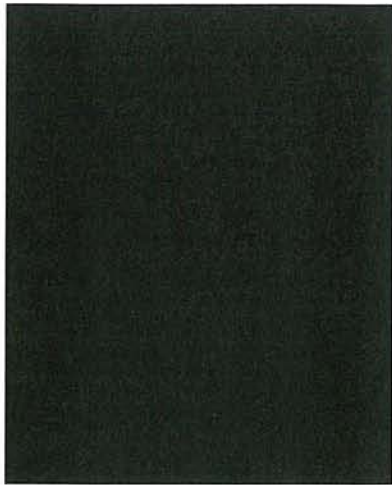


## Summary









## Summary

*This summary briefly describes the contents of the I-5 Columbia River Crossing Draft Environmental Impact Statement (DEIS), including who is leading the project, what studies preceded the project, and what problems the project is seeking to fix. It also discusses the different alternatives for addressing these problems, and the key effects and impacts of these alternatives. It concludes with a brief discussion of the next steps and methods by which the public can get involved in the project.*

### What is the I-5 Columbia River Crossing project?

The Interstate 5 (I-5) Columbia River Crossing (CRC) project is a multimodal project focused on improving safety, reducing congestion, and increasing mobility of motorists, freight, transit riders, bicyclists, and pedestrians along a five-mile section of the I-5 corridor connecting Vancouver, Washington and Portland, Oregon. The project area stretches from State Route 500 (SR 500) in northern Vancouver, south through downtown Vancouver and over the I-5 bridges across the Columbia River to just north of Columbia Boulevard in north Portland.

I-5 is the only continuous north-south interstate highway on the West Coast, linking the United States, Canada, and Mexico. In the Vancouver-Portland region, I-5 is one of two major north-south highways that provide interstate connectivity and mobility. I-5 directly connects the central cities of Vancouver and Portland. Traffic conditions on the I-5 crossing over the Columbia River are influenced by the five-mile section of I-5 between SR 500 in Vancouver and Columbia Boulevard in Portland. This section includes six interchanges that connect three state highways and several major arterial roadways. These interchanges serve a variety of land uses and provide access to downtown Vancouver, two international marine ports, industrial centers, residential neighborhoods, retail centers, and recreational areas.

## CHAPTER CONTENTS

What is the I-5 Columbia River Crossing project?	S-1
Who is leading the CRC project?	S-2
What studies preceded the CRC project?	S-3
What problems does this project seek to fix?	S-4
What are the different choices for addressing the problems in the CRC corridor?	S-6
How do the different alternatives and components compare?	S-28
What are the next steps and how will a decision be made?	S-35
How can the public learn more about and be involved in the project?	S-36

Exhibit 1  
CRC Project Area



DIMENSIONS ARE APPROXIMATE.

## Agencies and Tribes this project is working with

- City of Vancouver
- City of Portland
- Clark County Community Development Department
- Clark Public Utilities
- Chinook Tribe (non-federally recognized)
- Confederated Tribes of the Grand Ronde Community of Oregon
- Confederated Tribes of the Siletz Reservation, Oregon
- Confederated Tribes of the Umatilla Reservation, Oregon
- Confederated Tribes of the Warm Springs Reservation of Oregon
- Confederated Tribes and Bands of the Yakama Nation, Washington
- Cowlitz Indian Tribe, Washington
- Federal Aviation Administration
- National Marine Fisheries Service
- National Park Service
- Nez Perce Tribe of Idaho
- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon Department of Land Conservation and Development
- Oregon Department of State Lands
- Oregon State Historic Preservation Office
- Spokane Tribe of the Spokane Reservation, Washington
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Environmental Protection Agency
- U.S. General Services Administration
- U.S. Fish and Wildlife Service
- Vancouver Housing Authority
- Washington Department of Natural Resources
- Washington State Department of Archaeology and Historic Preservation
- Washington State Department of Ecology
- Washington State Department of Fish and Wildlife

See Appendix A for more information on how this project has coordinated with local, state, and federal agencies and Tribes.

Transit connections within the CRC project area are currently constrained by many of the same problems facing highway motorists—outdated highway safety design features and traffic congestion are increasing travel times and reducing reliability for buses connections between Clark County and to Portland.

## Who is leading the CRC project?

The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) are the lead federal agencies for this study. Both agencies must ensure that the National Environmental Policy Act (NEPA) process is properly conducted and completed, including the publication of this Draft Environmental Impact Statement, before they can provide funding or approval for this project. After FTA and FHWA have completed the NEPA process, they will ultimately sign a Record of Decision, if a build alternative is chosen. The Record of Decision will affirm that all federal environmental regulations have been met before this project can proceed into final design and construction, if a build alternative is selected.

State transportation agencies and local governments in the Vancouver-Portland region have joined together to develop a comprehensive strategy for addressing highway, freight, transit, bicycle, and pedestrian needs within the CRC project area. The co-lead agencies for this project, in addition to the aforementioned federal lead agencies, are: Washington State Department of Transportation (WSDOT), the Oregon State Department of Transportation (ODOT), the Tri-County Metropolitan Transportation District (TriMet), Clark County Public Transportation Benefit Area (C-TRAN), the Southwest Washington Regional Transportation Council (RTC), and the Metropolitan Regional Government (Metro). These co-lead agencies, together with the cities of Vancouver and Portland, comprise the local agencies that are sponsoring this project. Each of these sponsoring agencies will be responsible for approving all or part of the project that will be built.

WSDOT and ODOT are leading the highway design. Metro and RTC are the Metropolitan Planning Organizations for the region, and they maintain the regional and metropolitan transportation plans that will need to be amended to include a locally preferred alternative for the CRC project. TriMet and C-TRAN, the region's transit operators, must endorse the transit elements of the project. The cities of Portland and Vancouver must approve any local project elements. Other state and federal agencies and stakeholders are also participating in technical, regulatory, or advisory roles.

The agencies leading the CRC project have worked with many other local, state, and federal agencies (see list at left) during the planning and development of this project to ensure that the ultimate construction of this project can be permitted and allowed, and that this project best represents the interests of this region. Appendix A describes the agencies this project is working with and the coordination processes within this diverse group.



## What studies preceded the CRC project?

Major transportation improvements in the CRC project area have been studied for over a decade. More recently, in 2001, the Washington and Oregon governors appointed a bi-state task force of 28 community members, business representatives, and elected officials to address concerns about congestion on I-5 between Portland and Vancouver. This task force developed a plan to improve transportation in the I-5 corridor between the I-405 interchange in Portland and the I-205 interchange north of Vancouver, and adopted the Final Strategic Plan on June 18, 2002. Below is a summary of their recommendations:

- Expand I-5 to include three through-lanes in each direction, including the area through Delta Park.
- Introduce a phased light rail loop in Clark County in the vicinity of the I-5, SR 500/Fourth Plain, and I-205 corridors.
- Provide an additional bridge or a replacement crossing for the I-5 crossing of the Columbia River, with up to two additional lanes for merging traffic and two light rail tracks.
- Improve interchanges and add merging lanes between SR 500 in Vancouver and Columbia Boulevard in Portland, including a full interchange at Columbia Boulevard.
- Improve capacity for freight rail.
- Encourage bi-state coordination of land use and transportation issues to reduce highway demand and protect corridor investments.
- Involve communities along the corridor to ensure that final project outcomes are equitable.

Several of these recommendations are being further evaluated by this project. See Section 2.5 of this DEIS for more information on the early development of the CRC project.

High-capacity transit in the I-5 corridor through north Portland and Vancouver has been studied periodically for over a decade. In 1993, the FTA, in cooperation with Metro, began studying high-capacity transit in the “South/North Corridor”, which stretches from Clackamas and Milwaukie, Oregon to Vancouver, Washington. FTA and Metro published the South/North Corridor Project Draft Environmental Impact Statement in 1998. This identified a variety of alignments and length options for a light rail corridor connecting Milwaukie, downtown Portland, North Portland, and downtown Vancouver. Subsequent funding challenges didn’t allow construction of the entire corridor assessed in the South/North project, but did allow construction of the MAX Yellow line. The Yellow line was built in 2004 through North Portland, a section of the South/North corridor. The new light rail line currently being constructed along the north-south axis of downtown Portland can accommodate a future extension to Milwaukie; an environmental impact study is currently evaluating this extension. The transit component of the CRC project is now assessing the extension of high-capacity transit through Vancouver. These projects are part of the vision outlined in the original planning studies of the 1990s.

Exhibit 2  
Preceding Studies



DIMENSIONS ARE APPROXIMATE.



## TERMS &amp; DEFINITIONS

## Traffic Terms

**Congestion** – For highways, congestion occurs when the average speed is below 30 mph.

**Peak Period** – This is more generally described as “rush hour” when travel patterns generate the most traffic, especially in a certain direction.

Exhibit 3  
Projected Hours of Congestion  
on I-5 Crossing

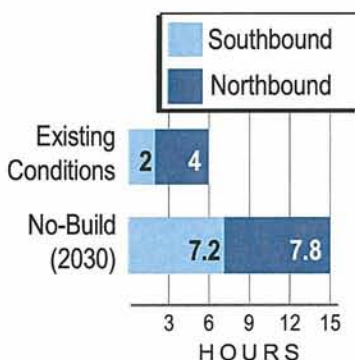


Exhibit 4  
A Bus and Truck Wait During a  
Bridge Lift



## What problems does this project seek to fix?

The CRC project seeks to address six problems, as described below:

1. **Growing travel demand and congestion:** Heavy congestion has resulted from growth in regional population, employment, and interstate commerce. The existing I-5 crossing provides three lanes for northbound and southbound travel, which can accommodate approximately 5,500 vehicles per hour in each direction. However, there are more people who want to use the crossing during peak periods than can be accommodated on the bridges, which results in stop-and-go traffic the mornings and afternoons. Cars getting on the highway have little room to accelerate and merge with highway traffic (short merging lanes) and have no room to pull off the highway (narrow shoulders) when an accident occurs or when vehicles break down. These conditions make congestion worse and decrease safety. Traffic can also become congested when large river vessels must use the lift spans to navigate underneath the I-5 bridges.
2. **Impaired freight movement:** Congestion on I-5 reduces freight mobility between regional markets in Portland and Vancouver, as well as national (California and other neighboring states) and international (Mexico or Canada) destinations along the I-5 corridor. Freight trucks most often travel in the middle of the day to avoid congestion. As hours of congestion continue to increase over time, travel times for freight trucks will continue to increase—even when traveling during the off-peak hours. This increases delivery times and raises shipping costs. It also negatively affects this region's economy. Truck-hauled freight in the Portland-Vancouver region is expected to grow more rapidly than other forms of freight movement (such as marine-hauled freight). Truck-hauled freight is forecast to grow from 67 percent of total freight movement in 2000 to 75 percent in 2035.<sup>1</sup>
3. **Limited public transportation operation, connectivity, and reliability:** Congestion on I-5 reduces bus travel speeds and reliability. Local bus services currently travel between downtown Vancouver and downtown Portland. Express bus routes serve commuters by providing service directly from Clark County park and rides to downtown Portland. Both of these services travel over the I-5 bridges. Bus travel times from downtown Vancouver to Hayden Island increased 50 percent between 1998 and 2005. On average, local bus travel times are 10 to 60 percent longer during peak periods than during off-peak periods.
4. **Safety and vulnerability to incidents:** Over 300 crashes are reported annually on I-5 in the project area, making this one of the most accident-intensive section of I-5. This high accident rate is a result of multiple highway design features that do not meet current standards, including:

<sup>1</sup> Metro. 2006.



- Close interchange spacing – within the CRC project area, I-5 has six interchanges spaced approximately one-half mile apart. The recommended minimum distance between interchanges is one mile so that cars entering and exiting the highway have enough distance to fully merge with traffic or diverge to the off-ramp before the next interchange.
- Short on- and off-ramps – several on-ramps are not long enough for vehicles to reach highway speed before merging with highway traffic. Off-ramps are too short for safely slowing down, and may cause back ups from exits that block traffic on I-5. This generates traffic congestion and can cause accidents because maneuvering is difficult, especially for large trucks.
- Vertical grade changes – a “hump” in the I-5 bridges that accommodates the Columbia River shipping channel blocks the view of roadway conditions ahead. This blocked view reduces speeds and creates potential hazards to motorists.
- Narrow lanes and shoulders – several portions of I-5 in the project area have narrow inside and outside shoulders, while the I-5 bridges essentially have no shoulders, with less than one foot between the outside lanes and the barrier. The northbound I-5 bridge also has lanes one foot narrower than the minimum standard for a highway, and no shoulders. These conditions place vehicles very close to physical barriers and other vehicles, causing motorists to slow down, and do not provide space for broken down vehicles or emergency vehicles.
- Hazardous river navigation – the Coast Guard has agreed not to raise the I-5 bridges’ lift spans during peak traffic periods because of the substantial impact this would have on automotive traffic. This requires boats heading downstream (west) to navigate using the fixed “barge channel” near the middle of the river, and then quickly turn to line up with the narrow opening on the north end of the Burlington Northern Santa Fe (BNSF) railroad bridge, located about one mile downstream. This movement is especially difficult during high river levels.

Exhibit 5  
**Accident on Narrow Shoulder Closes Travel Lane**

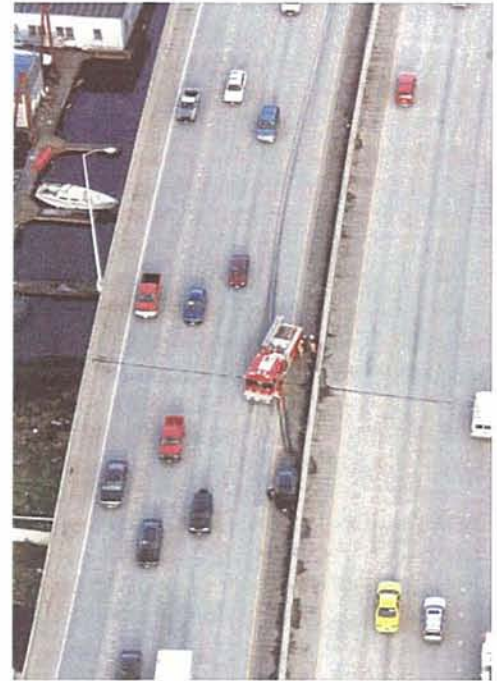
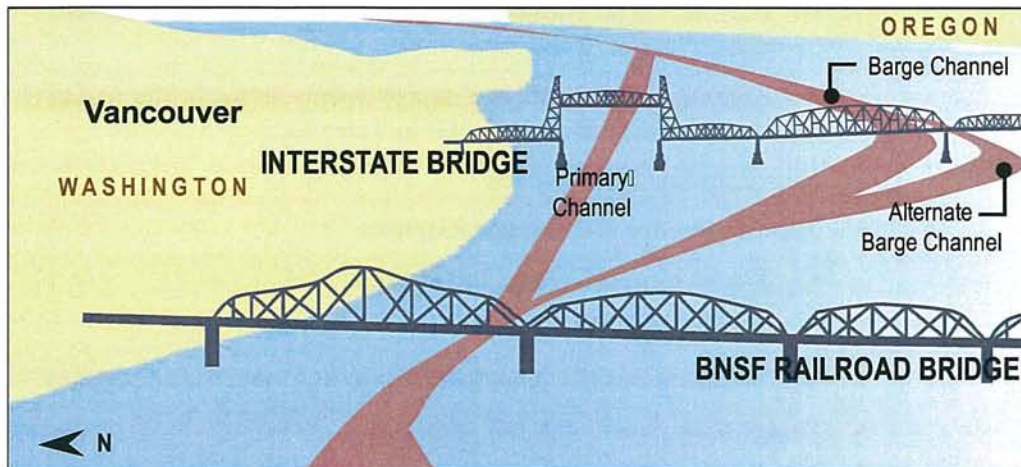


Exhibit 6  
**Constrained River Navigation**



NOT TO SCALE



Exhibit 7

**Bicycle and Pedestrian Path**

Exhibit 8

**Earthquake Damage to a Steel Truss Bridge**

A span of the "Million Dollar Bridge" in Alaska slipped off its foundation during an earthquake in 1964.

5. **Substandard bicycle and pedestrian facilities:** The bicycle and pedestrian paths on the I-5 bridges are very narrow (four feet wide in most places) and extremely close to traffic and to the steel trusses. Also, the connections to these paths at both ends of the bridges are difficult to follow, especially around the Marine Drive and Hayden Island interchanges. Many existing non-motorized facilities cannot be used by persons with disabilities, and thus do not comply with the Americans with Disabilities Act standards.
6. **Seismic vulnerability:** The I-5 crossing is comprised of two bridges, one built in 1917 (the northbound structure) and the other built in 1958 (the southbound structure). The foundations of both bridges rest in soils that could liquefy during a major earthquake. Neither bridge was built to current earthquake safety standards, and could be damaged or collapse during a major earthquake.

### What are the different choices for addressing the problems in the CRC corridor?

This DEIS assesses how different alternatives could improve the conditions mentioned above, such as increasing safety, improving mobility between Vancouver and Portland, and reducing congestion. All build alternatives assessed in this DEIS include transit, highway, bicycle, and pedestrian improvements. Some of these are physical improvements, such as widening the highway or installing dedicated transit lanes. Others are operational improvements to help the system function more efficiently, such as adding meters to a highway ramp to affect how quickly vehicles can enter the highway, or tolling the river crossing to reduce automobile traffic.

Four build alternatives are being assessed in this DEIS, in addition to a No-Build alternative. Each alternative being evaluated is comprised of several components that, when combined, create a particular multimodal alternative that comprehensively addresses the problems this project seeks to fix. These components include:

- Multimodal river crossing and highway improvements
  - Bridges over the Columbia River carrying transit, highway, and bicycle and pedestrian traffic
  - Bicycle and pedestrian improvements between north Portland and downtown Vancouver
  - Highway and interchange improvements between Marine Drive in north Portland and SR 500 in Vancouver
- High-capacity transit modes
- Transit terminus and alignment options
  - Transit terminus (endpoint) options
  - Transit alignment options
- Transit operations (frequency of train or bus rapid transit service)
- Bridge tolls
- Transportation System and Demand Management measures

Exhibit 9 summarizes the components included in each alternative. Each component is described following an overview of the full alternatives.

## Exhibit 9

**Components Making up the Project Alternatives**

Component	Alternative 1 (No-Build)	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Multimodal River Crossing and Highway	Current I-5 bridges	Replacement <sup>a</sup>	Replacement <sup>a</sup>	Supplemental	Supplemental
High-Capacity Transit Mode <sup>b</sup>	None	Bus Rapid Transit	Light Rail	Bus Rapid Transit	Light Rail
High-Capacity Transit Terminus	N/A	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS <sup>c</sup> , or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	((A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS
Transportation Demand and System Management programs	Current programs	Expanded Transportation Demand and System Management programs			
I-5 Bridge Toll	None	Standard rate	Standard rate <sup>d</sup>	Higher rate <sup>e</sup>	Higher rate <sup>e</sup>
Transit Operations	Existing	Efficient	Efficient	Increased	Increased

<sup>a</sup> The Replacement crossing has two designs, a 3-bridge design and a Stacked Transit/Highway Bridge design concept; these are described below.

<sup>b</sup> High-Capacity Transit Mode also dictates the location of a maintenance base expansion. Bus Rapid Transit would entail expanding a bus maintenance facility in eastern Vancouver. Light Rail would entail expanding the Ruby Junction maintenance base in Gresham.

<sup>c</sup> Minimum operable segment; see Glossary.

<sup>d</sup> Alternative 3 was also evaluated without a toll to quantify the traffic effects of tolling the I-5 crossing.

<sup>e</sup> Alternatives 4 and 5 include a higher toll rate during peak commute periods to reduce traffic demand in order to compensate for these alternatives' lower highway capacity (compared to Alternatives 2 and 3) that is a result of these alternatives including a Supplemental river crossing.

Exhibit 10 on the following page identifies key features of each alternative.

## COLUMBIA RIVER CROSSING

Exhibit 10

## Key Transit and Highway Features of the Alternatives

Alternative	Transit Features	Highway Features
<b>1: No-Build Alternative</b>	<p>Modest increases to C-TRAN's service hours for bus routes throughout Vancouver and Clark County to keep pace with anticipated changes in congestion.</p> <p>Modest increases to TriMet's services hours for bus routes throughout north and northeast Portland to keep pace with anticipated changes in congestion.</p> <p>Completion of the first phase of the South Corridor light rail project on the Portland Mall and I-205.</p>	I-5 widening and improvements around Delta Park.
<b>2: Replacement crossing with bus rapid transit</b>	<p>Exclusive bus lanes from the Expo Center, over Hayden Island, across the Columbia River, and to a terminus in Vancouver.</p> <p>The exclusive bus lanes would extend 2.07–4.22 miles north from the Expo Center through Vancouver, and include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus.</p> <p>Introduction of a new bus rapid transit service, including a simplified payment method (e.g., the use of off-board ticket vending machines) and 60-foot articulated vehicles with special markings to create a "branded identity."</p> <p>Expansion of the current C-TRAN bus maintenance facility in eastern Vancouver.</p> <p>Changes to C-TRAN local bus routes to connect with the new bus guideway and park and rides.</p> <p>27 bus rapid transit vehicles (60' articulated buses) and 12 standard buses would be included in this alternative.</p>	<p>A new replacement crossing over the Columbia River, with either three separate bridges (two for interstate traffic and a third for buses, bicycles, and pedestrians) or a "stacked highway/transit bridge" design that would include transit beneath the western highway bridge deck. (see the Multimodal River Crossing and highway improvements section below for more information on these designs).</p> <p>Improvements to the following I-5 interchanges: Marine Drive, Hayden Island, SR 14, Mill Plain, Fourth Plain, and SR 500.</p> <p>Additional auxiliary lanes for traffic entering and/or exiting I-5 between Marine Drive and SR 500.</p> <p>A toll would be charged on the I-5 crossing, with higher rates during peak travel periods.</p>
<b>3: Replacement crossing with light rail</b>	<p>Extension of the light rail guideway from the Expo Center over Hayden Island and across the Columbia River to a terminus in Vancouver. The light rail guideway would extend 2.07–4.22 miles north from the Expo Center, and would include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus.</p> <p>Changes to C-TRAN local bus routes to connect with the new light rail stations and park and rides.</p> <p>Expansion of TriMet's Ruby Junction light rail maintenance facility in Gresham.</p> <p>Fourteen light rail vehicles and 27 standard buses would be included in this alternative.</p>	<p>Same highway features as Alternative 2.</p> <p>This alternative was also modeled without a toll to determine the potential effects of tolling on traffic patterns.</p>
<b>4: Supplemental crossing with bus rapid transit</b>	<p>Same transit features as Alternative 2, but higher frequency operations of bus rapid transit and local bus routes.</p> <p>This alternative would include 38 bus rapid transit vehicles and 143 standard buses.</p>	<p>A new, supplemental crossing for southbound interstate traffic and exclusive lanes for buses.</p> <p>Both existing I-5 bridges would be re-striped for two lanes each to carry northbound I-5 traffic.</p> <p>Seismic retrofits to the existing bridges.</p> <p>Improvements to the following I-5 interchanges: Marine Drive, Hayden Island, SR 14, Mill Plain, Fourth Plain, and SR 500.</p> <p>Additional auxiliary lanes (generally one less additional lane than Alternatives 2 and 3) for traffic entering and/or exiting I-5 between Marine Drive and SR 500.</p> <p>A toll would be charged on the I-5 crossing, with higher rates during peak travel periods. During these peak travel periods, the toll would be higher than with Alternatives 2 or 3.</p>
<b>5: Supplemental crossing with light rail</b>	<p>Same transit features as Alternative 3, but higher frequency operations for light rail and for local bus routes.</p> <p>This alternative would include 18 light rail vehicles and 147 standard buses.</p>	Same highway features as Alternative 4.



Exhibits 11 through 15, below, describe the build alternatives. These exhibits are followed by detailed descriptions of the various components that make up the alternatives.

Exhibit 11

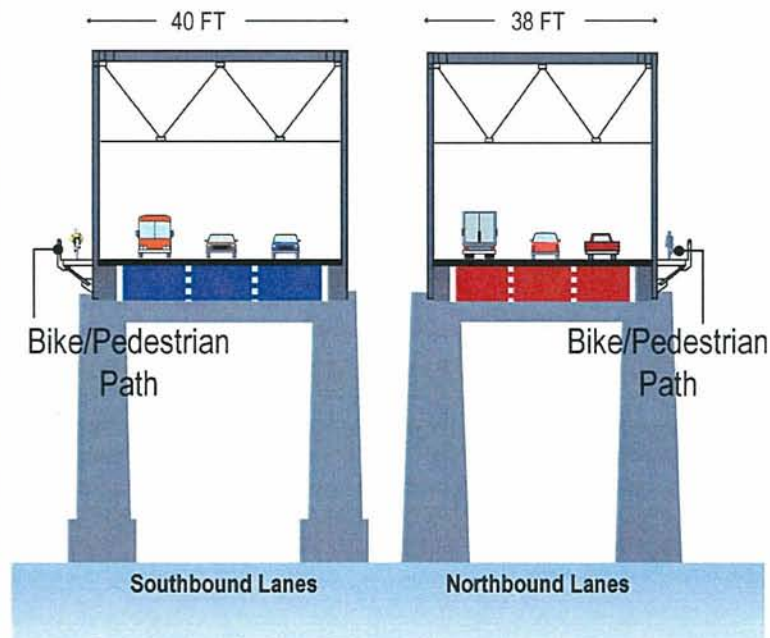
## ALTERNATIVE 1: No-Build



DIMENSIONS ARE APPROXIMATE.

The No-Build Alternative illustrates how transportation and environmental conditions would change by the year 2030 if the I-5 CRC project is not built. This alternative makes the same assumptions as the build alternatives regarding population and employment growth through 2030, and also assumes that the same transportation and land use projects in the region would occur as planned. For example, the No-Build Alternative includes the I-5 widening around Delta Park that is scheduled to begin construction in 2008. The No-Build Alternative also includes several large land use changes that are planned within the project area, such as the Riverwest development just south of Evergreen Boulevard west of I-5, the Columbia West Renaissance project along the western waterfront in downtown Vancouver, and redevelopment plans for the Jantzen Beach shopping center on Hayden Island. All traffic and transit projects within or near the CRC project area that are anticipated to be built by 2030 separately from this project are included in the Cumulative Effects Technical Report. All these projects are also assumed in the build alternatives.

### Existing River Crossing



MEASUREMENTS PROVIDED ARE APPROXIMATE.



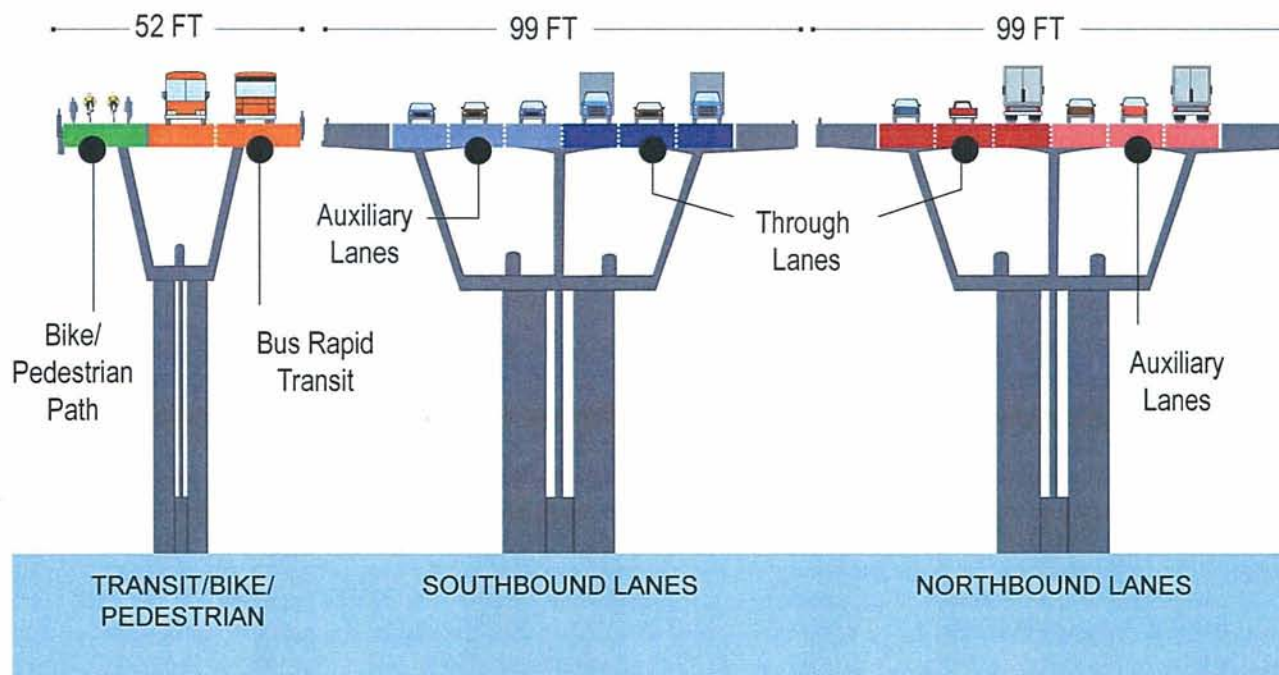
Exhibit 12 (page 1 of 2)

## ALTERNATIVE 2: Replacement Crossing with Bus Rapid Transit

This alternative would replace the existing I-5 bridges with a new crossing downstream (west) of the current I-5 alignment. The existing bridges would be removed. The new crossing could include three bridges, two for northbound and southbound Interstate traffic, and a third bridge for buses in dedicated transit lanes, bicyclists, and pedestrians. There is also a “Stacked Transit/Highway Bridge” (STHB) design that would require two new bridges, rather than the three needed for the standard replacement crossing design. The STHB design would include transit beneath the highway deck of the I-5 southbound bridge and would suspend the bicycle and pedestrian path under the eastern edge of the northbound I-5 bridge.

Bus rapid transit would operate in an exclusive guideway from the Expo Center in Portland along one of several alignment options through the project area to end at one of four possible terminus options (a description of these options starts on page S-22). The exclusive bus lanes would extend 2.07–4.22 miles north from the Expo Center through Vancouver, and include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus. Riders could transfer at the Expo Center to the existing MAX light rail system. Local bus service in Vancouver would increase to serve new transit passengers. Automobiles and trucks would pay a toll to cross the Columbia River on the new I-5 bridges.

### Replacement River Crossing with Bus Rapid Transit



Please see page S-18 for a definition of Auxiliary Lanes  
MEASUREMENTS PROVIDED ARE APPROXIMATE.



Exhibit 12 (page 2 of 2)

**Transit Terminus and Alignment Options for Alternative 2****Kiggins Bowl Terminus****Lincoln Terminus**

MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment

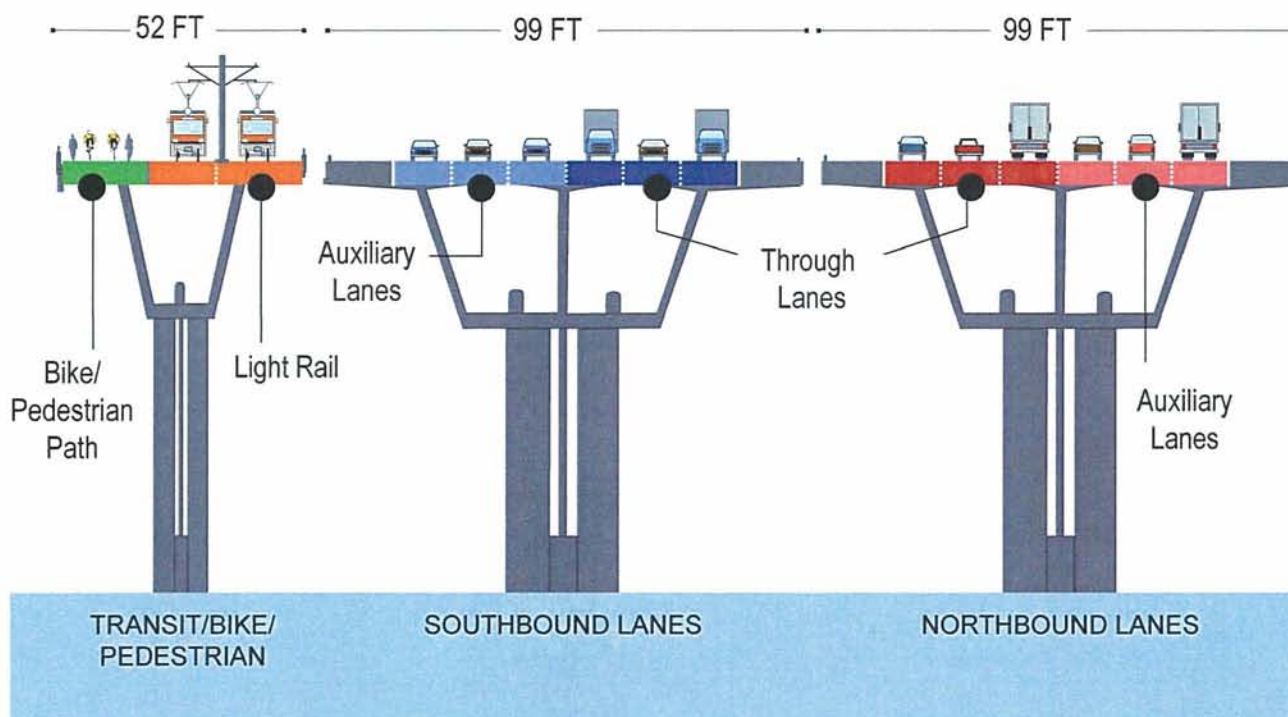


Exhibit 13 (page 1 of 2)

### ALTERNATIVE 3: Replacement Crossing with Light Rail

Alternative 3 is similar to Alternative 2 except that light rail would be used instead of bus rapid transit. Light rail could use the same alignments and station locations as bus rapid transit. Trains would not run as frequently as the buses in Alternative 2 because they have higher capacity. The light rail guideway would connect with the MAX system at the Expo Center, allowing trains to continue directly into downtown Portland without a transfer. This alternative includes the same tolling scenario as Alternative 2, but was also modeled without a toll on the I-5 crossing in order to determine the effects that tolling could have on traffic patterns.

#### Replacement River Crossing with Light Rail

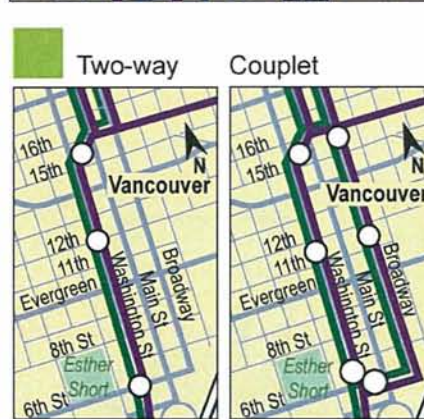


Please see page S-18 for a definition of Auxiliary Lanes

MEASUREMENTS PROVIDED ARE APPROXIMATE.



Exhibit 13 (page 2 of 2)

**Transit Terminus and Alignment Options for Alternative 3****Kiggins Bowl Terminus****Lincoln Terminus**

MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment



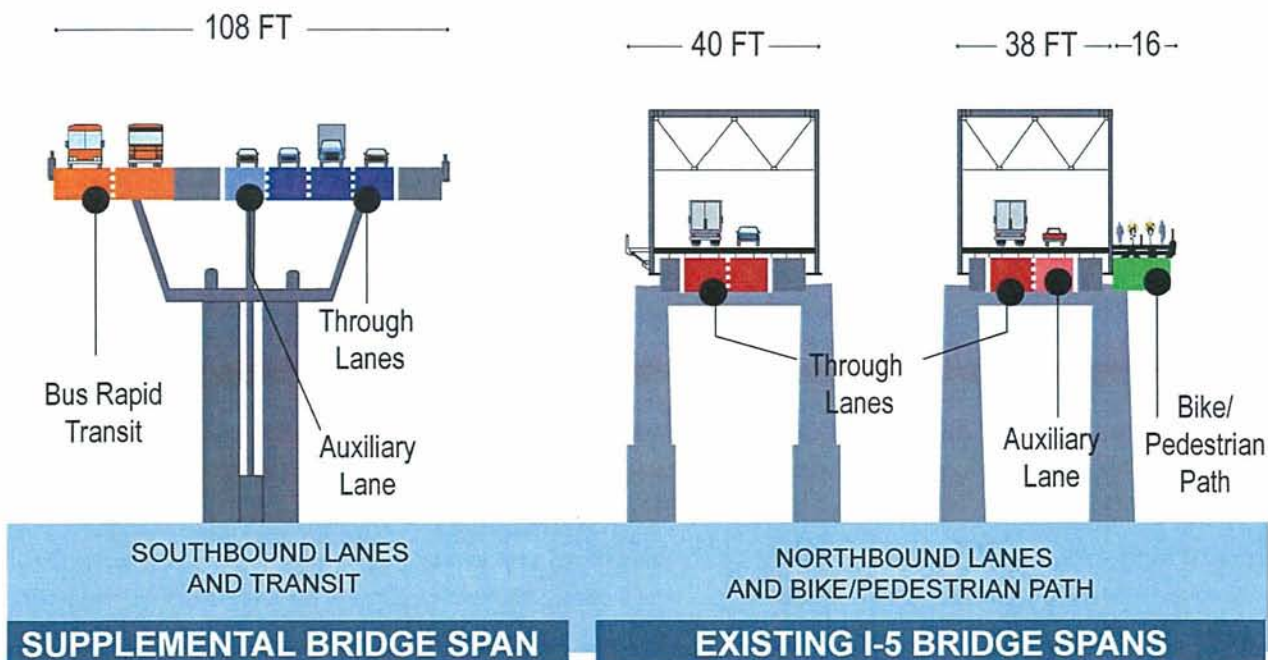
Exhibit 14 (page 1 of 2)

## ALTERNATIVE 4: Supplemental Crossing with Bus Rapid Transit

This alternative would retain both existing I-5 bridges and add one new bridge. The existing I-5 bridges would be re-striped to provide two northbound lanes on each bridge and provide safety shoulders for disabled vehicles. Currently each bridge has three lanes and no shoulders. A new, wider bicycle and pedestrian facility would be added to the east side of the existing northbound (eastern) bridge. A new supplemental bridge would be constructed downstream of the existing bridges, and would include four southbound I-5 traffic lanes, safety shoulders and a bus rapid transit guideway.

Buses would operate in an exclusive guideway from the Expo Center in Portland along one of several possible alignments through the project area to end at one of four possible terminus options (a description of these options starts on page S-22). The exclusive bus lanes would extend 2.07–4.22 miles north from the Expo Center through Vancouver, and include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus. Buses would operate more frequently than with Alternative 2, to compensate for the reduced auto capacity of the supplemental crossing compared to the replacement crossing. Local bus service in Vancouver and Clark County would increase to serve new transit passengers. Automobiles and trucks would pay a toll to cross the Columbia River that would be slightly higher during peak commute periods than for Alternatives 2 and 3.

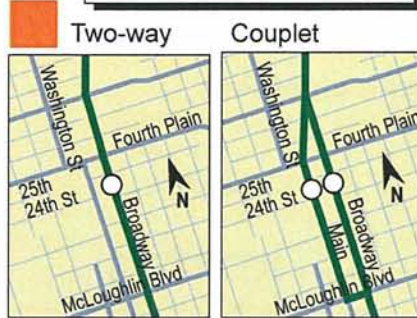
### Supplemental River Crossing with Bus Rapid Transit



Please see page S-18 for a definition of Auxiliary Lanes  
MEASUREMENTS PROVIDED ARE APPROXIMATE.



Exhibit 14 (page 2 of 2)

**Transit Terminus and Alignment Options for Alternative 4****Kiggins Bowl Terminus****Lincoln Terminus**

MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment

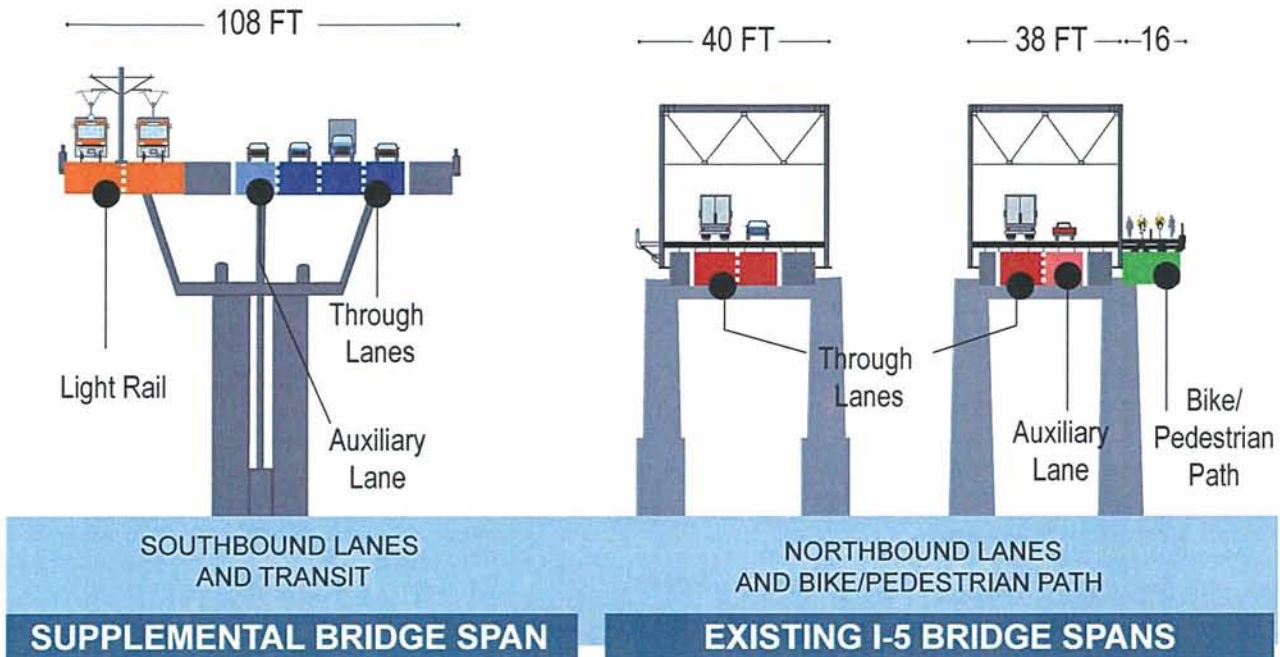


Exhibit 15 (page 1 of 2)

## ALTERNATIVE 5: Supplemental Crossing with Light Rail

Alternative 5 is similar to Alternative 4 except that light rail would be used instead of bus rapid transit. Light rail would have the same possible alignments and station locations. Compared to Alternative 3, trains would operate more frequently to increase the capacity of the transit system in order to compensate for the lower capacity of the supplemental crossing compared to the replacement crossing.

### Supplemental River Crossing with Light Rail



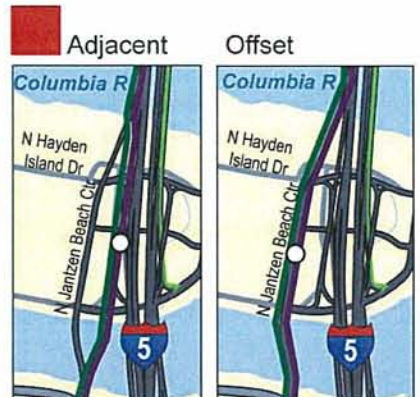
Please see page S-18 for a definition of Auxiliary Lanes  
MEASUREMENTS PROVIDED ARE APPROXIMATE.



Exhibit 15 (page 2 of 2)

# Transit Terminus and Alignment Options for Alternative 5

## Kiggins Bowl Terminus



## Lincoln Terminus



MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment

## Multimodal River Crossing and Highway Improvements

Two options for improving the river crossing are being evaluated:

- Replace the existing bridges with new bridges, or
- Reuse the existing bridges and build a new structure next to them.

Each river crossing has a unique set of improvements for highway traffic, transit vehicles, and bicyclists and pedestrians.

### REPLACEMENT CROSSING

A replacement river crossing would remove the two existing I-5 bridges and replace them with three new, parallel bridges immediately west of the current I-5 crossing. The new eastern (northbound traffic) and middle (southbound traffic) bridges could accommodate six lanes each for highway traffic. The new western bridge would carry high-capacity transit across the river, with a separated path for bicyclists and pedestrians.

A pathway for bicyclists and pedestrians would be located on the high-capacity transit guideway, and extend from the Expo Center, across Hayden Island, and into downtown Vancouver. This pathway could be placed on either or both sides of the river crossing. The bicycle and pedestrian path would be continuous and above-grade from just north of Marine Drive to Sixth Street in Vancouver.

Highway improvements north and south of the replacement river crossing would provide three lanes for traffic traveling through the project area, and one to three auxiliary lanes for traffic entering, exiting, or traveling short distances on the highway within the project area.

### TERMS & DEFINITIONS

#### Auxiliary Lanes

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Auxiliary lanes can improve safety and reduce congestion by accommodating cars and trucks entering or exiting the highway or traveling short distances between adjacent interchanges, and can reduce conflicting weaving and merging movements. This is especially important at the river crossing, where three large interchanges (Marine Drive, Hayden Island, and SR 14) all have traffic entering and exiting I-5 within a 1.5-mile segment.

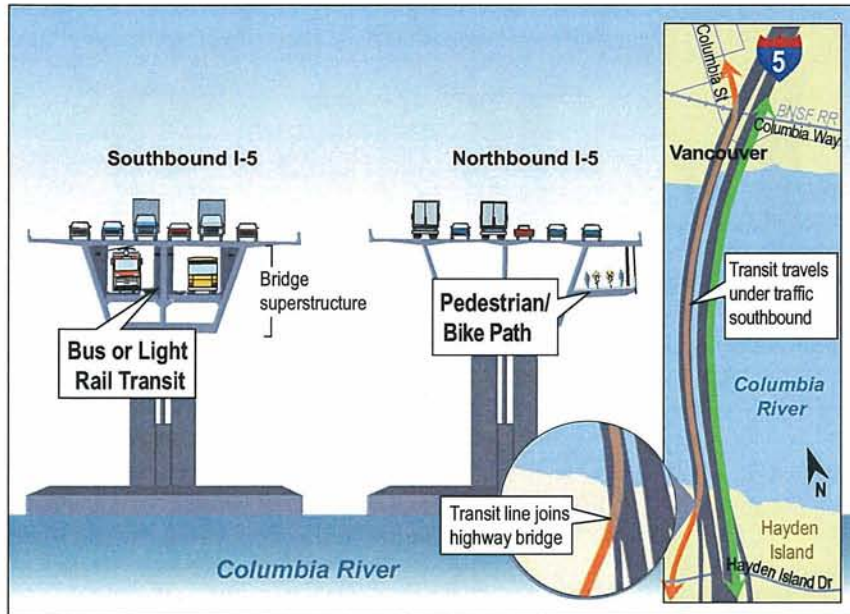
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There is also a “Stacked Transit/Highway Bridge” (STHB) design for the replacement crossing that would include transit beneath the highway deck of the I-5 southbound bridge and would suspend the bicycle and pedestrian path under the eastern edge of the northbound I-5 bridge. This design would require two new bridges, rather than the three needed for the standard replacement crossing design.

Exhibit 16

#### Conceptual Design of Stacked Transit/Highway Bridge Design



NOT TO SCALE

Note: The bridge type shown is for display purposes only.

#### SUPPLEMENTAL CROSSING

A supplemental river crossing would keep the existing bridges and build an adjacent new bridge. The supplemental river crossing would reuse both existing I-5 bridges, but only northbound traffic would travel on them. These bridges would each be re-striped to accommodate two lanes of traffic, for a total of four northbound I-5 lanes over the Columbia River. Bicyclists and pedestrians would use a new, wider path suspended from one of the existing bridges (current designs show the eastern bridge). The existing bridges would also receive major seismic upgrades. A new, parallel but higher bridge would be constructed downstream (west) to accommodate four lanes of southbound highway traffic, and would carry high-capacity transit in dedicated transit lanes.

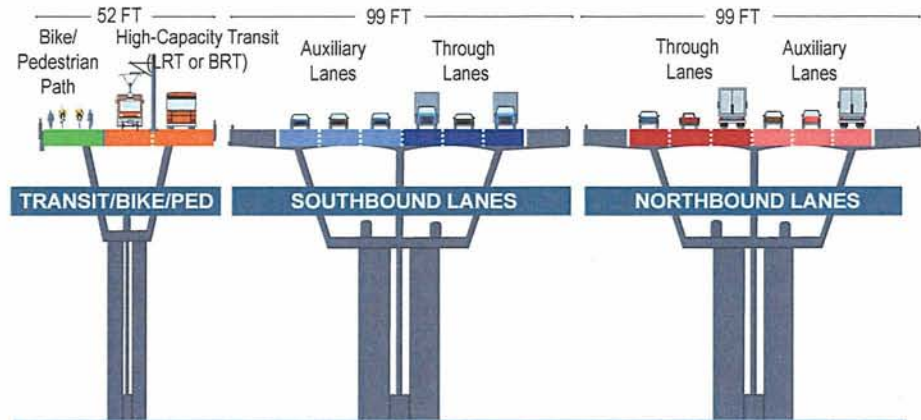


# Replacement River Crossing



DIMENSIONS ARE APPROXIMATE.

## Number of Lanes and Traffic Types on Bridges



MEASUREMENTS PROVIDED ARE APPROXIMATE.

## Detailed Area of River Crossing

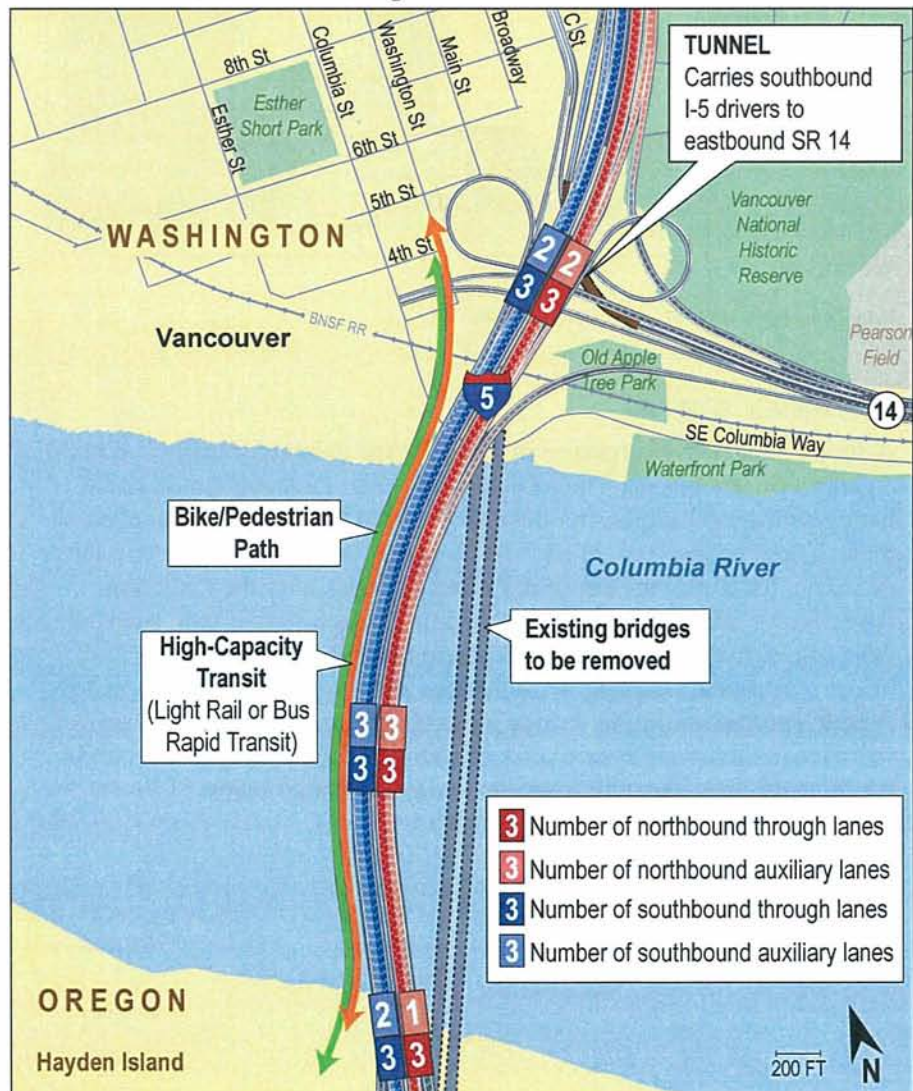




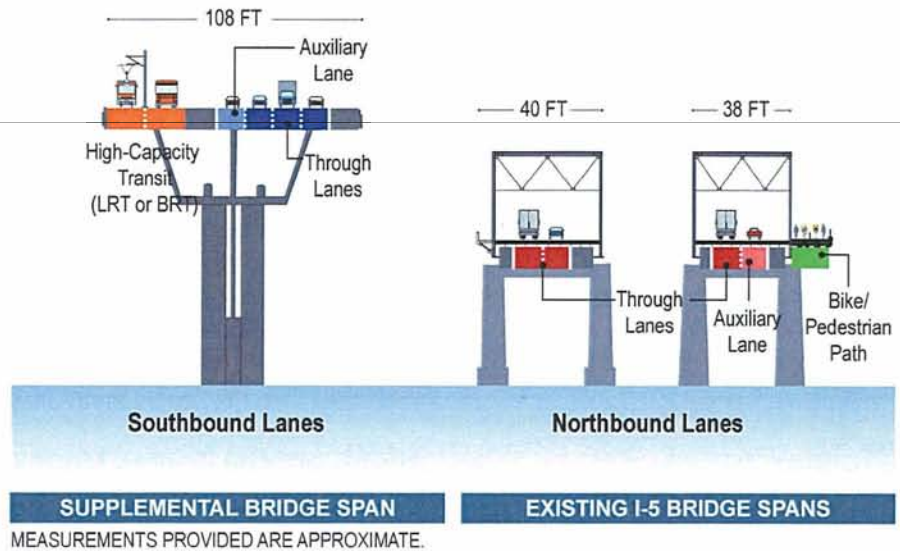
Exhibit 18

## Supplemental River Crossing



DIMENSIONS ARE APPROXIMATE.

### Number of Lanes and Traffic Types on Bridges



### Detailed Area of River Crossing





A wider path on the outside of one of the existing bridges would be constructed to safely accommodate both pedestrians and bicyclists. Ramps would connect this wider pathway with Columbia Way in Vancouver and with Tomahawk Island Drive on Hayden Island. An elevated multi-use pathway would also be provided alongside the transit guideway between Tomahawk Island Drive and Marine Drive, crossing over North Portland Harbor. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through intersections. Stairs, ramps, and/or elevators would be provided on both bridge alternatives to connect with existing and planned sidewalks and pathways in Vancouver, on Hayden Island, and near Marine Drive.

Highway improvements north and south of the river crossing would provide three lanes for traffic traveling through the project area, and one to two additional lanes for traffic entering, exiting, or traveling short distances on the highway within the project area. North of the river, the supplemental crossing would have one less auxiliary lane in each direction than the replacement crossing.

Exhibit 19  
BRT Vehicle



Exhibit 20  
Light Rail Vehicle



### High-Capacity Transit Modes

The CRC project is examining two high-capacity transit modes to determine the best solution for providing transit within the CRC project area:

- Bus rapid transit (BRT), and
- Light rail (LRT).

Both modes would offer high capacity transit service connections with existing transit facilities and flexibility for future expansion. Both modes would provide increased capacity for passengers and improved amenities compared to the bus service that currently operate in the project area. Some existing bus routes would be modified to support the high-capacity transit system by connecting suburban commuters to the new system and retaining direct bus service from suburban areas to key employment centers such as downtown Portland.

Bus rapid transit would increase capacity for transit users and supply dedicated bus lanes in the project area. BRT would cost less to construct than a light rail system, and would provide flexibility for increasing future routes. Dedicated lanes through the project area would allow buses to bypass traffic and avoid delays from automobile congestion. Bus rapid transit would use larger buses (60 feet long instead of the typical 40-foot length). BRT stations would offer an easy fare payment method, such as ticket vending machines, and have a “branded” look, distinct from regular buses. Buses would stop at the Expo Center MAX station, where riders could transfer to or from the existing regional light rail system.



Light rail transit would follow the same potential alignments as bus rapid transit. It would extend the existing light rail system from its current northern ending point (terminus) at the Expo Center station across the Columbia River and into Vancouver, offering passengers a no-transfer ride between Vancouver and downtown Portland. Vehicles and station design would be similar to the existing MAX system, with ticket vending machines and a consistent appearance that is easy to recognize. Light rail trains would be allowed to pass through signalized intersections before other vehicles, which would shorten transit riders' trip through downtown Vancouver.

### Transit Terminus and Alignment Options

Each of the CRC build alternatives includes four options in Vancouver where the high-capacity transit guideway could end, called transit terminus options. These terminus options are included in each alternative to provide the public and project co-lead agencies with a range of choices to consider and to provide possibility for extension in the future based on funding availability.

These include the Kiggins Bowl terminus, Lincoln terminus, Clark College minimum operable segment (MOS), and Mill Plain MOS. Each of these terminus options includes both the specific endpoint, such as the park and ride and the transit station, and the entire guideway and stations preceding this terminus through the project corridor. For example, the Kiggins Bowl terminus includes the guideway extending from the Expo Center to the Kiggins Bowl Park and Ride. Likewise, the Clark College MOS terminus includes the guideway extending from the Expo Center to the Clark College Park and Ride.

Exhibit 21

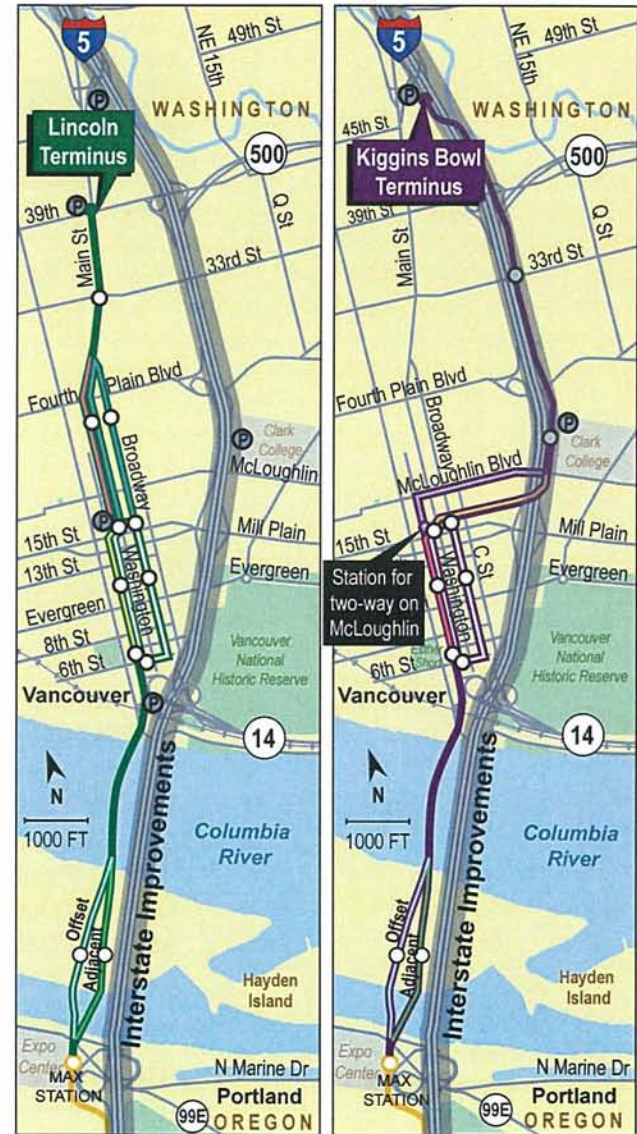
### Transit Terminus and Alignment Options

#### Lincoln Terminus

- Washington-Broadway Couplet
- Two-way Broadway (south)
- Broadway-Main Couplet
- Two-way Broadway (north)
- Transit Station
- Ⓟ Park and Ride Lot

#### Kiggins Bowl Terminus

- Washington-Broadway Couplet
- Two-way Broadway
- Two-way on McLoughlin Blvd
- Two-way on 16th Street
- Transit Station
- Ⓟ Park and Ride Lot



DIMENSIONS ARE APPROXIMATE.

Exhibit 22  
Station Locations and Guideway Length

	Kiggins Bowl terminus (A)	Lincoln terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Guideway Length	4.22 miles	3.43 miles	2.65	2.07
Hayden Island Station	Adjacent or Offset from I-5	Adjacent or Offset from I-5	Adjacent or Offset from I-5	Adjacent or Offset from I-5
Downtown Vancouver Stations	7th Street 12 Street Mill Plain	7th Street 12 Street Mill Plain	7th Street 12 Street Mill Plain	7th Street 12 Street Mill Plain
North Vancouver Stations	Clark College 33rd Street Kiggins Bowl	24th Street 33rd Street Lincoln	Clark College	None
Park and Rides	Expo Center (existing)	Expo Center (existing)	Expo Center (existing)	Expo Center (existing)
	Clark College (structure)	Clark College (surface lot) <sup>a</sup>	Clark College (surface lot)	SR-14 surface lots
	Kiggins Bowl (structure)	Lincoln (structure)	Kiggins Bowl (surface lot) <sup>a</sup>	Clark College (surface lot) <sup>a</sup>
		Kiggins Bowl (surface lot) <sup>a</sup>		Lincoln (surface lot) <sup>a</sup> Kiggins Bowl (surface lot) <sup>a</sup>
Total park and ride stalls	2,410	1,250	2,410	2,365

<sup>a</sup> These park and rides are proposed at sites that would not be on the HCT guideway, but would be connected to an HCT via local bus routes.

#### KIGGINS BOWL TERMINUS

The Kiggins Bowl terminus option would construct high-capacity transit from the Expo Center, across Hayden Island, over the Columbia River, and through downtown Vancouver. It would then travel east to cross under I-5 and connect to Clark College, continue north adjacent to I-5, and end at a park and ride at Kiggins Bowl. This terminus option would include a three-level parking structure at Clark College and a six-level structure at the Kiggins Bowl station.

#### LINCOLN TERMINUS

The Lincoln terminus option would construct high-capacity transit from the Expo Center, across Hayden Island, over the Columbia River, through downtown Vancouver, and continue north on local streets to the Lincoln Park and Ride north of 39th Street.

The Lincoln Park and Ride would contain up to two levels below ground and one level at-grade or above ground. To provide a wider range of access across Clark County, the Lincoln terminus option would also include a surface parking lot at Clark College and another surface lot at Kiggins Bowl. Local bus routes would connect these lots to the Lincoln Park and Ride or the Mill Plain station for transfer to the high-capacity transit line.



### CLARK COLLEGE MINIMUM OPERABLE SEGMENT

The Clark College MOS ends the HCT guideway at the Clark College Park and Ride. This terminus option would provide flexibility for future extension, as part of another project, to either the Kiggins Bowl terminus or the Lincoln terminus.

The Clark College MOS would include the same three-level parking structure at Clark College as the Kiggins Bowl terminus. There would also be a surface lot at Kiggins Bowl that would be connected to the transit guideway by new local bus routes. The terminus station could be between the park and ride and the highway, as indicated in the graphics, or it could be parallel to McLoughlin, either in the middle or to the side of the street.

### MILL PLAIN MINIMUM OPERABLE SEGMENT

The Mill Plain MOS would end the transit guideway at a new Mill Plain station between 15th and 16th Streets and between Washington and Main Streets, and could serve as a shortened version of either the Kiggins Bowl terminus or Lincoln terminus. Future projects could extend the transit guideway to either full-length terminus option. The Mill Plain MOS would include park and ride facilities around the SR 14 interchange in lower downtown Vancouver, a multi-level structure north of the Mill Plain station, and surface lots at Clark College, Kiggins Bowl, and Lincoln.

### TRANSIT ALIGNMENT OPTIONS

Each of the four terminus options described above has different alignment options, or routes, for extending the high-capacity transit guideway from the Expo Center to the terminus. There are distinct sets of alignment options within three sections of the project corridor. There are two alignment options in the southern section from the Expo Center over Hayden Island and across the Columbia River. The middle section through downtown Vancouver also has two alignment options. The northern section, extending through northern Vancouver, has four alignment options—two for the Kiggins Bowl terminus and Clark College MOS, and two different alignment options for the Lincoln terminus.

From the Expo Station across Hayden Island, transit could run either adjacent to, or several hundred feet away (offset) from, I-5. Through downtown Vancouver, HCT could run both directions (two-way) on

Exhibit 23

### Minimum Operable Segment (MOS)

#### Mill Plain MOS Alignment Options

- Washington-Broadway Couplet
- Two-way Broadway

#### Clark College MOS Alignment Options

- Washington-Broadway Couplet
- Two-way Broadway
- Two-way on McLoughlin Blvd
- Two-way on 16th Street



DIMENSIONS ARE APPROXIMATE.

The same alignments and station locations are available for bus rapid transit or light rail.

Washington Street, or run southbound on Washington Street and northbound on Broadway Street (a couplet).

In northern Vancouver, the Kiggins Bowl terminus and Clark College MOS have substantially different alignment options than the Lincoln terminus. The Kiggins Bowl terminus and Clark College MOS would turn east at either McLoughlin Boulevard or 16th Street to go under I-5 and connect with a new park and ride at Clark College. From there, the Kiggins Bowl terminus would continue north parallel to the east side of I-5 before crossing back over I-5 near the SR 500 interchange and ending at a new Kiggins Bowl Park and Ride.

The Lincoln terminus would continue north from downtown Vancouver, using either Broadway Street for two-way travel or a couplet on Broadway and Main Streets. Either of these alignment options would then merge to a two-way guideway on Main Street, north of Fourth Plain Boulevard, and end at the new Lincoln Park and Ride north of 39th Street.

Transit Operations

The build alternatives include two different operating scenarios for the high-capacity transit system—“Efficient” and “Increased” operations. These operating scenarios differ by how often the high-capacity transit vehicles would arrive at stations and what other bus routes would be used to feed the system. The transit system would be able to accommodate more people if the trains or buses arrive more often during the peak commute periods.

Exhibit 24  
Transit Vehicle Headways in the Guideway (Minutes)

	Efficient Operations (Alternatives 2 and 3)		Increased Operations (Alternatives 4 and 5)	
	BRT <sup>a</sup>	LRT	BRT <sup>a</sup>	LRT
Peak periods <sup>b</sup>	2.5	7.5	1.5	6
Off-peak period	15	15	15	15

Source: CRC Transit Technical Report.

<sup>a</sup> BRT headways include local buses using the guideway.

<sup>b</sup> Peak periods are between 6 a.m. and 10 a.m. on weekday mornings and between 3 p.m. and 7 p.m. on weekday evenings.

Bridge Toll

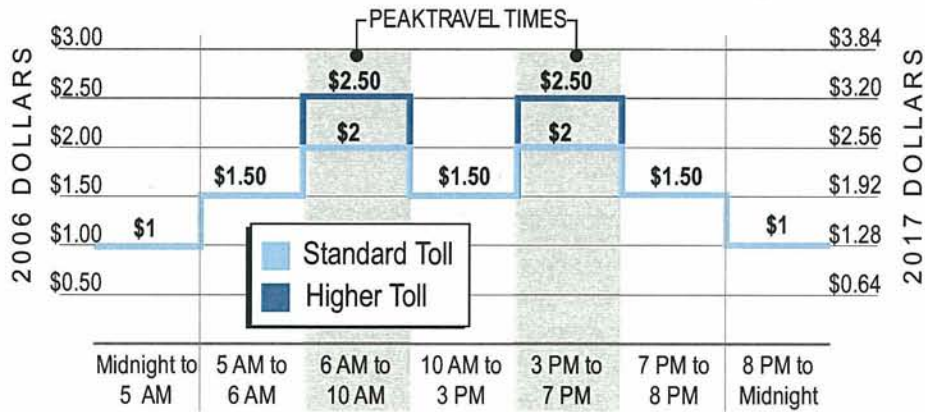
Tolling will likely be necessary to generate the local revenue needed to help pay for the CRC project. Tolling was used to fund the original construction of the Interstate Bridge in 1917, and again in 1958 to pay for construction of the second span.

Several tolling scenarios are being evaluated (Exhibit 21):

- No toll (part of the No-Build Alternative, and also modeled with Alternative 3 to determine the traffic effects of tolling).

- Standard variable rate on the I-5 crossing (paired with Alternatives 2 and 3).
- Higher variable rate on the I-5 crossing (paired with Alternatives 4 and 5).
- Standard variable rate on both the I-5 and I-205 crossings (not paired with any build alternative, but evaluated separately to assess potential traffic diversions resulting from tolling the I-5 crossing).

Exhibit 25

**Tolls for Passenger Cars (with Transponders)**



Different toll rates would be charged based on the type of vehicle and the time of day, with higher tolls charged during peak commute periods. Tolls would be collected through an electronic toll collection system so that traffic would not have to stop or slow down when crossing the bridge. Instead, motorists could equip their cars with transponders that would automatically bill the vehicle owner each time they crossed the bridge. Cars without transponders would be tolled by a license-plate recognition system that would bill the address of the owner registered to that license plate.

These different tolling scenarios are being evaluated for several purposes. Evaluating different rates on the I-5 crossing provides information about travelers' sensitivity to paying a toll, and whether a higher toll would provide more revenue or simply cause reduced use of the river crossing. Evaluating a toll on the I-205 crossing provides an indication of how many motorists would divert to the I-205 crossing if this project were to implement a toll on just the I-5 crossing.

### **Transportation System and Demand Management Measures**

In addition to the components described above, all build alternatives evaluated in this DEIS include transportation system management (TSM) and transportation demand management (TDM) measures to help reduce congestion during peak travel periods, improve traffic movement on the highway, and provide alternative transportation options to commuters. Transportation system management measures attempt to improve how traffic moves on existing roadways through a variety of techniques focused on keeping drivers informed and moving as safely, efficiently, and reliably as possible. Measures include:

- Adding traveler information systems (electronic reader boards) in the project area to alert motorists of temporary changes in highway conditions, such as a traffic accident or construction;
- Improving the emergency vehicle response system;
- Separate on-ramp lanes for transit vehicles and other designated vehicles to bypass traffic at ramp signals; and
- Expanded traffic monitoring equipment and cameras.

Transportation demand management measures seek to reduce the number of vehicles using the road system, especially single-occupant vehicles, while providing alternatives to automobile travel. Several of the project components would reduce demand for automobile travel, such as the introduction of high-capacity transit, charging a toll on cars and trucks using the I-5 crossing, and upgrading the bicycle and pedestrian facilities that cross the Columbia River.



## How do the different alternatives and components compare?

This section highlights how the alternatives differ in terms of transportation performance, and community and environmental effects. Key differences between the full alternatives are highlighted first, followed by more detailed comparisons of the individual components. This is not a comprehensive discussion on the effects of these alternatives. Rather, the most substantial effects or those effects that help differentiate the alternatives are discussed. Chapter 3 provides more breadth and detail on how these alternatives and components perform and how they could affect the community and environment.

### Comparison of Alternatives

Exhibits 26 and 27 below summarize the key performance and impact differences between each alternative. There are many factors contributing to these differences that are explained by the different combinations of components represented by each alternative. These components are compared in the next section.

## Exhibit 26

## Summary of Transportation Effects and Cost for Each Alternative

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Hours of Congestion/day</b>	15 hours	3.5-5.5 hours	3.5-5.5 hours	10.75 hours	10.75 hours
<b>People over the I-5 Crossing during PM peak<sup>a</sup></b>	28,550 total	40,500 total	41,650 total	31,600 total	33,050 total
<b>In cars</b>	26,500	34,400	34,400	25,700	25,700
<b>On transit</b>	2,050	6,100	7,250	5,900	7,350
<b>Vehicle trips over the I-5 crossing/day<sup>b</sup></b>	184,000	178,000 <sup>b</sup>	178,000 <sup>b</sup>	165,000 <sup>b</sup>	165,000 <sup>b</sup>
<b>Pedestrian and Bicycle Connections</b>	Potentially no improvement to connections.	Provide continuous grade-separate multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separate multi-use path between Marine Drive and downtown Vancouver.	Improvements over the river but has at-grade crossings on Hayden Island.	Improvements but has at-grade crossings on Hayden Island.
<b>Transit mode split in p.m. peak period<sup>c</sup></b>	13%	17-21%	19-23%	30-34%	34-38%
<b>Transit travel time from Mill Plain station to Expo Center</b>	N/A	8 min	7 min	14 min	8 min
<b>Traffic safety</b>	Potentially no improvement.	Reduced congestion and improved highway design would reduce collisions.	Reduced congestion and improved highway design would reduce collisions.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.
<b>Transit safety</b>	Potentially no changes	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.
<b>Effect on river navigation</b>	Potentially no improvement	Eliminates S-curve maneuver and reduces number of piers.	Eliminates S-curve maneuver and reduces number of piers.	S-curve maneuver worsened with more piers and narrower channel.	S-curve maneuver worsened with more piers and narrower channel.
<b>Capital Cost<sup>d</sup></b>	\$0	\$3,260 - \$3,915	\$3,368 - \$4,091	\$3,125 - \$3,781	\$3,214 - \$3,950

Sources: CRC Traffic Technical Report, 2008; CRC Transit Technical Report, 2008; CRC Cost Risk Assessment, 2007.

<sup>a</sup> Total number of people in cars and on transit vehicles using the I-5 crossing traveling north during the four-hour afternoon/evening peak period (3 p.m. to 7 p.m.).

<sup>b</sup> These values assume a Kiggins Bowl terminus. See transit terminus section below for information on how the transit terminus option affects vehicle trips.

<sup>c</sup> Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

<sup>d</sup> Capital costs are in millions of year-of-expenditure dollars. Cost ranges are due to the HCT terminus option in each of the build alternatives and to confidence (low being 60% confidence that cost would not be exceeded, and high being 90% confidence that cost would not be exceeded.)

## Exhibit 27

## Summary of Community and Environmental Effects for Each Alternative

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Residential displacements	0 <sup>a</sup>	21-36	21-36	24-33	24-33
Commercial displacements	0 <sup>a</sup>	41-68	41-68	34-64	34-64
Number of potential adverse impacts to historic resources	0	5-8	5-8	5-8	5-8
Air Quality <sup>b</sup>					
Carbon monoxide	30% reduction	30% reduction	30% reduction	30% reduction	30% reduction
Nitrogen oxides	70% reduction	70% reduction	70% reduction	70% reduction	70% reduction
Volatile organic compounds	50% reduction	50% reduction	50% reduction	50% reduction	50% reduction
Particulate matter	90% reduction	90% reduction	90% reduction	90% reduction	90% reduction
Traffic noise impacts on sensitive receptors (before mitigation) <sup>c</sup>	264	334	334	329	329
Transit noise impacts on sensitive receptors (before mitigation) <sup>c</sup>	0	35-82	7-45	38-92	7-51
Impacts on fish	No impacts from in-water construction, existing piers would remain, and water quality issues would remain.	Impacts from in-water construction, fewer piers would be in water, but greatest improvement in water quality.	Impacts from in-water construction, fewer piers would be in water, but greatest improvement in water quality.	Impacts from in-water construction, more piers would be in water, but some improvement in water quality.	Impacts from in-water construction, more piers would be in water, but some improvement in water quality.
Wetland impacts	No impacts	0.11 acres of direct impacts	0.06 acres of direct impacts	0.16 acres of direct impacts	0.11 acres of direct impacts
Total Suspended Solids (lbs./year)	136,020	43,293	43,235	40,735	40,677
Total Phosphorus (lbs./year)	207	109	108	102	102
Dissolved Copper (lbs./year)	9	8	8	8	8
Dissolved zinc (lbs./year)	64	49	49	46	46
CO <sub>2</sub> Emissions (tons/day)	463	452	452	494	491

Sources: CRC Acquisitions Technical Report, 2008; CRC Historic Resources Technical Report, 2008; Air Quality Technical Report, 2008; CRC Noise and Vibration Technical Report, 2008; CRC Ecosystems Technical Report, 2008; CRC Wetlands Technical Report, 2008; CRC Water Quality Technical Report, 2008; CRC Energy Technical Report, 2008.

<sup>a</sup> Both the C-TRAN bus maintenance facility and TriMet Ruby Junction light rail maintenance facility could be expanded with the No-Build alternative, though the exact size of the expansions is not known. Both of these expansions would likely result in both residential and commercial displacements.

<sup>b</sup> Reductions in emissions are largely due to expected improvements in vehicle emissions by 2030, and are thus not the result of this project and therefore are common amongst all alternatives.

<sup>c</sup> Noise impacts are expressed as the total number of impacts on sensitive receptors as defined by FHWA guidelines. This means that, for example, a 30 unit apartment complex that is impacted by traffic noise would register as 30 impacts on sensitive receptors.

## Comparison of Components

Exhibits 28 through 32 below compare the performance and impacts of the individual components that comprise the full alternatives using similar metrics as those in the preceding section. This comparison of components illustrates what elements of the full alternatives are causing the differences in their transportation performance and impacts.



Exhibit 28

**Comparison of No-Build and Replacement and Supplemental River Crossings and Highway Improvements**

	<b>No-Build (Alternative 1)</b>	<b>Replacement Crossing and highway improvements (Alternatives 2 and 3)</b>	<b>Supplemental Crossing and highway improvements (Alternatives 4 and 5)</b>
<b>Hours of Congestion/day</b>	15 hours	3.5-5.5 hours	10.75 hours
<b>People in cars over the I-5 Crossing during PM Peak<sup>a</sup></b>	26,500	34,400	25,700
<b>Vehicle trips over the I-5 crossing/day</b>	184,000	178,000	165,000
<b>Pedestrian and Bicycle Connections</b>	Potentially no improvement to connections.	Provide continuous grade-separate multi-use path between Marine Drive and downtown Vancouver.	Improvements over the river but has at-grade crossings on Hayden Island.
<b>Traffic safety</b>	Potentially no improvement.	Reduced congestion and improved highway design would reduce collisions.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.
<b>Effect on river navigation</b>	Potentially no improvement.	Eliminates S-curve maneuver and reduces number of piers.	S-curve maneuver worsened with more piers and narrower channel.
<b>Seismic vulnerability</b>	Existing vulnerability	Improved seismic safety	Improved seismic safety
<b>Capital cost<sup>b</sup></b>	\$0	\$2,741 - \$3,042	\$2,560 - 2,813
<b>Residential displacements</b>	0 <sup>c</sup>	20	16
<b>Business displacements</b>	0 <sup>c</sup>	41	34
<b>Number of potential adverse impacts to historic resources</b>	0	5	5
<b>Traffic noise impacts on sensitive receptors (before mitigation)<sup>d</sup></b>	264	334	329
<b>Impacts on fish</b>	No impacts from in-water construction, existing piers would remain, and water quality issues would remain.	Impacts from in-water construction, fewer piers would be in water, but greatest improvement in water quality.	Impacts from in-water construction, fewer piers would be in water, but some improvement in water quality.

<sup>a</sup> Total number of people in cars using the I-5 crossing traveling north during the four-hour afternoon/evening peak period (3 p.m. to 7 p.m.).

<sup>b</sup> Capital costs shown are for the highway portion of the river crossing and highway improvements throughout the project area, and are in millions of year-of-expenditure dollars. Cost ranges are different levels of confidence that the costs will not be exceeded (low being 60% confidence and high being 90% confidence).

<sup>c</sup> Both the C-TRAN and TriMet maintenance facilities may be expanded with the No-Build alternative. The exact size of the expansion, therefore the number of residences or businesses potentially displaced by these expansions, is not known.

<sup>d</sup> Noise impacts are expressed as the total number of impacts on sensitive receptors as defined by FHWA guidelines. This means that, for example, a 30 unit apartment complex that is impacted by traffic noise would register as 30 impacts on sensitive receptors.

## Exhibit 29

## Comparison of Bus Rapid Transit versus Light Rail

	No-Build (Alternative 1)	Bus Rapid Transit (Alternatives 2 and 4)	Light Rail (Alternatives 3 and 5)
People in transit vehicles over the I-5 Crossing during PM Peak <sup>a</sup>	2,050	6,100	7,250
Transit mode split in p.m. peak period <sup>a</sup>	13%	17-21%	19-23%
HCT vehicle average speed through project area	N/A	14.5 mph	17.3 mph
Transit noise impacts on sensitive receptors (before mitigation) <sup>b</sup>	0	35-82	7-45

<sup>a</sup> Four-hour afternoon/evening peak period (3 p.m. to 7 p.m.).

<sup>b</sup> Noise impacts are expressed as the total number of impacts on sensitive receptors as defined by FHWA and FTA guidelines. This means that, for example, a 30 unit apartment complex that is impacted by transit noise would register as 30 impacts on sensitive receptors.

Note: values in this table assume Efficient transit operations scenario.

All four terminus options have been assessed with each of the build alternatives. Differences in the performance and impacts of these four terminus options account for many of the ranges of impacts that are summarized in the tables of the full alternatives above.

## Exhibit 30

## Comparison of Kiggins Bowl Terminus, Lincoln Terminus, and Clark College MOS, and Mill Plain MOS

	Kiggins Bowl terminus (Alternatives 2-5)	Lincoln terminus (Alternatives 2-5)	Clark College MOS (Alternatives 2-5)	Mill Plain MOS (Alternatives 2-5)
People in transit vehicles over the I-5 Crossing each weekday	21,100	20,800	18,200	19,100
Transit mode split in peak period and peak direction <sup>a</sup>	22%	21%	19%	23%
Capital cost <sup>b</sup>	\$1,045 - \$1,108	\$850 - \$881	\$654 - \$689	\$596 - \$628
Residential displacements	9-16	9-16	1-8	1-8
Commercial displacements	27-36	42-52	25-34	28-30
Number of potential adverse impacts to historic resources	1-3	3	0-2	0
Transit noise impacts on sensitive receptors (before mitigation) <sup>c</sup>	17-37	7-45	7-37	7-21

<sup>a</sup> Four-hour afternoon/evening peak period (3 p.m. to 7 p.m.).

<sup>b</sup> Capital costs are in millions of year-of-expenditure dollars. Cost ranges are different levels of confidence that the costs will not be exceeded (low being 60% confidence and high being 90% confidence).

<sup>c</sup> Noise impacts are expressed as the total number of impacts on sensitive receptors as defined by FHWA and FTA guidelines. This means that, for example, a 30 unit apartment complex that is impacted by transit noise would register as 30 impacts on sensitive receptors.

Note: Numbers in this table assume LRT and Efficient transit operations; differences between transit mode and operating scenarios compared in other tables.



The two transit operating scenarios, Efficient and Increased, affect transit performance and impacts differently for BRT than for LRT. This is primarily because the additional vehicles afforded by the Increased operating scenario causes some impact to BRT performance due to the high number of buses congesting the transit guideway; this congestion would not occur with LRT. Additionally, the different noise profile of BRT vehicles compared to LRT vehicles is affected differently by the changing number of transit vehicles between these two transit operating scenarios.

Exhibit 31

**Comparison of Efficient and Increased Transit Operating Scenarios**

	Efficient transit operating scenario (Alternatives 2 and 3)		Increased transit operating scenario (Alternatives 4 and 5)	
	BRT	LRT	BRT	LRT
People in transit vehicles over the I-5 Crossing each weekday	16,800 <sup>a</sup>	20,800 <sup>a</sup>	19,800 <sup>a</sup>	23,100 <sup>a</sup>
Average travel speed through CRC area	14.5 mph	17.3 mph	13.1 mph	17.3 mph
Transit noise impacts on sensitive receptors (before mitigation) <sup>b</sup>	35-82	7-45	38-92	7-51

<sup>a</sup> These values assume a Lincoln terminus.

<sup>b</sup> Noise impacts are expressed as the total number of impacts on sensitive receptors as defined by FHWA and FTA guidelines. This means that, for example, a 30 unit apartment complex that is impacted by transit noise would register as 30 impacts on sensitive receptors.

Exhibit 32

**Comparison of tolling scenarios**

	No Toll (Alternative 1, and modeled with Alternative 3)	I-5 standard toll (Alternatives 2 and 3)	I-5 higher toll (Alternatives 4 and 5)	I-5 and I-205 toll (Not packaged with any alternative)
Daily vehicle trips over I-5 crossing	210,000 <sup>a</sup>	178,000 <sup>a</sup>	165,000 <sup>b</sup>	196,000 <sup>a</sup>
Daily vehicle trips over I-205 crossing	200,000 <sup>a</sup>	213,000 <sup>a</sup>	219,000 <sup>b</sup>	170,000 <sup>a</sup>
Total amount of bonds allowed from toll revenues	None	\$750 - \$1,350 million	\$640 - \$1,160 million	\$1,570 - \$2,800 million

<sup>a</sup> Assumes a replacement crossing.

<sup>b</sup> Assumes a supplemental crossing.

## What are the next steps and how will a decision be made?

### Identifying a Preferred Alternative

Following publications of this DEIS, public and stakeholder feedback will be collected during a 60-day comment period. During this period, a variety of groups will be solicited for feedback, including Native American tribes and the agencies this project is working with, as described at the beginning of this Summary.

After this comment period, the CRC Task Force will consider the findings in this DEIS and the feedback from the public and stakeholder groups before making a recommendation on a Locally Preferred Alternative (LPA) to each of the project co-lead agencies. The LPA will designate a river crossing type and high-capacity transit mode, and will likely choose a preferred transit terminus but leave open the possibility of either minimum operable segment for flexibility to accommodate funding for this project.

Once the public comment period on the DEIS has ended, and after the Task Force makes their recommendation, the Draft LPA will go to the local sponsor agencies for their consideration. Local sponsoring agencies are expected to endorse an LPA during the summer of 2008. The LPA would then be adopted into Metro's Regional Transportation Plan and RTC's Metropolitan Transportation Plan.

### Final EIS and Proposed Mitigation Plan

Following identification of an LPA, the project team will advance the engineering design detail of the LPA, refining and optimizing transportation performance, cost estimates, and design to minimize community and environmental impacts. A variety of design details are not yet determined and will be identified through further engineering, environmental evaluation, and public and stakeholder involvement. These include construction management plans and landscape and architectural designs for most elements of the project, such as transit stations and the bridges over the Columbia River. Other additional work will include completion of a variety of regulatory requirements such as evaluating and documenting historic resources and methods for avoiding, reducing, or mitigating impacts to these resources.

The Final EIS will address comments received on this DEIS. Comments on this DEIS will be grouped by issue and responded to in the FEIS. The FEIS will also analyze the refined design in a manner similar to how alternatives are analyzed in this DEIS. Because there will be fewer options and the engineering designs will be further refined, the Final EIS will be able to more accurately and definitively identify impacts and measures for avoiding, minimizing, or mitigating adverse impacts.

Part of the process of completing a Final EIS will be developing a proposed mitigation plan. The proposed mitigation plan will identify measures for mitigating adverse impacts and incorporating these measures into the project design. The preferred alternative and a mitigation plan will be confirmed in a Record of Decision that is anticipated to be issued by FTA and FHWA in late 2009.

## How can the public learn more about and be involved in the project?

The project website ([www.columbiarivercrossing.org](http://www.columbiarivercrossing.org)) provides more information, including project background and the process that has led to the development of this DEIS. The website also has information on upcoming public events, project milestones, and how to obtain a full copy of the DEIS.

You are invited to submit your comments on the DEIS between May 2nd, 2008 through July 1st, 2008. Comments received during this time will be reviewed and considered, and responses will be published in the Final EIS. Questions and comments can be submitted by several methods:

**Email:** Email comments and questions about the project in general, or about this DEIS specifically, to:

**[DraftEISfeedback@columbiarivercrossing.org](mailto:DraftEISfeedback@columbiarivercrossing.org)**

**Postal mail:** Columbia River Crossing  
700 Washington Street, Suite 300  
Vancouver, WA 98660

**Fax:** 360-737-0294

**Attend a public open house:** Public open houses will be held in Portland and Vancouver in at the following dates and locations:

May 28, 2008  
5 p.m. to 8 p.m.  
Red Lion at the Quay  
100 Columbia Street  
Vancouver, WA 98660

May 29, 2008  
5 p.m. to 8 p.m.  
Portland Metropolitan Exposition Center  
2060 North Marine Drive  
Portland, Oregon 97217





## **CHAPTER 1**

### Project Purpose and Need





## CHAPTER 1

# Project Purpose and Need

*This chapter describes the primary objectives for the I-5 Columbia River Crossing (CRC) project.*

## 1.1 Importance of the I-5 Corridor and the Columbia River Crossing

As the only continuous north-south Interstate on the West Coast connecting the Canadian and Mexican borders, Interstate 5 (I-5) is vital to the local, regional, and national economy. At the Columbia River, I-5 provides a critical connection to two major ports, deep-water shipping, up-river barging, two transcontinental rail lines, and much of the region's industrial land. Truck-hauled freight movement onto, off of, and over the I-5 Columbia River crossing is critical for these industrial centers and to the regional and national economies.

The I-5 crossing provides the primary transportation link between Vancouver and Portland, and the only direct connection between the downtown areas of these cities. Residents of Vancouver and Portland drive, ride buses, bike, and walk across the I-5 bridges for work, recreation, shopping, and entertainment purposes. On average, 135,000 trips over the I-5 bridges occur each day. The I-205 crossing, about five miles east, is the only other highway crossing over the Columbia River within the metropolitan region, but it serves more as a suburban bypass.

## 1.2 Developing the Purpose and Need for the I-5 Columbia River Crossing Project

Defining the Purpose and Need for a project such as CRC is a crucial step in designing and evaluating alternatives. The Purpose and Need for this project was developed by relying on previous planning studies, solicitation of public input, and coordination with stakeholder groups.

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## CRC Task Force

The 39-member CRC Task Force is composed of leaders representing a broad cross section of Washington and Oregon communities. Public agencies, businesses, civic organizations, neighborhoods, and freight, commuter, and environmental groups are represented on the Task Force. This group meets regularly to advise the CRC project team and provide guidance and recommendations at key decision points. The Public Involvement Appendix of this DEIS lists task force members.

More than a decade of planning and prior studies have evaluated transportation deficiencies in the I-5 CRC project area. These studies have identified a variety of transportation mobility and safety problems, many of which have been passed on to the I-5 CRC project to correct.

High-capacity transit in the I-5 corridor through north Portland and Vancouver has been studied periodically for over a decade. In 1993, the Federal Transit Administration (FTA), in cooperation with Metro, began studying high-capacity transit in the “South/North Corridor,” which stretches from Clackamas and Milwaukie, Oregon to Vancouver, Washington. FTA and Metro published the South/North Corridor Project Draft Environmental Impact Statement in 1998. This document identified a variety of alignments and length options for a light rail corridor connecting Milwaukie, downtown Portland, north Portland, and downtown Vancouver.

More recently, in 2001, the Washington and Oregon governors appointed a bi-state task force of 28 community members, business representatives, and elected officials to address concerns about congestion on I-5 between Portland and Vancouver. This task force developed a plan to improve transportation in the I-5 corridor between the I-405 interchange in Portland and the I-205 interchange north of Vancouver (Exhibit 1.2-1), and adopted the Final Strategic Plan on June 18, 2002. The following recommendations were produced from this Plan:

- Expand I-5 to include three through-lanes in each direction, including the area through Delta Park.
- Introduce a phased light rail loop in Clark County in the vicinity of the I-5, SR 500/Fourth Plain, and I-205 corridors.
- Provide an additional bridge or a replacement crossing for the I-5 crossing of the Columbia River, with up to two additional lanes for merging traffic and two light rail tracks.
- Improve interchanges and add merging lanes between SR 500 in Vancouver and Columbia Boulevard in Portland, including a full interchange at Columbia Boulevard.
- Improve capacity for freight rail.
- Encourage bi-state coordination of land use and transportation issues to reduce highway demand and protect corridor investments.
- Involve communities along the corridor to ensure that final project outcomes are equitable.

Several of these recommendations were passed on to the I-5 CRC project for further consideration.

Public and stakeholder input also played an important role in the development of this project’s Purpose and Need. Beginning in early 2005, and concentrated in the fall of 2005, the CRC project worked with stakeholder groups and held public meetings to solicit feedback on how the overall goals and objectives of this project should be defined.

The CRC project worked with the community to form the CRC Task Force (see sidebar) as a broad group of stakeholders representative of the range of interests affected by the project. This group has met regularly with the CRC project team to provide advice and recommendation on all

project milestones thus far. Meetings with this group throughout 2005 and into early 2006 provided important input during the formation of the Purpose and Need statement. In addition, a series of public Open Houses during the fall of 2005 provided more input from the public regarding how the project should define its goals and objectives.

The CRC project also worked with many other local, state, and federal agencies to ensure that the purpose of this project would not conflict with other local and regional goals and would not predispose itself to an alternative that would be difficult for agencies to permit or approve. Section 1.4 provides more detail on how this project has worked with local, state, and federal agencies in compliance with current federal regulations. The federal co-lead agencies for this project, Federal Transit Administration (FTA) and Federal Highway Administration (FHWA), were also instrumental in the development of the project's Purpose and Need. Appendix A provides further details, describing the agencies this project is working with and the coordination processes with this diverse group.

Ultimately, the preceding transportation planning studies of the CRC project area provided the underlying scope of this project, while coordination with stakeholder groups, the public, and a variety of local, state, and federal agencies provided important input on how this project should define why it is being initiated and what problems it seeks to address.

### 1.3 Purpose and Need for the I-5 Columbia River Crossing Project

One of the first and most important steps of any major project is to define why the project has been initiated, and what problem(s) it seeks to address. The Purpose and Need statement provides this definition for all projects complying with the National Environmental Policy Act (NEPA), and serves as the basis for defining how alternatives will be developed and measured. A reasonable alternative must address the needs specified in the Purpose and Need statement for the alternative to be considered in a draft environmental impact statement (DEIS), making the purpose and need an influential statement that guides all future development of the project.

The Purpose and Need statement developed by CRC Task Force and the project co-lead agencies is provided below.

#### Project Purpose

The purpose of the proposed action is to improve Interstate 5 corridor mobility by addressing present and future travel demand and mobility needs in the Columbia River Crossing Bridge Influence Area (BIA). The BIA extends from approximately Columbia Boulevard in the south to SR 500 in the north (Exhibit 1.2-1). Relative to the No-Build Alternative, the proposed action is intended to achieve the following objectives: a) improve travel safety and traffic operations on the Interstate 5 crossing's bridges and associated interchanges; b) improve connectivity, reliability, travel times and operations of public transportation modal alternatives in the BIA; c) improve highway freight mobility and address interstate

Exhibit 1.2-1

#### CRC Project Area and Bridge Influence Area



The Bridge Influence Area (BIA) encompasses the I-5 corridor within the CRC project area.



travel and commerce needs in the BIA; and d) improve the Interstate 5 river crossing's structural integrity.

### Project Need

The specific needs to be addressed by the proposed action include:

The transportation data included in this section is explained in greater detail in Chapter 3, and further detail in the CRC Traffic Technical Report and CRC Transit Technical Report.

Exhibit 1.3-1

#### Accident Blocking the Bridge



### Congestion and Safety

Congestion not only causes delays for travelers, but also increases the risk of accidents. Right now, accidents are more than twice as likely to occur during peak travel periods as during off-peak periods. The number of cars using the I-5 crossing is predicted to increase by about 35% by 2030. Accident rates in the CRC project area could double if nothing is done to improve existing conditions.

- Growing Travel Demand and Congestion:** Existing travel demand exceeds capacity in the I-5 Columbia River crossing and associated interchanges. This corridor experiences heavy congestion and delay lasting 2 to 5 hours during both the morning and afternoon peak travel periods and when traffic accidents, vehicle breakdowns, or bridge lifts occur. Due to excess travel demand and congestion in the I-5 bridge corridor, many trips take the longer, alternative I-205 route across the river. Spillover traffic from I-5 onto parallel arterials such as Martin Luther King Boulevard and Interstate Avenue increases local congestion. The two crossings currently carry over 260,000 trips across the Columbia River daily. Daily traffic demand over the I-5 crossing is projected to increase by 40 percent during the next 20 years, with stop-and-go conditions increasing to at least 10 to 12 hours each day if no improvements are made.
- Impaired freight movement:** I-5 is part of the National Truck Network, and the most important freight freeway on the West Coast, linking international, national and regional markets in Canada, Mexico and the Pacific Rim with destinations throughout the western United States. In the center of the project area, I-5 intersects with the Columbia River's deep water shipping and barging as well as two river-level, transcontinental rail lines. The I-5 crossing provides direct and important highway connections to the Port of Vancouver and Port of Portland facilities located on the Columbia River as well as the majority of the area's freight consolidation facilities and distribution terminals. Freight volumes moved by truck to and from the area are projected to more than double over the next 25 years. Vehicle-hours of delay on truck routes in the Portland-Vancouver area are projected to increase by more than 90 percent over the next 20 years. Growing demand and congestion will result in increasing delay, costs and uncertainty for all businesses that rely on this corridor for freight movement.
- Limited public transportation operation, connectivity, and reliability:** Due to limited public transportation options, a number of transportation markets are not well served. The key transit markets include trips between the Portland Central City and the City of Vancouver and Clark County, trips between North/Northeast Portland and the City of Vancouver and Clark County, and trips connecting the City of Vancouver and Clark County with the regional transit system in Oregon. Current congestion in the corridor adversely impacts public transportation service reliability and travel speed. Southbound bus travel times across the bridge are currently up to three times longer during parts of the am peak compared to off peak. Travel times for public transit using general purpose lanes on I-5 in the bridge influence area are expected to increase substantially by 2030.
- Safety and Vulnerability to Incidents:** The I-5 river crossing and its approach sections experience crash rates nearly 2.5 times higher



than statewide averages for comparable facilities. Incident evaluations generally attribute these crashes to traffic congestion and weaving movements associated with closely spaced interchanges. Without breakdown lanes or shoulders, even minor traffic accidents or stalls cause severe delay or more serious accidents.

- **Substandard bicycle and pedestrian facilities:** The bike/pedestrian lanes on the I-5 Columbia River bridges are 6 to 8 feet wide, narrower than the 10-foot standard, and are located extremely close to traffic lanes, thus impacting safety for pedestrians and bicyclists. Direct pedestrian and bicycle connectivity are poor in the BIA.
- **Seismic vulnerability:** The existing I-5 bridges are located in a seismically active zone. They do not meet current seismic standards and are vulnerable to failure in an earthquake.

## 1.4 Compliance with SAFETEA-LU

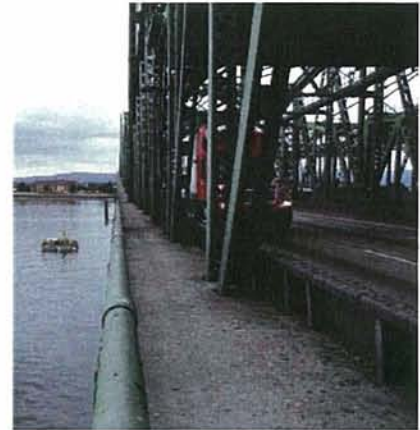
The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) authorizes the Federal surface transportation programs for highways, highway safety, and transit for the five-year period 2005-2009. SAFETEA-LU includes many provisions for USDOT and includes a section (Section 6002) dedicated to the environmental review process.

SAFETEA-LU requires the development of a coordination plan to outline how the CRC project will work with the public, stakeholder groups, and local, state, and federal agencies with an interest in the project. Appendices A and B of this DEIS document how this project has worked with agencies, tribes, and the public to date.

Section 6002 of SAFETEA-LU added a new category of participants in major transportation projects that allows state, local and tribal agencies to have a more formal role in the environmental process of these projects. These agencies are called “participating agencies.” The CRC project team sent out participating agency invitations in January 2006 to Tribal Governments with an interest in the project area, and to various state and local governments. Nineteen agencies and Tribal Governments accepted the invitation to be participating agencies. These agencies include:

- City of Vancouver
- Clark County Community Development Department
- Clark Public Utilities
- Confederated Tribes of Grand Ronde
- Cowlitz Indian Tribe
- Oregon Department of Land Conservation and Development
- Portland Fire & Rescue
- Portland Office of Neighborhood Involvement
- Portland Police Bureau
- Washington Department of Fish and Wildlife
- Portland Parks and Recreation
- Portland Bureau of Water Works

Exhibit 1.3-2  
Bicycle and Pedestrian Path



- Portland Bureau of Development Services
- Portland Planning Bureau
- Portland Bureau of Environmental Services
- Portland Development Commission
- Vancouver Housing Authority
- Washington Department of Ecology
- Washington Department of Archaeology and Historic Preservation

The CRC project has also worked with another group of state and federal agencies that are likely to have permitting or approval authority over one or more elements of this project. This group is referred to as the Interstate Collaborative Environmental Process group, or InterCEP. The InterCEP group has assisted the project in many ways, including identifying applicable environmental information early in the analytical process and providing technical expertise on state and federal regulations, such as Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act of 1966. Work with InterCEP has increased communication with these agencies, avoided duplication with other federal, state, tribal, and local procedures, and established a mechanism for addressing intergovernmental issues.

On January 25, 2006, the InterCEP Agreement was signed by WSDOT, ODOT, FHWA, FTA and 12 resource agencies from Oregon, Washington, and the federal government. This agreement formally established the InterCEP group, defined obligations of the signatory agencies and the CRC project, and described the process for communication and collaboration within this group.

The following resource agencies signed the InterCEP Agreement:

- National Marine Fisheries Service
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Washington State Department of Ecology
- Washington State Department of Fish and Wildlife
- Washington State Department of Archaeology and Historic Preservation
- Oregon Department of Fish and Wildlife
- Oregon Department of Land Conservation and Development
- Oregon Department of State Lands
- Oregon State Historic Preservation Office
- Oregon Department of Environmental Quality

Participating agencies and InterCEP agencies have been given opportunity for formal comment on several important elements of this project:

- Purpose and Need – InterCEP agencies had an opportunity to comment on the Purpose and Need in November and December,

2005, through meetings. The Purpose and Need was sent to the participating agencies in the invitation letter, and discussion was held at a meeting in late January, 2006.

- Methodologies – The CRC project solicited input on the methodologies used to analyze the various environmental effects of each Alternative in the DEIS through the development of Method and Data Reports. All cooperating, participating and InterCEP agencies were integrally involved in developing these reports from March 2006 through October 2006.
- Range of alternatives – The CRC project held several meetings with the InterCEP and participating agencies during the fall of 2006 and winter of 2007 to discuss the range of alternatives to be evaluated in the DEIS.

## 1.5 Vision and Values

The CRC project co-lead agencies, with the help and recommendation of the CRC Task Force, developed a vision for how to address the CRC's Purpose and Need, and the values they would follow to develop a solution. These values were instrumental in the development of evaluation criteria used during the development of the range of alternatives evaluated in this DEIS (see Section 2.5 for more information on this process).

The following describes the CRC project vision:

The Columbia River Crossing Vision provides the foundation for developing criteria and performance measures that will be used to evaluate the I-5 Bridge Influence Area alternatives. The Columbia River Crossing Project NEPA process will include consideration of: crossing infrastructure; multimodal transportation; connectivity; high capacity transit; land use; funding; community and business interests; under-represented, low income and minority communities; commuter and freight mobility; maritime mobility; and the environment.

Values that have guided this project's development and framed identification and evaluation of alternatives are noted below.

### **Community Livability**

- Supporting a healthy community.
- Supporting a healthy and vibrant land use mix of residential, commercial, industrial, recreational, cultural, and historic areas.
- Supporting aesthetic quality that achieves a regional landmark.
- Recognizing the history of the community surrounding the I-5 bridge influence area, supporting improved community cohesion, and avoiding neighborhood disruption.
- Preserving parks, historic and cultural resources, and green spaces.



**Mobility, Reliability, Accessibility, Congestion Reduction and Efficiency**

- Providing congestion reduction and mobility, reliability, and accessibility for all users, and recognizing the requirements of local, intra-corridor, and interstate movement now and in the future.
- Providing an efficient transportation system through transportation system management, encouraging reduced reliance on single occupancy vehicles, improved incident management, and increased capacity measures.

**Modal Choice**

- Providing modal choice for users of the river crossing, including highway, transit, high-capacity transit, bicycle, and pedestrian modes.

**Safety**

- Ensuring safety for vehicles (trucks, autos, emergency, and transit), pedestrians, bicyclists, river users, and air traffic at the crossing.

**Regional Economy; Freight Mobility**

- Supporting a sound regional economy and job growth.
- Enhancing the I-5 corridor as a global trade gateway by addressing the need to move freight efficiently and reliably through the I-5 bridge influence area, and allowing for river navigational needs.

**Stewardship of Natural and Human Resources**

- Respecting, protecting, and improving natural resources including fish, wildlife habitat, and water quality.
- Supporting improved air quality.
- Minimizing impacts of noise, light, and glare.
- Supporting energy efficiency through design, construction, and use.

**Distribution of Impacts and Benefits**

- Ensuring the fair distribution of benefits and adverse effects of the project for the region, communities, and neighborhoods adjacent to the project area.

**Cost-Effectiveness and Financial Resources**

- Ensuring cost-effectiveness in design, construction, maintenance, and operation.
- Ensuring a reliable funding plan for the project.

**Bi-State Cooperation**

- Fostering regional cooperation and planning.
- Supporting existing growth management plans in both states.
- Supporting balanced job growth.



## **CHAPTER 2**

### Description of Alternatives







## CHAPTER 2

# Description of Alternatives

*This chapter describes the alternatives and components evaluated in this DEIS, and outlines the process followed to develop them. The CRC project proposes improvements to the river crossing, bicycle and pedestrian connections, and highway safety and capacity, and the addition of a high-capacity transit system. Other elements include tolling the river crossing, and transportation system and demand management measures.*

## 2.1 Introduction

This Draft Environmental Impact Statement (DEIS) evaluates four build alternatives and a No-Build alternative. Each build alternative is designed to comprehensively address the project's purpose and need using a package of multimodal transportation improvements, referred to as "components." These components include river crossing and highway improvements, high-capacity transit (HCT), tolling scenarios, and other measures that address the various transportation needs discussed in Chapter 1.

The build alternatives differ from each other in how they cross the Columbia River, the amount of highway capacity proposed, the high-capacity transit mode included, the proposed level of transit operations, and highway tolling. Other components, such as four different transit terminus options, are included in all of the build alternatives.

Each component represents an independent choice. For example, choosing a particular river crossing does not preclude choosing any of the transit modes or alignments that are also being considered. Components are independent pieces that when combined comprise a full alternative that will comprehensively address this project's purpose and need. Therefore, an important part of the evaluation in this DEIS is the assessment of individual components, in addition to analysis of the full alternatives.

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To understand how each component affects an alternative's performance, this DEIS describes and evaluates the impacts of the individual components. Some components are physical improvements, such as the river crossing, high-capacity transit mode, and transit alignments. Other components are purely operational, such as tolling and transit operation levels (frequency of light rail trains or buses in the proposed transit guideway). All build alternatives include a representative combination of both physical and operational components.

The CRC alternatives are described in Section 2.2. Components that make up the alternatives are described in Section 2.3. Section 2.4 describes how the alternatives could be constructed, and the anticipated duration of construction. Finally, Section 2.5 explains how the current range of alternatives was determined, and describes the alternatives that were previously evaluated but dropped from consideration prior to this DEIS.

## 2.2 Alternatives

There are four build alternatives and a No-Build Alternative. Each build alternative is a combination of components that, taken together, comprise a multimodal package of transportation improvements that comprehensively address the CRC project's purpose and need.

Exhibit 2.2-1 outlines the components that are included with each of the alternatives. These components are described in Section 2.3.

Exhibit 2.2-1

### Components Making up the Project Alternatives

Components	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Multimodal River Crossing and Highway	Existing	Replacement <sup>a</sup>	Replacement <sup>a</sup>	Supplemental	Supplemental
HCT Mode <sup>b</sup>	None	Bus Rapid Transit	Light Rail	Bus Rapid Transit	Light Rail
HCT Terminus	N/A	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS
TDM/TSM	Current Programs	Expanded TDM/TSM programs			
I-5 Bridge Toll	None	Standard rate	Standard rate <sup>c</sup>	Higher rate	Higher rate
Transit Operations	Existing	Efficient	Efficient	Increased	Increased

<sup>a</sup> The Replacement crossing has two designs, a 3-bridge design and a Stacked Transit/Highway Bridge design; these are described in Section 2.3.1.

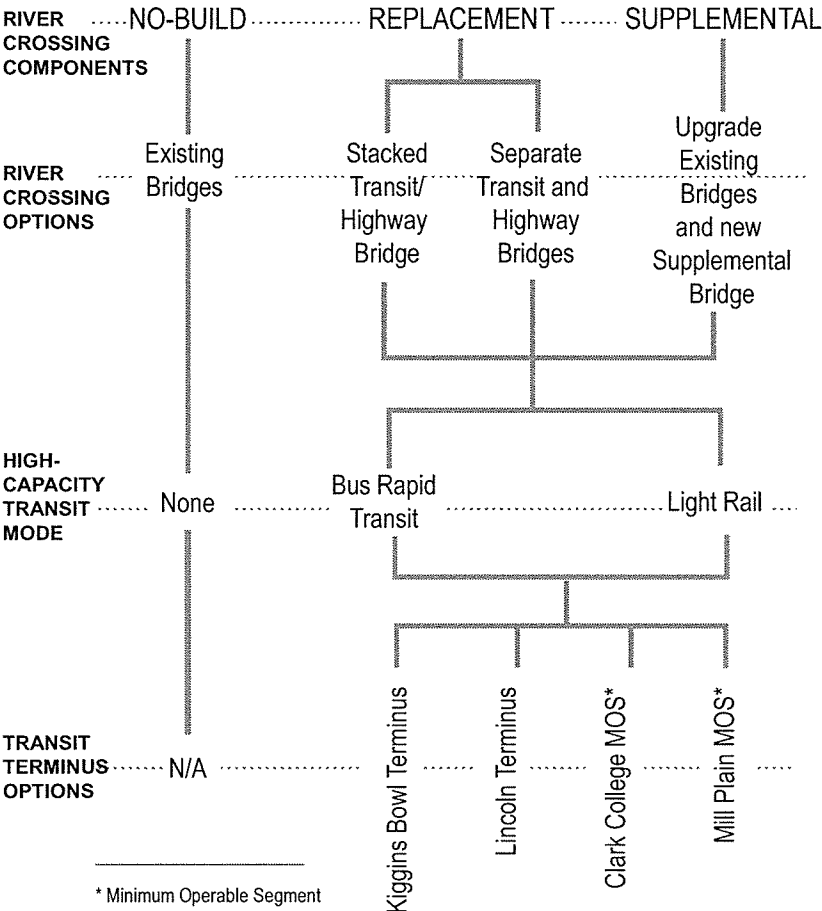
<sup>b</sup> HCT Mode also dictates the location of a maintenance base expansion. BRT would entail expanding a bus maintenance facility in eastern Vancouver. LRT would entail expanding the Ruby Junction maintenance base in Gresham. See Section 2.3.2.

<sup>c</sup> Alternative 3 was also evaluated without a toll to quantify the traffic affects of tolling the I-5 crossing. This is discussed more in Section 2.3.5.

Alternatives 2 and 3 provide similar, relatively balanced combinations of investments in highway and investments in high-capacity transit. They each include a new replacement river crossing, highway improvements, bicycle/pedestrian improvements, and a new high-capacity transit line into Vancouver. Both alternatives include the same four terminus

options—Kiggins Bowl, Lincoln, Clark College minimum operable segment (MOS), and Mill Plain MOS (these may be abbreviated A, B, C, and D respectively)—and transit alignment options (see Exhibit 2.2-2 below). Alternative 2 includes bus rapid transit, while Alternative 3 includes light rail.

Exhibit 2.2-2  
Highway and Transit Component Options





Alternatives 4 and 5 differ from 2 and 3 largely in how they address travel demand. Alternatives 4 and 5 put less emphasis on highway improvements, and are configured to test how more investment in transit operations and other measures could address transportation needs. Because these alternatives reuse the existing bridges for northbound interstate traffic, they are restricted to four lanes in each direction. This is because each of the existing bridges can only accommodate two lanes while leaving enough room for safety shoulders that, while still below highway standards, would be better than existing or No-Build conditions. Because Alternatives 2 and 3 use all new bridges for the river crossing, they have been designed to represent a more balanced highway and transit investment, and provide six lanes in each direction. Exhibit 2.2-3 on the following page identifies the key elements of each alternative.

The major features of each alternative are summarized in Exhibits 2.2-5 through 2.2-9. Alternatives 2 through 5 each include the four different transit terminus options that are shown on Exhibits 2.2-6 through 2.2-9. These terminus options represent a range of possibilities for balancing ridership and cost, as well as local land use compatibility and the potential for future phasing.

All four build alternatives include the same four high-capacity transit terminus options and various alignment options (Exhibit 2.2-2). Alternatives 4 and 5 would provide much more frequent transit service to increase the capacity of the transit system, and a higher toll on the river crossing to encourage alternative modes of transportation. Transit mode—bus rapid transit or light rail—is the key distinction between Alternatives 2 and 3 and between Alternatives 4 and 5.

Exhibit 2.2-3

**Key Transit and Highway Features of the Alternatives**

Alternative	Transit Features	Highway Features
<b>1: No-Build Alternative</b>	<p>Modest increases to C-TRAN's service hours for bus routes throughout Vancouver and Clark County to keep pace with anticipated changes in congestion.</p> <p>Modest increases to TriMet's services hours for bus routes throughout north and northeast Portland to keep pace with anticipated changes in congestion.</p> <p>Completion of the first phase of the South Corridor light rail project on the Portland Mall and I-205.</p>	I-5 widening and improvements around Delta Park.
<b>2: Replacement crossing with bus rapid transit</b>	<p>Exclusive bus lanes from the Expo Center, over Hayden Island, across the Columbia River, and to a terminus in Vancouver.</p> <p>The exclusive bus lanes would extend 2.07– 4.22 miles north from the Expo Center through Vancouver, and include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus.</p> <p>Introduction of a new bus rapid transit service, including a simplified payment method (e.g. the use of off-board ticket vending machines) and 60-foot articulated vehicles with special markings to create a "branded identity."</p> <p>Expansion of the current C-TRAN bus maintenance facility in eastern Vancouver.</p> <p>Changes to C-TRAN local bus routes to connect with the new bus guideway and park and rides.</p> <p>Twenty-four bus-rapid-transit vehicles would be included in this alternative.</p>	<p>A new replacement crossing over the Columbia River with either three separate bridges (two for interstate traffic, and a third for buses, bicycles, and pedestrians) or a "Stacked Highway/Transit Bridge" design that would include transit beneath the western highway bridge deck (note: these designs are discussed in Section 2.3.1 below).</p> <p>Improvements to the following I-5 interchanges: Marine Drive, Hayden Island, SR 14, Mill Plain, Fourth Plain, and SR 500.</p> <p>Additional auxiliary lanes for traffic entering and/or exiting I-5 between Marine Drive and SR 500.</p> <p>A toll would be charged on the I-5 crossing, with higher rates during peak travel periods.</p>
<b>3: Replacement crossing with light rail</b>	<p>Extension of the light rail guideway from the Expo Center over Hayden Island and across the Columbia River to a terminus in Vancouver. The light rail guideway would extend 2.07– 4.22 miles north from the Expo Center, and would include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus.</p> <p>Changes to C-TRAN local bus routes to connect with the new light rail stations and park and rides.</p> <p>Expansion of TriMet's Ruby Junction light rail maintenance facility in Gresham.</p> <p>Fourteen light rail vehicles would be included in this alternative.</p>	<p>Same highway features as Alternative 2.</p> <p>This alternative was also modeled without a toll to determine the potential effects of tolling on traffic patterns.</p>
<b>4: Supplemental crossing with bus rapid transit</b>	<p>Same transit features as Alternative 2, but higher frequency operations of bus rapid transit and local bus routes.</p> <p>This alternative would include 38 bus-rapid-transit vehicles, and 143 standard buses.</p>	<p>A new, supplemental crossing for southbound Interstate traffic and exclusive lanes for buses.</p> <p>The existing I-5 bridges would be re-stripped for two lanes each to carry northbound I-5 traffic.</p> <p>Seismic retrofits to the existing bridges.</p> <p>Improvements to the following I-5 interchanges: Marine Drive, Hayden Island, SR 14, Mill Plain, Fourth Plain, and SR 500.</p> <p>Additional auxiliary lanes (generally one less additional lane than Alternatives 2 and 3) for traffic entering and/or exiting I-5 between Marine Drive and SR 500.</p> <p>A toll would be charged on the I-5 crossing, with higher rates during peak travel periods. During these peak travel periods, the toll would be higher than with Alternatives 2 or 3.</p>
<b>5: Supplemental crossing with light rail</b>	<p>Same transit features as Alternative 3, but higher frequency operations for light rail and for local bus routes.</p> <p>This alternative would include 18 light rail vehicles, and 147 standard buses.</p>	Same highway features as Alternative 4.

Exhibit 2.2-4 lists the transit alignment options evaluated in this document. The Kiggins Bowl terminus has two alignment options on Hayden Island (adjacent to, or offset from, I-5), two alignment options in downtown Vancouver (two-way travel on Washington Street, or one-way travel on Washington and Broadway Streets), and another pair of options north of downtown to connect with Clark College (travel on McLoughlin or 16th Street). The Lincoln terminus has the same alignment options on Hayden Island and in downtown Vancouver, but has unique alignment options in northern Vancouver (two-way travel on Broadway or one-way travel on Broadway and Main Streets). The Clark College minimum operable segment (MOS) has the same alignment options as the Kiggins Bowl terminus, but ends the transit guideway at Clark College rather than continuing north to Kiggins Bowl. The Mill Plain MOS has the same alignment options on Hayden Island and in downtown Vancouver, but ends the transit guideway before northern Vancouver. These alignment options are described in detail in Section 2.3.3.

Exhibit 2.2-4  
Transit Alignment Options for Each Transit Terminus

Segment of Project Area	Transit Alignment Option	(A) Kiggins Bowl Terminus	(B) Lincoln Terminus	(C) Clark College MOS <sup>a</sup>	(D) Mill Plain MOS <sup>a</sup>
Expo Station to south downtown Vancouver	Adjacent	X	X	X	X
	Offset	X	X	X	X
Downtown Vancouver	Two-way Washington	X	X	X	X
	Washington-Broadway Couplet	X	X	X	X
North Vancouver	Two-way Broadway		X		
	Broadway-Main Couplet		X		
	McLoughlin	X		X	
	16th Street	X		X	

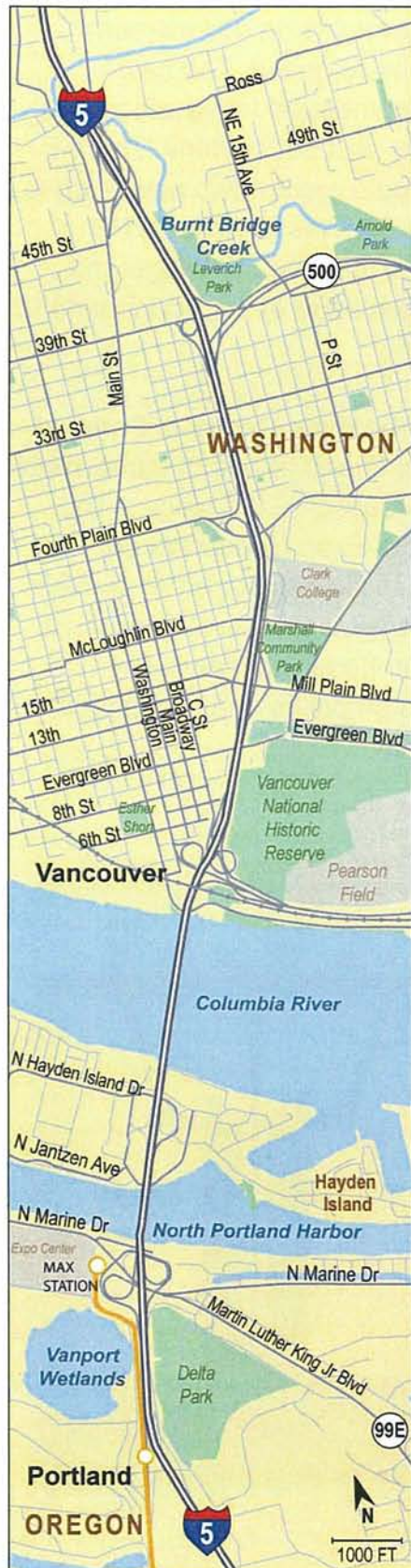
<sup>a</sup> Minimum Operable Segment (MOS).

Chapter 3 describes the range of impacts and performance that would occur with each of the full alternatives. In addition, it describes how the individual components, listed above and described in Section 2.3, would impact the environment. This allows the public and decision-makers to understand the impacts and trade-offs of the full alternatives and the impacts and trade-offs of the various component choices that comprise each of the alternatives.



Exhibit 2.2-5

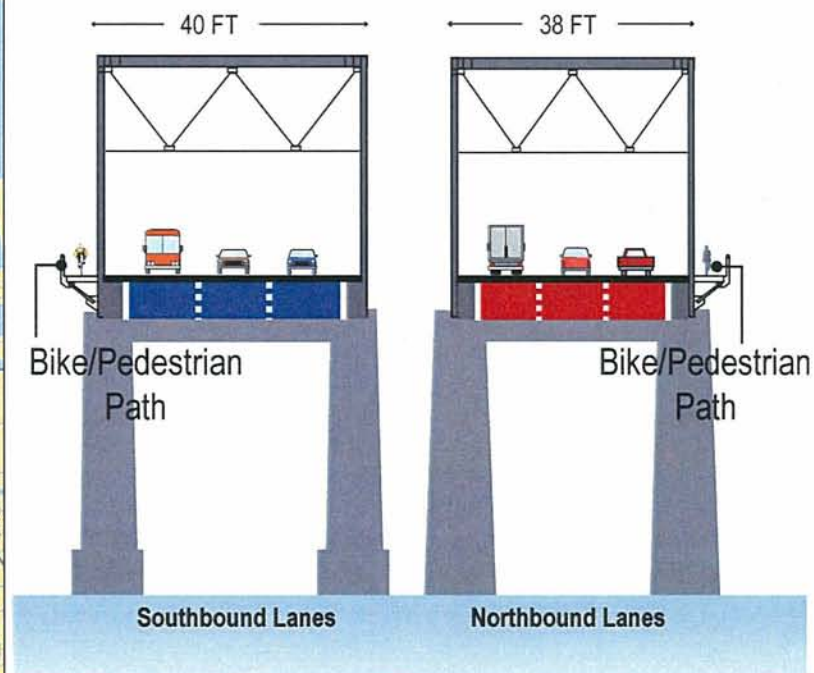
## ALTERNATIVE 1: No-Build



DIMENSIONS ARE APPROXIMATE.

The No-Build Alternative illustrates how transportation and environmental conditions would change by the year 2030 if the I-5 CRC project is not built. This alternative makes the same assumptions as the build alternatives regarding population and employment growth through 2030, and also assumes that the same transportation and land use projects in the region would occur as planned. For example, the No-Build Alternative includes the I-5 widening around Delta Park that is scheduled to begin construction in 2008. The No-Build Alternative also includes several large land use changes that are planned within the project area, such as the Riverwest development just south of Evergreen Boulevard west of I-5, the Columbia West Renaissance project along the western waterfront in downtown Vancouver, and redevelopment plans for the Jantzen Beach shopping center on Hayden Island. All traffic and transit projects within or near the CRC project area that are anticipated to be built by 2030 separately from this project are included in the Cumulative Effects Technical Report. All these projects are also assumed in the build alternatives.

### Existing River Crossing



MEASUREMENTS PROVIDED ARE APPROXIMATE.



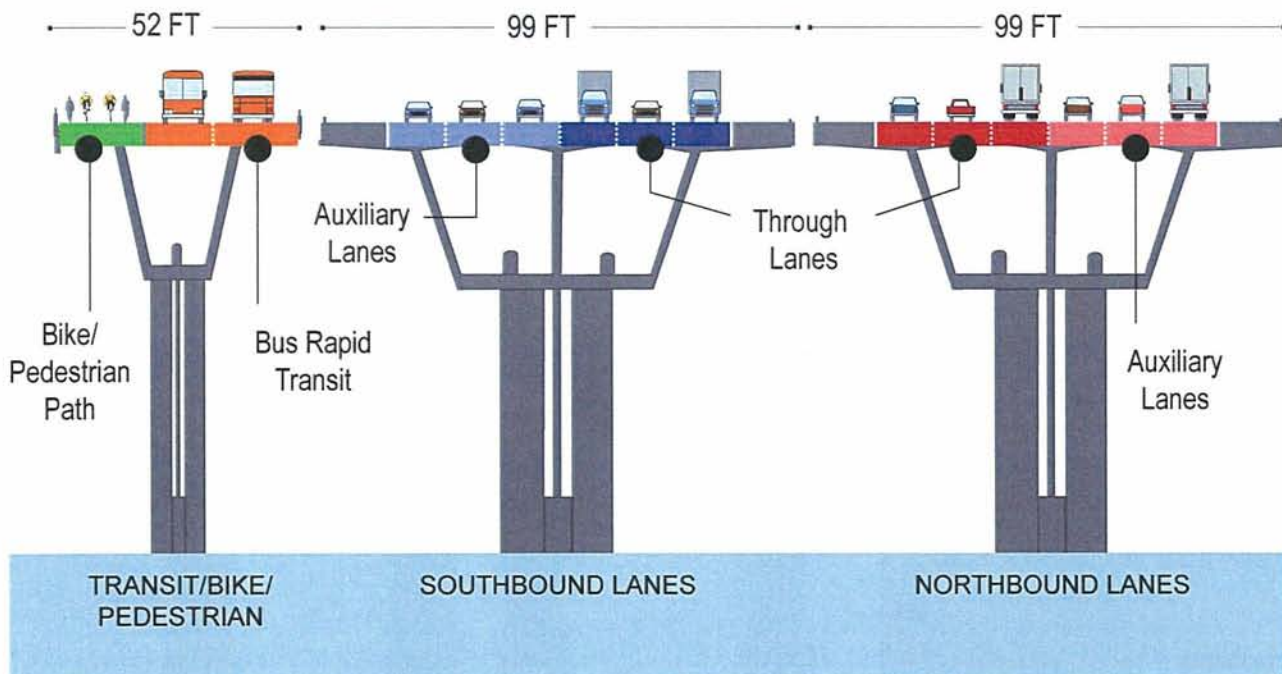
Exhibit 2.2-6 (page 1 of 2)

## ALTERNATIVE 2: Replacement Crossing with Bus Rapid Transit

This alternative would replace the existing I-5 bridges with a new crossing downstream (west) of the current I-5 alignment. The existing bridges would be removed. The new crossing could include three bridges, two for northbound and southbound Interstate traffic, and a third bridge for buses in dedicated transit lanes, bicyclists, and pedestrians. There is also a “Stacked Transit/Highway Bridge” (STHB) design that would require two new bridges, rather than the three needed for the standard replacement crossing design. The STHB design would include transit beneath the highway deck of the I-5 southbound bridge and would suspend the bicycle and pedestrian path under the eastern edge of the northbound I-5 bridge.

Bus rapid transit would operate in an exclusive guideway from the Expo Center in Portland along one of several alignment options through the project area to end at one of four possible terminus options (a description of these options is contained in Section 2.3.1 below). The exclusive bus lanes would extend 2.07–4.22 miles north from the Expo Center through Vancouver, and include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus. Riders could transfer at the Expo Center to the existing MAX light rail system. Local bus service in Vancouver would increase to serve new transit passengers. Automobiles and trucks would pay a toll to cross the Columbia River on the new I-5 bridges.

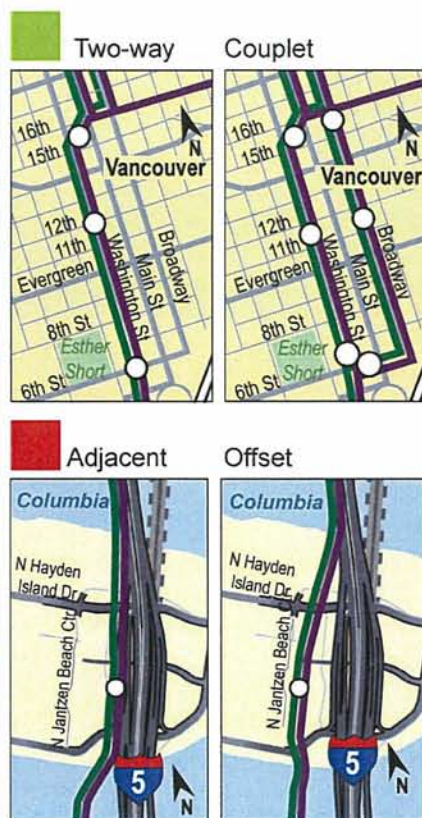
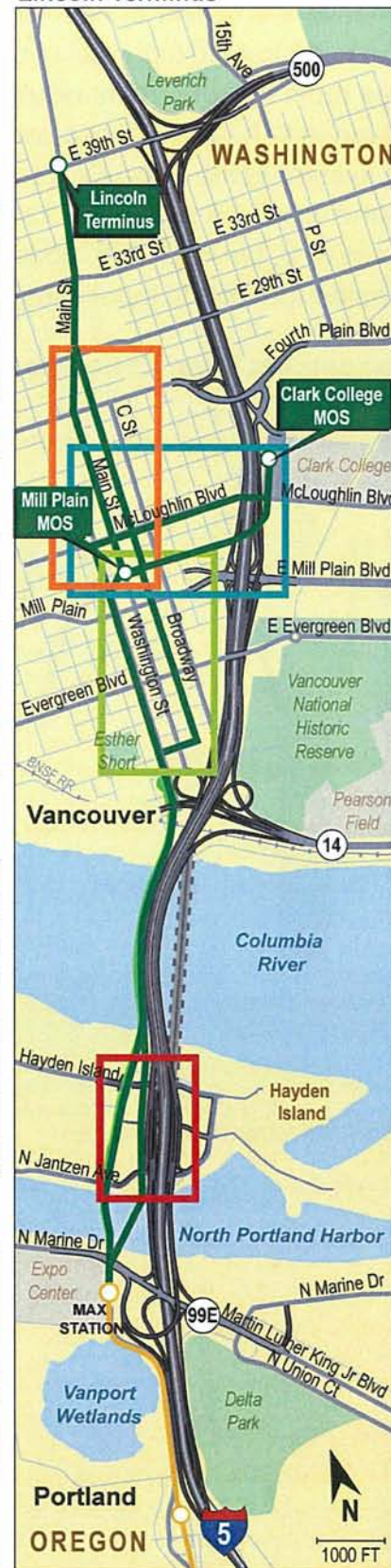
### Replacement River Crossing with Bus Rapid Transit



Please see page 2-19 for a definition of Auxiliary Lanes.  
MEASUREMENTS PROVIDED ARE APPROXIMATE.



Exhibit 2.2 6 (page 2 of 2)

**Transit Terminus and Alignment Options for Alternative 2****Kiggins Bowl Terminus****Lincoln Terminus**

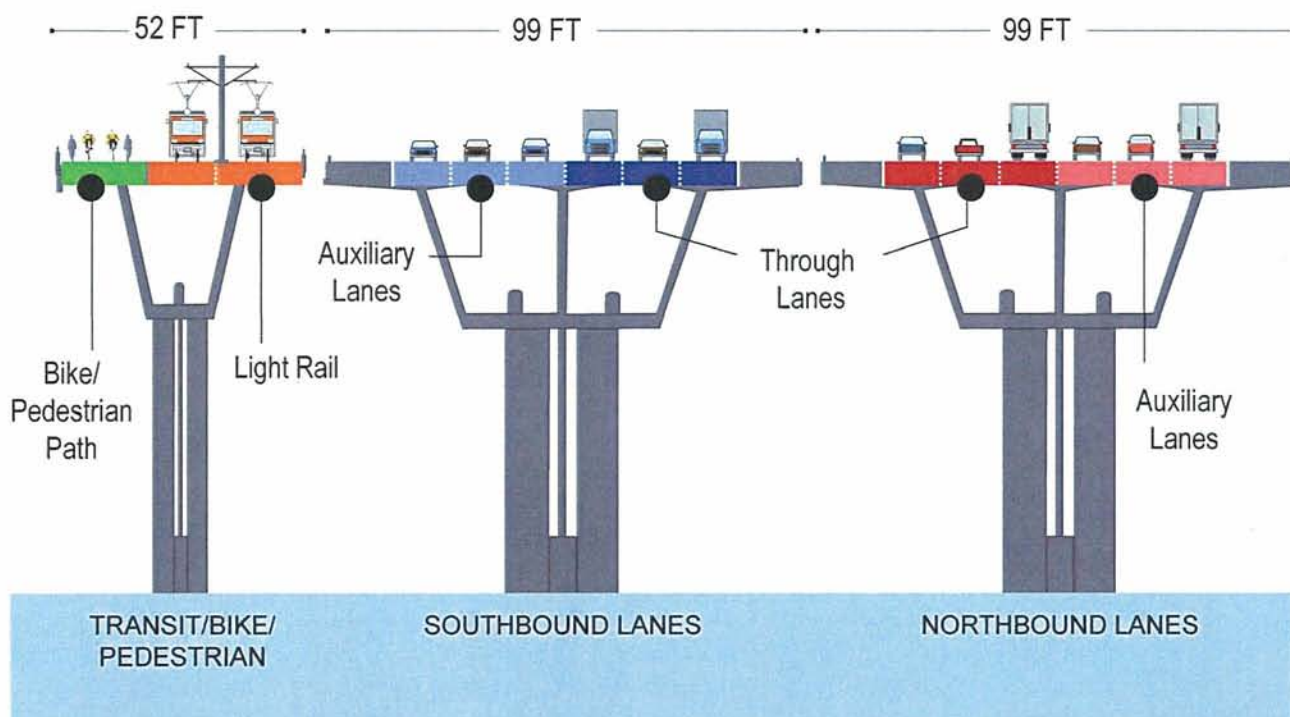
MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment



### ALTERNATIVE 3: Replacement Crossing with Light Rail

Alternative 3 is similar to Alternative 2 except that light rail would be used instead of bus rapid transit. Light rail could use the same alignments and station locations as bus rapid transit. Trains would not run as frequently as the buses in Alternative 2 because they have higher capacity. The light rail guideway would connect with the MAX system at the Expo Center, allowing trains to continue directly into downtown Portland without a transfer. This alternative includes the same tolling scenario as Alternative 2, but was also modeled without a toll on the I-5 crossing in order to determine the effects that tolling could have on traffic patterns.

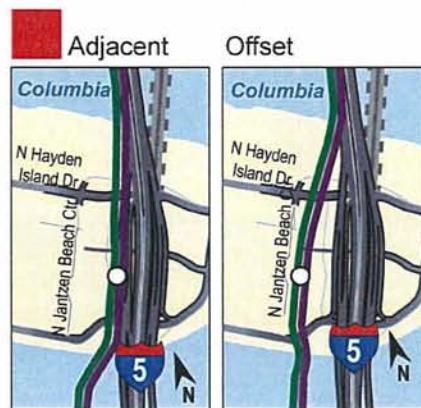
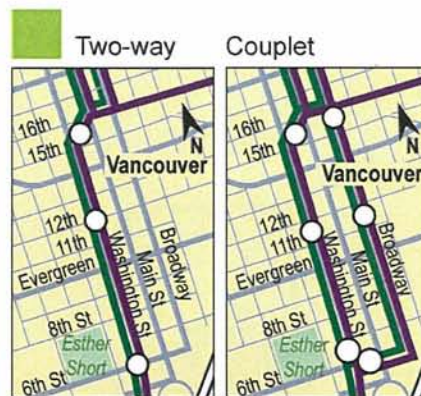
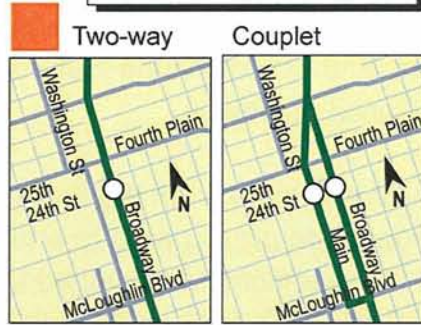
#### Replacement River Crossing with Light Rail



Please see page 2-19 for a definition of Auxiliary Lanes.  
MEASUREMENTS PROVIDED ARE APPROXIMATE.



Exhibit 2.2 7 (page 2 of 2)

**Transit Terminus and Alignment Options for Alternative 3****Kiggins Bowl Terminus****Lincoln Terminus**

MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment



Exhibit 2.2-8 (page 1 of 2)

## ALTERNATIVE 4: Supplemental Crossing with Bus Rapid Transit

This alternative would retain both existing I-5 bridges and add one new bridge. The existing I-5 bridges would be re-striped to provide two northbound lanes on each bridge and provide safety shoulders for disabled vehicles. Currently each bridge has three lanes and no shoulders. A new, wider bicycle and pedestrian facility would be added to the east side of the existing northbound (eastern) bridge. A new supplemental bridge would be constructed downstream of the existing bridges, and would include four southbound I-5 traffic lanes, safety shoulders and a bus rapid transit guideway.

Buses would operate in an exclusive guideway from the Expo Center in Portland along one of several possible alignments through the project area to end at one of four possible terminus options (a description of these options is contained in Section 2.3.1 below). The exclusive bus lanes would extend 2.07–4.22 miles north from the Expo Center through Vancouver, and include five to seven transit stations and three to five structured or surface park and rides with up to 2,410 spaces, depending upon the transit terminus. Buses would operate more frequently than with Alternative 2, to compensate for the reduced auto capacity of the supplemental crossing compared to the replacement crossing. Local bus service in Vancouver and Clark County would increase to serve new transit passengers. Automobiles and trucks would pay a toll to cross the Columbia River that would be slightly higher during peak commute periods than for Alternatives 2 and 3.

### Supplemental River Crossing with Bus Rapid Transit

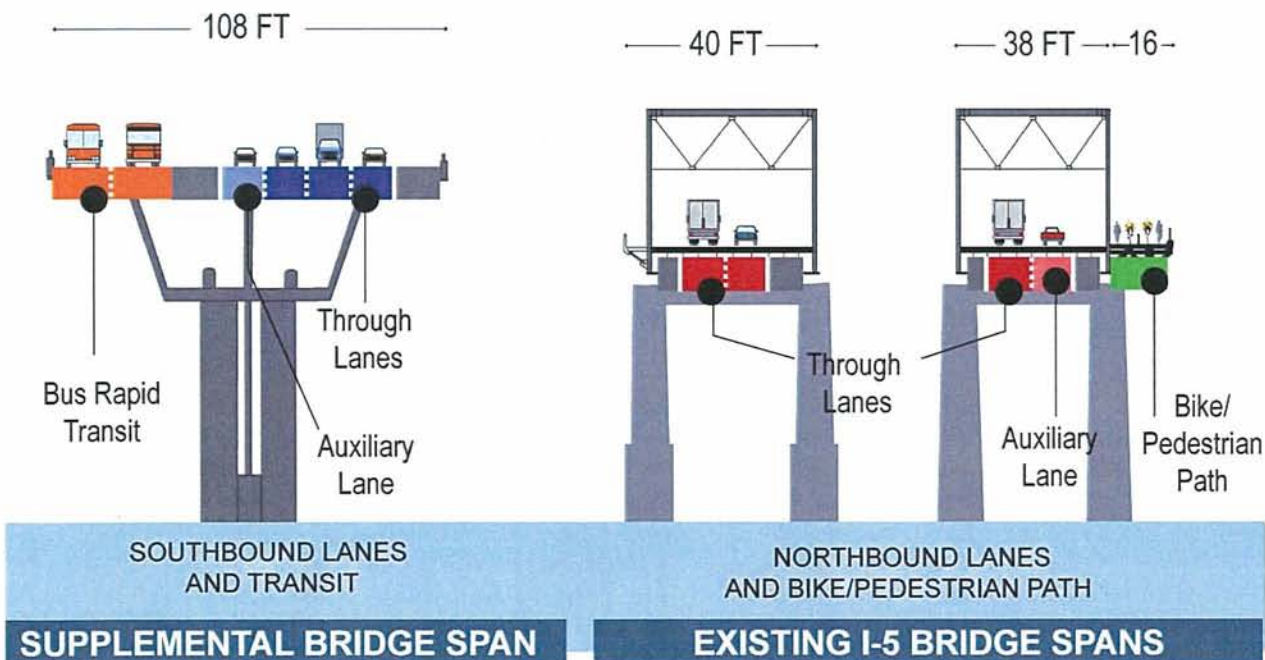
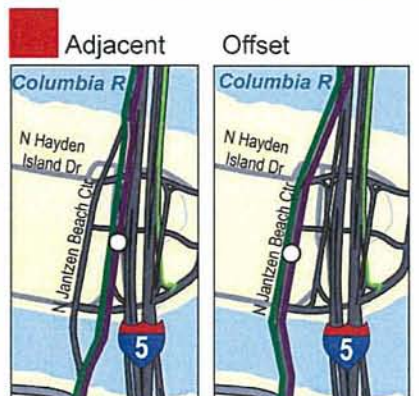




Exhibit 2.2 8 (page 2 of 2)

**Transit Terminus and Alignment Options for Alternative 4****Kiggins Bowl Terminus****Lincoln Terminus**

MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment

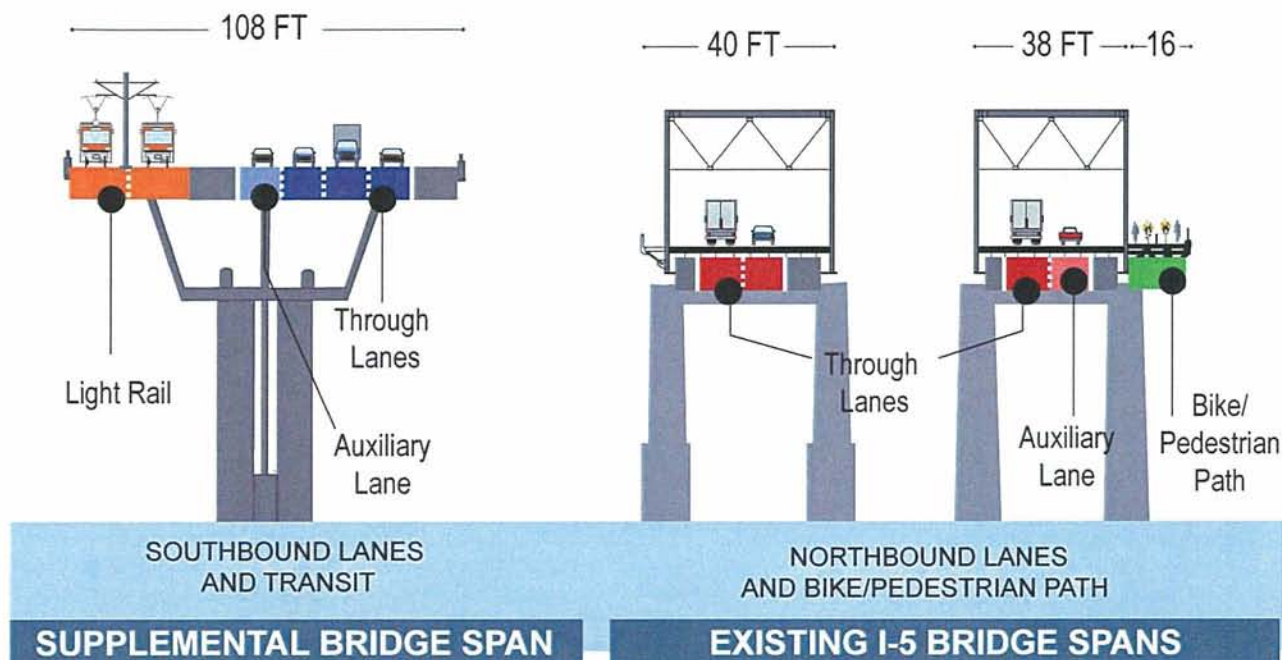


Exhibit 2.2-9 (page 1 of 2)

## ALTERNATIVE 5: Supplemental Crossing with Light Rail

Alternative 5 is similar to Alternative 4 except that light rail would be used instead of bus rapid transit. Light rail would have the same possible alignments and station locations. Compared to Alternative 3, trains would operate more frequently to increase the capacity of the transit system in order to compensate for the lower capacity of the supplemental crossing compared to the replacement crossing.

### Supplemental River Crossing with Light Rail



Please see page 2-19 for a definition of Auxiliary Lanes.  
MEASUREMENTS PROVIDED ARE APPROXIMATE.



Exhibit 2.2.9 (page 2 of 2)

# Transit Terminus and Alignment Options for Alternative 5

## Kiggins Bowl Terminus



## Lincoln Terminus



MAP DIMENSIONS ARE APPROXIMATE.  
MOS=Minimum Operable Segment



## 2.3 Components

Components are the building blocks of the alternatives. When combined, the components create the multimodal CRC alternatives intended to address the project's purpose and need. The components of the alternatives include:

- Multimodal river crossing and highway improvements
  - Bridges over the Columbia River carrying transit, highway, and bicycle and pedestrian traffic
  - Bicycle and pedestrian improvements between north Portland and downtown Vancouver
  - Highway and interchange improvements between Marine Drive in north Portland and SR 500 in Vancouver
- High-capacity transit modes
- Transit terminus and alignment options
  - Transit terminus options
  - Transit alignment options
- Transit operations (frequency of train or bus rapid transit service, as well as local buses)
- Bridge tolls
- Transportation System and Demand Management measures

### 2.3.1 Multimodal River Crossing and Highway Improvements

There are two primary multimodal river crossing options under consideration:

- A replacement multimodal river crossing (included with Alternatives 2 and 3), and
- A supplemental multimodal river crossing (included with Alternatives 4 and 5).

Both river crossings provide improved facilities for highway users, transit users, and bicyclists and pedestrians to enhance the multimodal crossing of the Columbia River and to improve safety, capacity, and mobility on I-5. The replacement and supplemental river crossings differ in the three key elements that comprise this component:

- The bridges over the Columbia River (with dedicated lanes for transit vehicles, cars and trucks, and bicycles and pedestrians),
- Bicycle and pedestrian facilities through Hayden Island, over the Columbia River, and at the Vancouver waterfront, and
- Highway and interchange improvements on I-5 throughout the project area.

Upcoming decisions to define a locally preferred alternative (LPA) will select between a supplemental or replacement crossing (or No Build), but will not decide the specific bridge type or material selection. To narrow the decision further, more analysis is required, and such decisions will be

made after the Draft Environmental Impact Statement (DEIS) and after adoption of an LPA. The decision for this phase of the project regarding the river crossing is only to choose a replacement or a supplemental crossing, or the No-Build Alternative. This process will ensure that the appropriate structural and material selection is evaluated fully before any decision becomes final.

If a replacement crossing is chosen, this will not yet determine the bridge type (for example, three parallel bridges or a stacked transit/highway bridge—see below for information on these design concepts) or bridge material (for example, concrete, steel, or composite). Decisions on bridge type and design would have to be approved by the Federal Highway Administration (FHWA) before a final selection is made. The Federal Transit Administration (FTA) will also take an approval action on the final structure type.

Likewise, if a supplemental crossing is chosen, bridge type or material of the new bridge would be determined during further design and evaluation after adoption of an LPA. Should the supplemental crossing move forward in the National Environmental Policy Act (NEPA) process and become part of the LPA, a bridge type study will be done to determine the bridge type and material, and that information will be submitted to FHWA for approval. FTA will also take approval action on the final structure type.

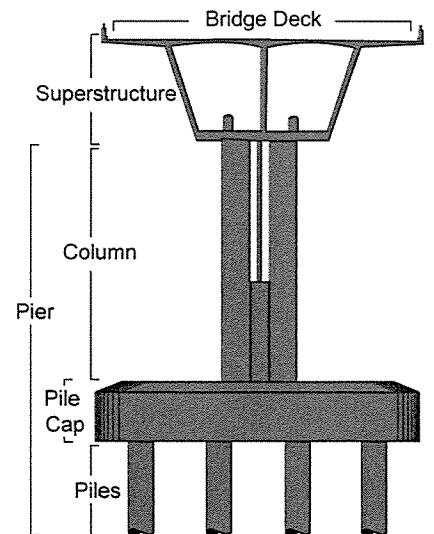
### Replacement River Crossing Bridges (Alternatives 2 and 3)

A replacement river crossing (Exhibit 2.3-1) would include removing the existing I-5 bridges and building new bridges west of the existing I-5 bridges. Two new bridges would carry north and southbound interstate traffic, and the third would have a high-capacity transit guideway and an exclusive path for bicycles and pedestrians. North and southbound interstate traffic would each travel on a separate bridge approximately 99 feet wide. A third bridge approximately 52 feet wide would carry transit vehicles, bicyclists, and pedestrians. (Note: there is a possible design that would include placing transit vehicles under one of the highway bridges; see the stacked transit/highway bridge discussion below for this description.)

Bridge design will be determined later in the project, but the basic size and height requirements have been defined. The bridge spans over the river must be tall enough for large barges and tugboats to pass underneath without the need for a lift span (approximately 90 feet vertical clearance), but low enough to minimize interference with aircraft using the nearby Pearson Field or Portland International Airport. The bridges cannot include tall towers, such as those associated with cable-stay or suspension bridges, because these would pose a hazard to aircraft.

### TERMS & DEFINITIONS

#### Bridge Terms



NOTE: The bridge type shown is for display purposes only.

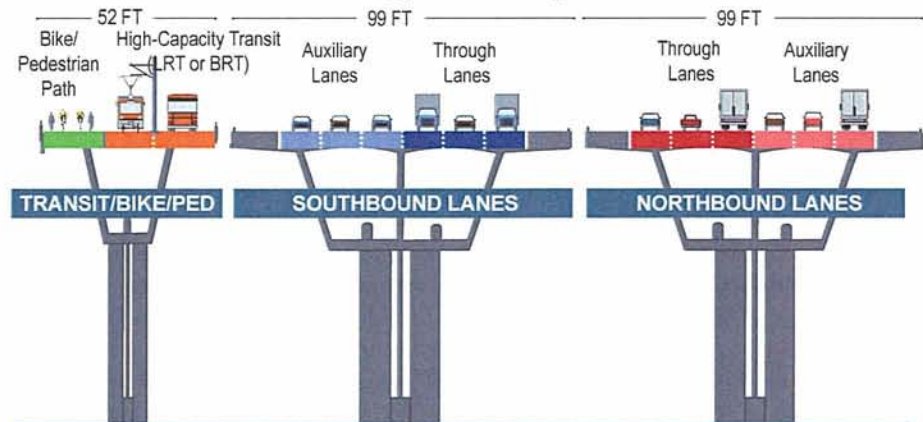


## Replacement River Crossing



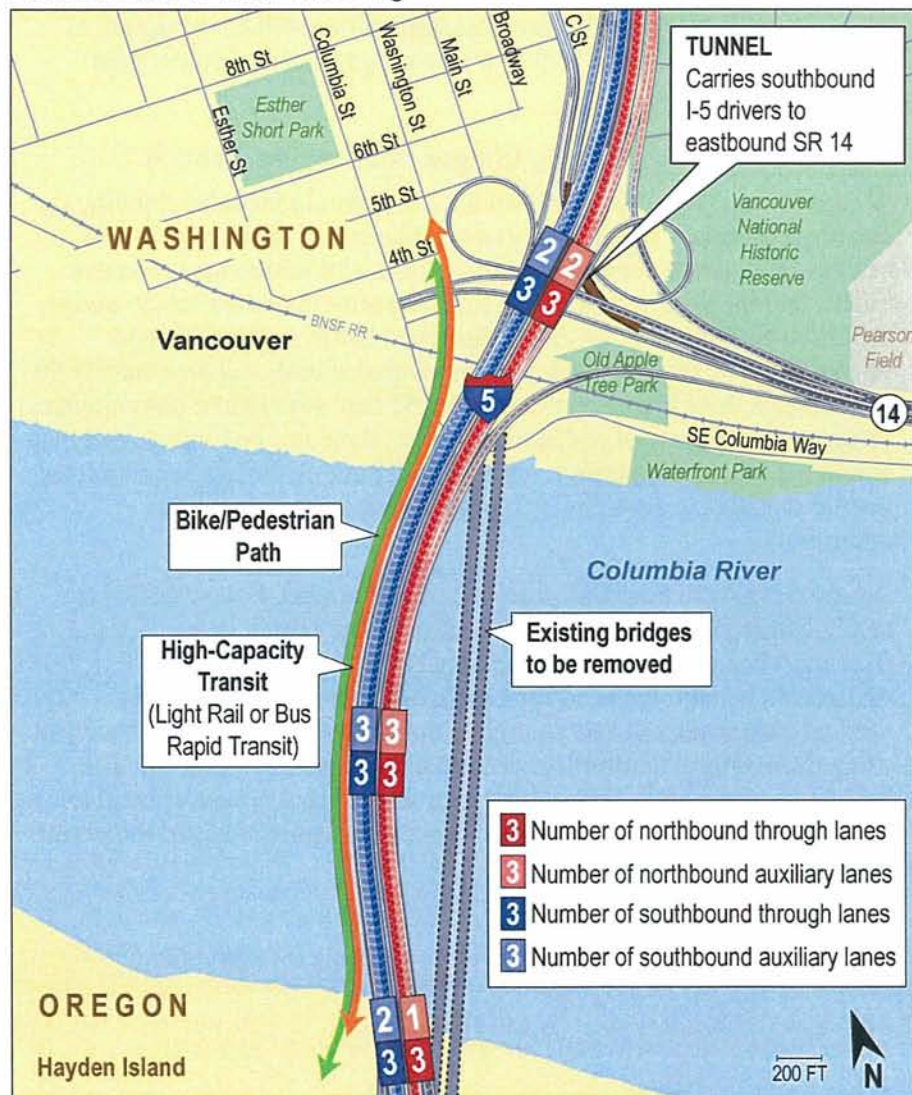
DIMENSIONS ARE APPROXIMATE.

### Number of Lanes and Traffic Types on Bridges



MEASUREMENTS PROVIDED ARE APPROXIMATE.

### Detailed Area of River Crossing





Spacing between the three bridges is likely to be between 10 and 50 feet. Wider spacing would reduce the visual mass of the structures and allow easier access for maintenance. Narrower spacing would reduce the breadth of bridge foundation coverage. Each structure would have separate piers, but pier spacing has not been finalized. The analysis in this DEIS is based on a typical 500-foot span length that would require six in-water piers for each of the new bridges, and potentially one to three smaller piers for ramps at either end of the bridges. The size of the piers at the water line would vary depending upon the type and size of piles used to construct these support structures.

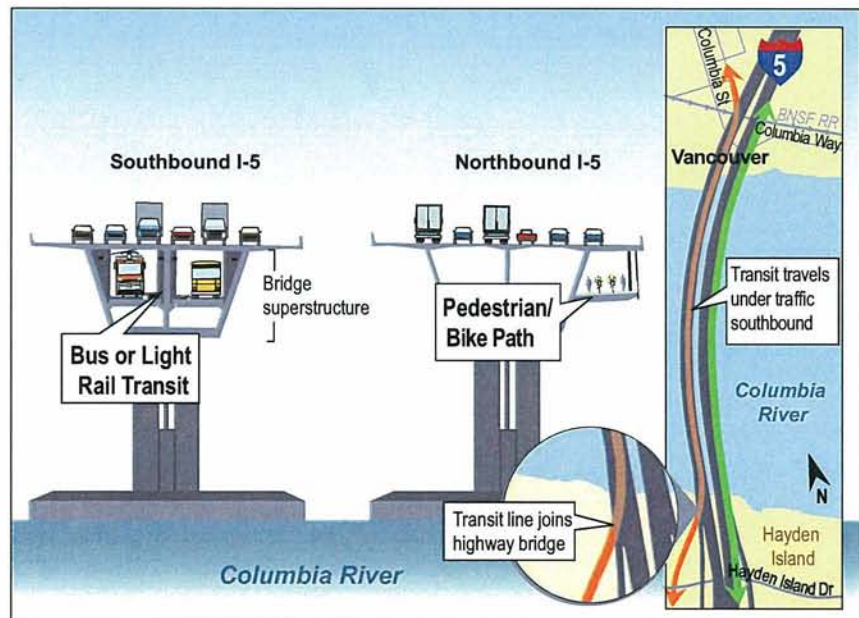
The highway bridges would be wide enough to be striped for six lanes in each direction, and would include safety shoulders on both sides. Each lane, and the safety shoulders, would be a standard 12-foot width. Three lanes would carry through-traffic, with three other “auxiliary lanes.” Auxiliary lanes can improve safety and capacity by accommodating cars and trucks entering or exiting the highway or traveling short distances between adjacent interchanges, and reduce potentially unsafe weaving and merging movements. This is especially important at the river crossing, where three large interchanges (Marine Drive, Hayden Island, and SR 14) all have traffic entering and exiting I-5 within a very short (1.5 miles) distance.

A third bridge, parallel to these two bridges, would accommodate transit vehicles, bicyclists, and pedestrians. Two lanes or tracks would accommodate bus rapid transit or light rail, and a path at least 12 feet wide would be dedicated to bicyclists and pedestrians.

### Replacement Crossing Option – “Stacked Transit/Highway Bridge”

This option for the replacement river crossing (Exhibit 2.3-2) could accommodate transit, bicycles, and pedestrians on two rather than three bridges over the Columbia River. This option, referred to as a “stacked transit/highway bridge” or “STHB,” would allow transit to travel beneath the highway deck of the I-5 southbound bridge. From the south, the transit guideway would join the highway bridge near the northern shore of Hayden Island. Before reaching Vancouver, the transit guideway would diverge to the northwest on a separate, smaller viaduct (possibly requiring additional piers in the Columbia River) before touching down on Washington Street between the intersections of Fifth and Sixth Streets and Washington Street. Bicyclists and pedestrians would use a path suspended under the eastern edge of the northbound highway bridge.

Exhibit 2.3-2  
Conceptual Design of Stacked Transit/Highway Bridge Design



Note: The bridge type shown is for display purposes only.

## TERMS & DEFINITIONS

### Piles

Piles are large-diameter steel pipes hammered or drilled into the soil until they reach dense soil or bedrock. The piles provide support to hold the weight of the bridge and traffic. Piles also provide stability in the event of an earthquake.

### Auxiliary Lanes

Auxiliary lanes can improve safety, reduce congestion by accommodating cars and trucks entering or exiting the highway or traveling short distances between adjacent interchanges, and reduce conflicting weaving and merging movements. This is especially important at the river crossing, where three large interchanges (Marine Drive, Hayden Island, and SR 14) all have traffic entering and exiting I-5 within a 1.5-mile segment.

## Bridge Type

Bridge type dictates the structural elements of a bridge, and strongly influences the visual and aesthetic design. In addition, the bridge type affects the duration and methods of construction. Some examples of different bridge types include:

- Steel box girder
- Cast-in-place segmental concrete box girder
- Precast segmental concrete box girder

The bridge type for this project will be determined during later phases after further engineering design refinement and environmental evaluation.

## Supplemental River Crossing Bridges (Alternatives 4 and 5)

A supplemental river crossing would include a new bridge downstream of the existing I-5 crossing, and would include two lanes or tracks for high-capacity transit and four lanes of southbound interstate traffic. The supplemental river crossing would use both existing I-5 bridges to carry four lanes of northbound interstate traffic, bicycles, and pedestrians. Substantial modifications would be made to the existing bridges—upgrading the piers, trusses, and lift towers for improved stability during an earthquake, replacing the bridge deck, and adding a cantilevered path for bicycles and pedestrians.

The new supplemental bridge would be built high enough to allow river traffic to pass underneath without the need for a lift span. The existing bridges would remain, thus continuing to require the current bridge lifts to accommodate some vessels, particularly during times of high water. The new bridge would be approximately 108 feet wide, enough to accommodate a two-way transit guideway, four southbound interstate lanes, and standard 12-foot wide shoulders. The size of the piers at the waterline would vary depending upon the type and size of piles used to construct these support structures.

The bicycle and pedestrian paths on the existing bridges would be consolidated into a single 16-foot wide path cantilevered on the east side of the current northbound (upstream) bridge. New beams would be added to the substructure of the bridge to support this widened pathway.



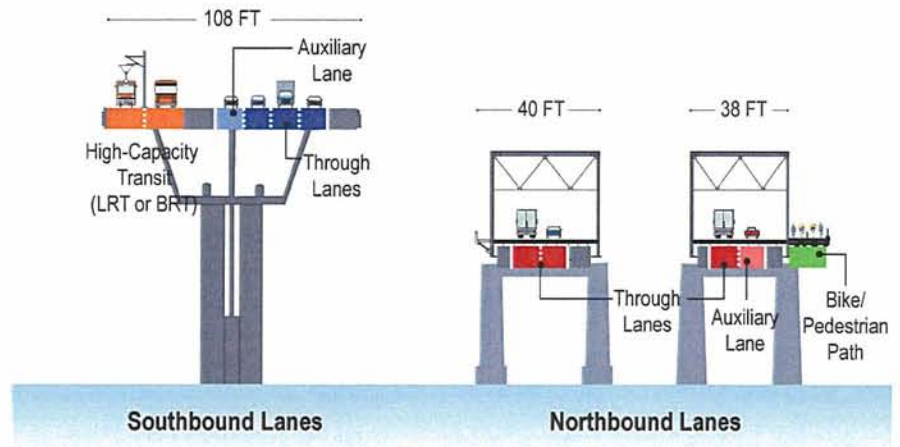
Exhibit 2.3-3

## Supplemental River Crossing



DIMENSIONS ARE APPROXIMATE.

### Number of Lanes and Traffic Types on Bridges



#### SUPPLEMENTAL BRIDGE SPAN

MEASUREMENTS PROVIDED ARE APPROXIMATE.

#### EXISTING I-5 BRIDGE SPANS

### Detailed Area of River Crossing

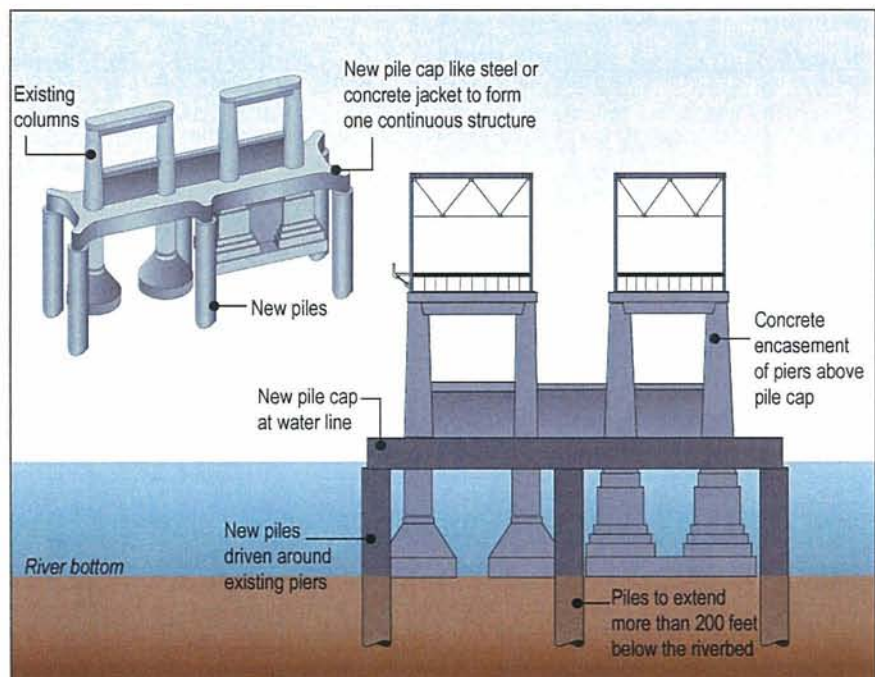




The decks of both existing bridges are wide enough to provide two standard width (12-foot) lanes, for a total of four northbound lanes, and still accommodate safety shoulders. The two lanes on the existing southbound bridge would serve northbound through-traffic. The inside (western) lane on the existing northbound bridge would serve both through-traffic and serve as an auxiliary lane. The outside (eastern) lane on the existing northbound bridge would be an auxiliary lane. Both bridges would have a 4-foot wide interior shoulder. The current northbound structure would have a 10-foot outside shoulder and the current southbound structure would have a 12-foot outside shoulder.

The foundations, piers, and superstructure of the existing bridges would be strengthened to improve stability during an earthquake (Exhibit 2.3-4). Large diameter (>10 feet) piles would be placed around the existing piers to reach firm substrate or bedrock, which lies more than 200 feet below the riverbed. New pile caps would connect these piles to the existing piers at the water line. A concrete or steel jacket would encase the piers of both existing bridges to form one continuous structure above the river. New or reinforced cross-bracing would strengthen trusses on the superstructure of the bridges. The lift span towers would be rebuilt in a style that resembles the current towers but provides much greater support for the counterweights used to raise the lift span.

Exhibit 2.3-4  
**Seismic Retrofits Concept for Existing Bridges**



NOT TO SCALE

### **Bicycle and Pedestrian Improvements Provided by Replacement and Supplemental River Crossings**

The replacement river crossing includes a pathway for bicyclists and pedestrian to travel between downtown Vancouver and the Expo Center. The pathway could be on either or both sides (east and/or west) of the river crossing; current designs have the pathway west of and adjacent to

the high-capacity transit alignment. The pathway would be continuous and above-grade from Marine Drive to Sixth Street in Vancouver, would be approximately 16 feet wide over the river, and would pass under Marine Drive to connect to the Expo Center. The STHB design could include a 16 foot wide path underneath the northbound (eastern) Interstate bridge deck.

The supplemental river crossing would widen the east sidewalk on the existing eastern bridge to approximately 16 feet in order to accommodate both pedestrians and bicyclists in a safe manner. Ramps would connect this widened pathway with Columbia Way in Vancouver and with Tomahawk Island Drive on Hayden Island. An above-grade multi-use pathway would also be provided alongside the transit guideway between Tomahawk Island Drive and Marine Drive, crossing over the Portland Harbor. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through at-grade intersections.

With all of the CRC alternatives, the multi-use pathway over North Portland Harbor would be on the transit structure; therefore, its location would vary depending on the transit route selected in this location. The transit routes are discussed in Section 2.3.3.

For either river crossing, connections consisting of stairs, ramps, and/or elevators would be provided to connect with existing and planned sidewalks and pathways in Vancouver, on Hayden Island, and near Marine Drive. Most of the connections will need to be coordinated with ongoing planning, such as the potential redevelopment and streetscape planning on Hayden Island.

### **Highway and Interchange Improvements Provided by Replacement and Supplemental River Crossings**

The highway improvements included with both river crossings would add additional auxiliary lanes as shown in Exhibit 2.3-5. Both the replacement and supplemental crossings would provide three through lanes on I-5 in each direction from Marine Drive to SR 500, but would differ in the number of auxiliary lanes provided and in the design of some interchanges. The replacement crossing would include two to three auxiliary lanes in each direction between Marine Drive and SR 500. The highway improvements provided by the supplemental crossing would generally include one fewer auxiliary lane through the project area than the replacement crossing, because it is designed to represent a lower highway investment.

Both river crossing components provide safety, access, and capacity improvements to the interchanges in the project area, as described below. The specific design of these interchanges could change as design progresses, but the basic performance, footprints, and impacts would be similar to those described here.

The southern extent of highway improvements is the Marine Drive/I-5 interchange. Merge lanes for southbound traffic entering the highway from Marine Drive would be extended past Victory Boulevard. A new roadway would cross over Vancouver Way to connect Marine Drive and Martin Luther King Jr. Boulevard.



There are three design options for the Marine Drive interchange (Exhibit 2.3-6); each configuration is available for both the replacement and supplemental river crossing. These options include a “standard” design option that would retain most of the existing Marine Drive alignment, a “southern realignment” that would realign Marine Drive south of the Expo Center property, and the “diagonal realignment” design option. The southern design would introduce a traffic signal at the new intersection of Marine Drive and Force Avenue; the other designs would largely retain the existing configuration. Each design option would add free-flow access (no stop signs or signals) for the most frequently used connections between I-5 and Marine Drive.

The Hayden Island interchange (Exhibit 2.3-6) would use ramps parallel to the mainline rather than looped ramps to minimize the east-west footprint of the highway. This would stretch the interchange footprint along the highway, narrowing its east-west footprint. A replacement crossing would provide auxiliary lanes connecting Hayden Island to Marine Drive and SR 14, allowing vehicles to travel between these points without merging into mainline interstate traffic. The replacement crossing would afford two to three auxiliary lanes in each direction, while a supplemental bridge would only provide one to two auxiliary lanes.

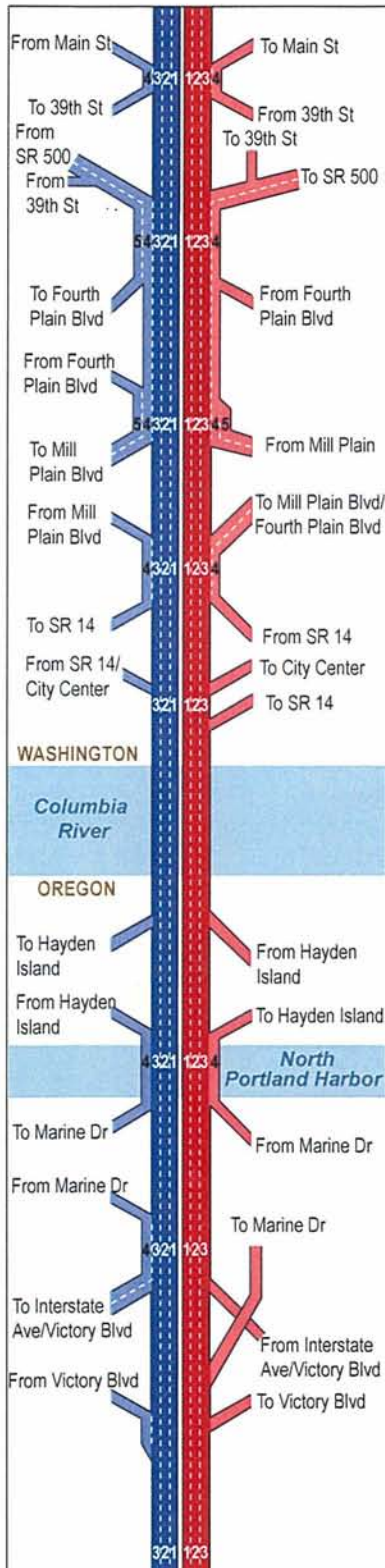
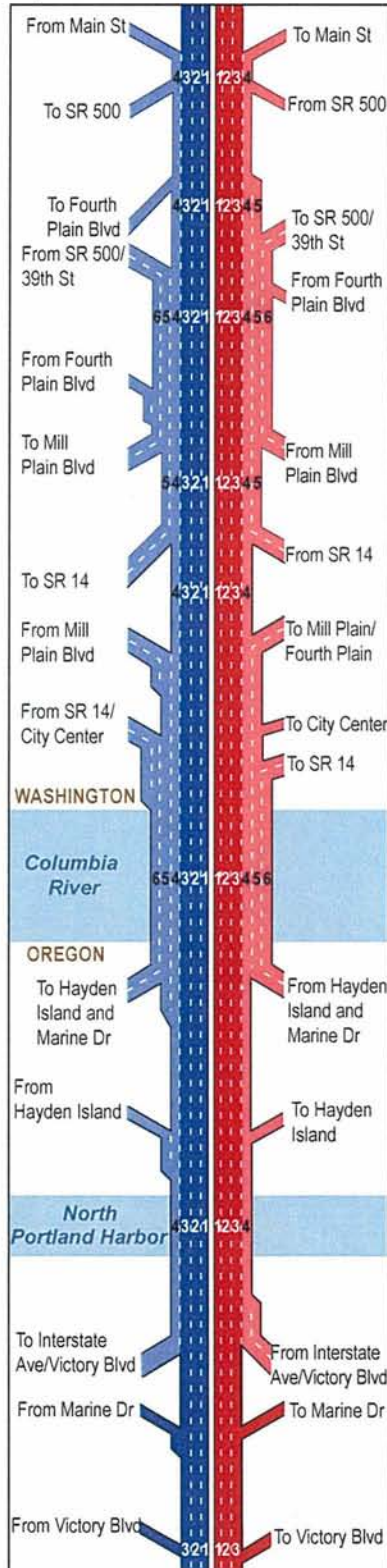
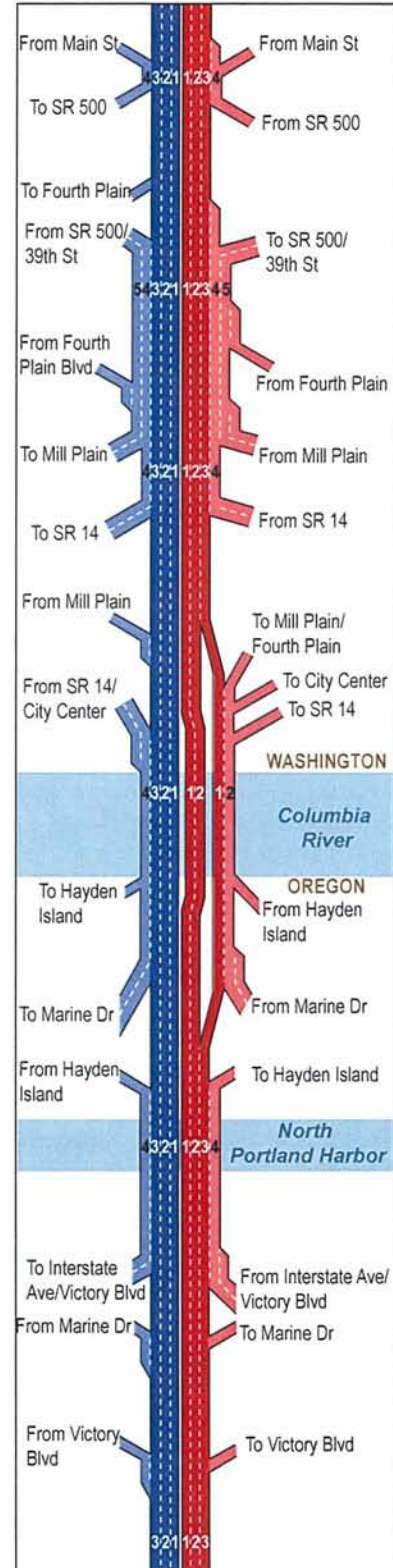
Local streets on Hayden Island near I-5 would be modified to connect with the redesigned I-5 interchange. Hayden Island Drive and Jantzen Drive would be widened to two lanes in each direction to connect with Jantzen Beach Center and provide circulation around the I-5 interchange. Tomahawk Island Drive would be extended to run underneath I-5 and provide a connection between the eastern half of the island and Jantzen Beach. The City of Portland is currently preparing a new land use plan for Hayden Island, which could revise local circulation and connections to the Hayden Island interchange.

With either river crossing, the SR 14 interchange (Exhibit 2.3-7) would be rebuilt to allow direct access (no stop signs or signals) between I-5 and SR 14 in all directions. Three interchange designs are being considered. A replacement river crossing could use ramps looping around both sides of the mainline to connect I-5 and SR 14, or utilize a left-turn loop on the eastern side of I-5 to connect I-5 northbound to SR 14 eastbound. With a supplemental crossing, the SR 14 interchange would be similar to the “dual-loop design,” but would differ slightly because of the different grades of the southbound and northbound highway.

Exhibit 2.3-5

**HIGHWAY & INTERCHANGE IMPROVEMENTS: Through/Auxiliary Lanes**

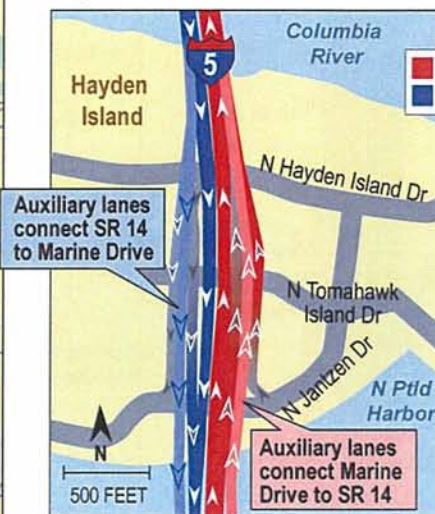
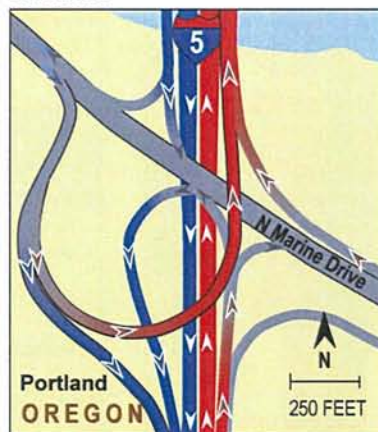
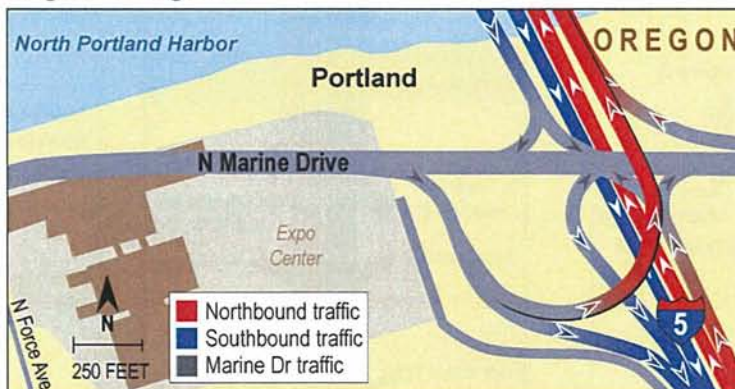
- Northbound through lanes  
■ Northbound auxiliary lanes  
■ Southbound through lanes  
■ Southbound auxiliary lanes

**No-Build****Replacement Crossing****Supplemental Crossing**

DIAGRAMS ARE NOT TO SCALE.



Exhibit 2.3-6

**HIGHWAY & INTERCHANGE IMPROVEMENTS: Marine Drive and Hayden Island****Hayden Island Interchange****Replacement****Supplemental****Marine Drive Interchange****Standard****Southern Realignment****Diagonal Realignment**

DIMENSIONS ARE APPROXIMATE.



Exhibit 2.3-7

# HIGHWAY & INTERCHANGE IMPROVEMENTS: SR 14 to Fourth Plain



DIMENSIONS ARE APPROXIMATE.

## SR 14 Interchange

### Supplemental Crossing



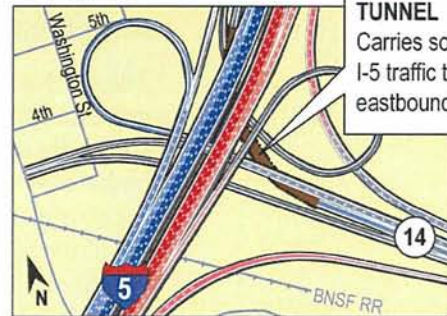
- Northbound through lanes
- Northbound auxiliary lanes
- Southbound through lanes
- Southbound auxiliary lanes

### Replacement Crossing Design Options

#### LEFT LOOP



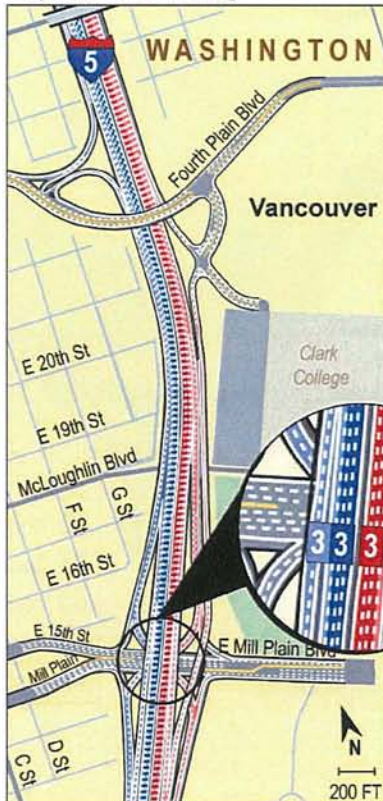
#### DUAL LOOP



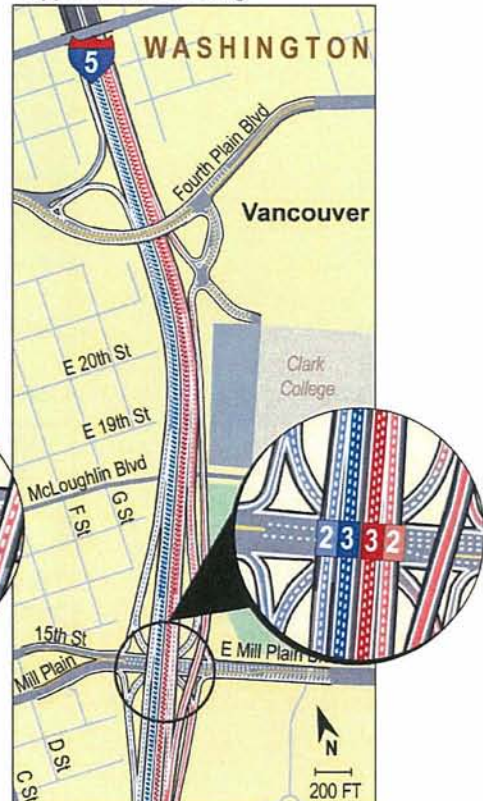
**TUNNEL**  
Carries southbound  
I-5 traffic to  
eastbound SR 14

## Mill Plain Boulevard to Fourth Plain Boulevard

### Replacement Crossing



### Supplemental Crossing



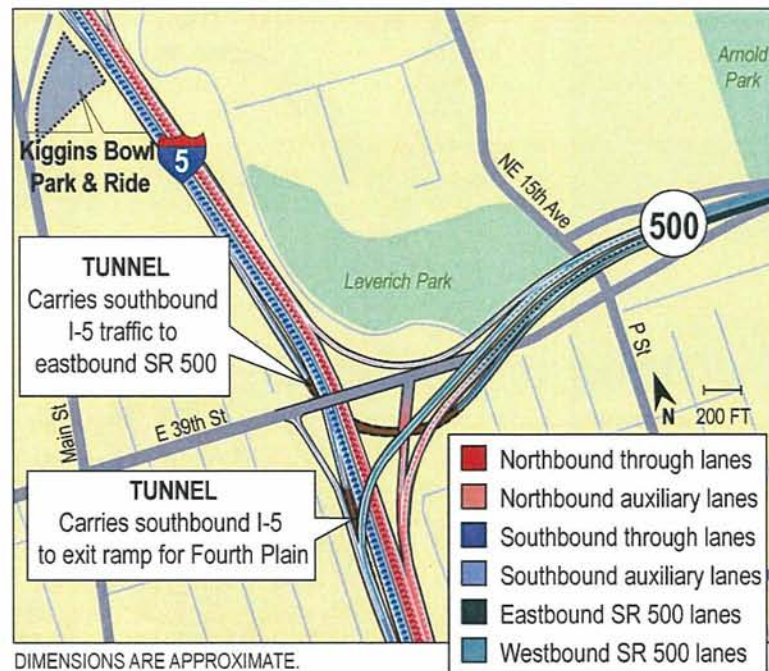


The Mill Plain interchange would use on- and off-ramps running parallel to the mainline, similar to the design on Hayden Island. A replacement crossing would have two auxiliary lanes in each direction, rather than one with a supplemental crossing. Northbound traffic could exit to Mill Plain Boulevard, or could merge onto an elevated structure that would continue north, parallel to I-5, to connect with Fourth Plain Boulevard.

The Fourth Plain interchange design would be functionally the same for a replacement or a supplemental river crossing. Both crossings would include on- and off-ramps for traffic exiting or entering I-5 southbound. Northbound exits to Fourth Plain Boulevard would use the off-ramp at the Mill Plain Boulevard interchange. The Fourth Plain overpass would be rebuilt to accommodate the additional width of I-5. A new access road would connect the Clark College Park and Ride (Section 2.3) to the Fourth Plain interchange and allow northbound entrances onto I-5. The replacement river crossing would include two to three auxiliary lanes, while the supplemental river crossing would provide two auxiliary lanes through this intersection.

The SR 500 interchange would be rebuilt to provide free-flow movements in all directions between SR 500 and I-5 (Exhibit 2.3-8). The I-5 southbound to SR 500 connection would include a tunnel that runs under the I-5 mainline and other interchange ramps. Highway improvements would continue north to Kiggins Bowl where the new auxiliary lane(s) would merge with the existing three through lanes. Southbound I-5 traffic would not access 39th Street directly from this interchange, but could do so from the preceding Main Street off-ramp.

Exhibit 2.3-8  
**SR 500 Interchange**





### 2.3.2 High-Capacity Transit Modes

The CRC alternatives include two high-capacity transit modes—bus rapid transit (Alternatives 2 and 4) or light rail (Alternatives 3 and 5). Bus rapid transit and light rail would both operate separately from other traffic in an exclusive right-of-way on city streets or on separate structures. Both transit modes are being evaluated for the same set of alignments, park and rides, and station locations. This section describes the general characteristics of each transit mode, as well as the transit improvements included in the No-Build Alternative. The upcoming decision to define a locally preferred alternative will select between bus rapid transit and light rail.

#### Bus Rapid Transit (Alternatives 2 and 4)

Bus rapid transit (BRT) would be comprised of three types of bus services: bus rapid transit service, express bus service, and local bus service. Bus rapid transit service, as well as existing and new express and local bus routes, would be able to use the exclusive transit guideway provided by this project where these services' routes coincide with the transit guideway.

Bus rapid transit service would include:

- An exclusive transit guideway from the Expo Center station over Hayden Island, across the Columbia River, and into Vancouver;
- Simplified, faster fare payment methods on the BRT lines (such as the use of off-board ticket vending machines);
- Passenger stations with increased amenities, similar in size and scale to existing light rail stations in Portland;
- 60-foot articulated vehicles (typical buses are 40 feet long) with special markings and paint colors for a “branded identity”; the DEIS analysis assumes the buses would be powered by diesel, although diesel/electric hybrids are also under consideration; and
- An expansion of the current C-TRAN bus maintenance facility in eastern Vancouver.

The Expo Center light rail station in Portland would be the southern end of the bus rapid transit service and would be expanded to accommodate passengers transferring between buses and light rail. Bus rapid transit service would provide a one-transfer ride from downtown Portland and other points on the existing MAX system, to stations in downtown Vancouver, the Salmon Creek Park and Ride, the Vancouver Mall, and Fisher's Landing Transit Centers.

Bus rapid transit service would consist of limited-stop versions of C-TRAN's three most popular routes and a fourth BRT route running solely within the exclusive guideway. Limited-stop versions of routes 4, 37, and 71 would travel along the same routes as their corresponding local service routes, but would operate with limited stops, located about one-half mile to one mile apart (Exhibit 2.3-9). Through downtown Vancouver and over Hayden Island, the bus rapid transit routes, as well as six local bus routes, would travel in an exclusive guideway to a new transfer center at the Expo Center light rail station.

Exhibit 2.3-9

#### Bus Rapid Transit Routes



DIMENSIONS ARE APPROXIMATE.

C-TRAN bus line numbers used in this document are based on the line numbers used during 2005 for consistency with other modeling details that use 2005 data to ensure accurate calibration data. C-TRAN has changed several bus line numbers since 2005.



Exhibit 2.3-10

**C-TRAN Bus Maintenance  
Base Expansion  
Bus Rapid Transit**



Express bus service would provide direct, non-stop service from Clark County park and ride lots to downtown Portland. These express bus routes in the I-5 corridor would not use the exclusive transit guideway, but would travel in general purpose lanes southbound and would use the existing I-5 northbound high-occupancy vehicle lane from Going Street to Marine Drive.

Most local bus lines would operate on routes similar to their current ones, but would connect to BRT in downtown Vancouver at the Mill Plain and Seventh Street stations (see Section 2.3 for a description of these locations). Some local buses would use the exclusive guideway to gain travel time advantage in downtown Vancouver. Six local routes would be extended across the Columbia River in the exclusive guideway to connect to Hayden Island and the Expo Center light rail station.

Bus rapid transit would require expanding C-TRAN's existing bus maintenance facility on NE 65th Avenue in Vancouver to accommodate new, larger sized buses (Exhibit 2.3-10). This expansion would include additional office space, and new bays and maintenance facilities for both standard 40-foot buses as well as the larger, 60-foot BRT vehicles.

### Light Rail (Alternatives 3 and 5)

This component would extend light rail service from the existing Expo Center light rail station in Portland over Hayden Island and through Vancouver. This would allow a no-transfer ride between points in Vancouver and downtown Portland. Light rail would serve the inner urban transit market (western Vancouver to downtown Portland) directly, and would serve suburban commuters through park and ride lots and transfers from local bus service.

Light rail vehicles would be similar to those currently used by TriMet's MAX system. Trains could operate in single- and double-car configurations. Exhibit 2.3-11 compares the transit vehicles being considered.

Exhibit 2.3-11

### Transit Vehicle Characteristics

Vehicle Type		Length	Seats	Average Vehicle Passenger Capacity <sup>a</sup>
Local Bus		40 feet	43	61
Express Bus		40 feet	43	61
BRT		60 feet	47	91
LRT	Single Train	90 feet	64	133
	Two-Car Train	180 feet	128	266

<sup>a</sup> Average vehicle capacity is the total number of seats and floor area of the transit vehicle divided by 3 persons per square meter.

The suburban commuter transit market would also continue to be served by express bus service to downtown Portland from suburban Clark County park and rides. Express bus routes 105 and 157 would be replaced by light rail service and three new limited-stop bus routes. The 4, 37, and 71 limited-stop versions would travel on the same routes as



their corresponding local buses, but would operate with limited stops at least one-half mile apart and would terminate in downtown Vancouver to transfer to the light rail system. Express bus routes would operate on I-5 in general purpose lanes southbound and would use the existing northbound high-occupancy vehicle lane from Going Street to Marine Drive. Specific bus routing, and headways could vary from these descriptions, but the basic transit coverage and service concept would be similar.

Light rail would require power substations to provide power to the catenary system used to propel light rail vehicles. These substations could be located in public right of way, but may require property acquisitions and/or easements. Substations would be placed based on voltage load but are generally needed about every mile along the guideway but especially near steep grades such as bridges. One substation would be needed on Hayden Island, one in downtown Vancouver near the bridge, and another near, or in, the Mill Plain District. A fourth sub-station would be required for either the Lincoln terminus or Kiggins Bowl terminus near the northern end of either of these termini. Signal and communications buildings may also need to be sited off the public right-of-way. These buildings are placed near, or on, every station. Siting for sub-station and signal and communication buildings will occur during future design efforts if light rail is advanced for further evaluation.

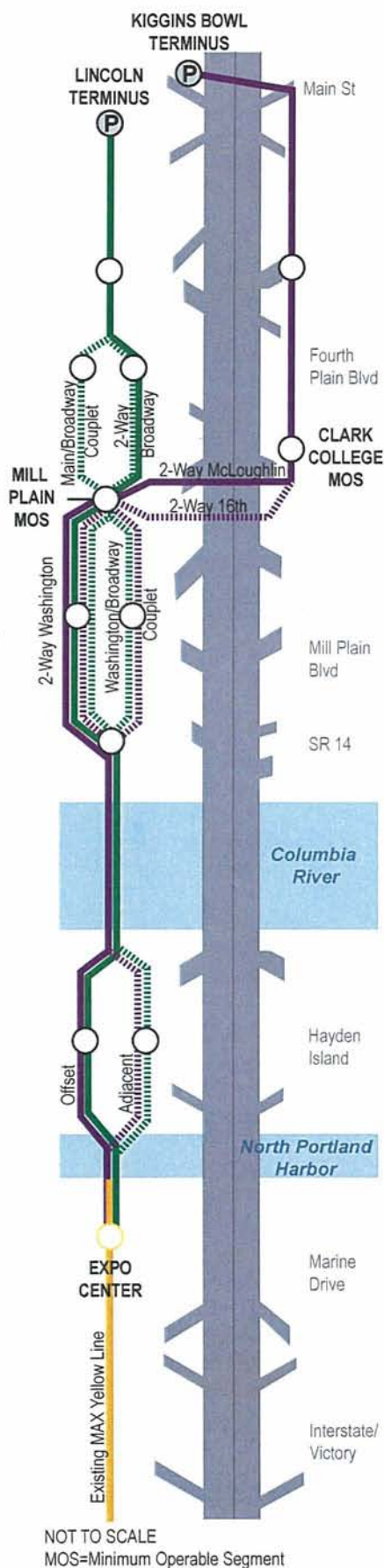
Light rail would also require expanding TriMet's existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham to accommodate the additional light rail vehicles included for the light rail component of this project. This expansion would include the need to acquire additional right-of-way (see Exhibit 2.3-12), and to build new storage tracks as well as a new operations control facility. This expansion of right-of-way would also provide enough land to accommodate light rail vehicles that might be added to TriMet's system by other future projects, such as the possible Milwaukie light rail extension that is currently being studied, although additional storage tracks and other improvements to the land would be required.

Exhibit 2.3-12

**Ruby Junction  
Maintenance Base Expansion  
Light Rail Transit**



Exhibit 2.3-13

**Transit Terminus and Alignment Options****2.3.3 Transit Terminus and Alignment Options**

Each of the CRC build alternatives includes four terminus options—Kiggins Bowl terminus, Lincoln terminus, Clark College minimum operable segment (MOS), and Mill Plain MOS (Exhibit 2.3-13). Each terminus option is inclusive of both the specific terminus or end of the transit guideway that it refers to, as well as the entire guideway and stations preceding this terminus through the project corridor. For example, the Kiggins Bowl terminus is the high-capacity transit guideway extending from the Expo Center to the Kiggins Bowl Park and Ride. Likewise, the Clark College MOS is the transit guideway extending from the Expo Center to the Clark College Park and Ride.

These terminus options are included in each alternative to provide the public and project co-lead agencies with a range of choices to consider and to provide possibility for extension in the future based on funding availability. The upcoming decision to select a locally preferred alternative is expected to select a transit terminus, but may maintain the option of an MOS pending additional design, refined cost estimates, land use impacts, park and ride access, and convenience to attract more transit riders, can identify the most cost effective transit guideway.

Exhibit 2.3-14 describes each of the four terminus options, including the unique elements such as park and rides and station locations that are part of each terminus option. The transit alignment options on Hayden Island, in downtown Vancouver and in northern Vancouver are described at the end of this section.

Exhibit 2.3-14

**Station Locations and Guideway Length**

	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Guideway Length	4.22 miles	3.43 miles	2.65	2.07
Hayden Island Station	Adjacent or Offset from I-5	Adjacent or Offset from I-5	Adjacent or Offset from I-5	Adjacent or Offset from I-5
Downtown Vancouver Stations	7th Street 12 Street Mill Plain	7th Street 12 Street Mill Plain	7th Street 12 Street Mill Plain	7th Street 12 Street Mill Plain
North Vancouver Stations	Clark College 33rd Street Kiggins Bowl	24th Street 33rd Street Lincoln	Clark College	None
Park and Rides	Expo Center (existing) Clark College (structure) Kiggins Bowl (structure)	Expo Center (existing) Clark College (surface lot) <sup>a</sup> Lincoln (structure) Kiggins Bowl (surface lot) <sup>a</sup>	Expo Center (existing) Clark College (surface lot) Kiggins Bowl (surface lot) <sup>a</sup>	Expo Center (existing) SR-14 surface lots Clark College (surface lot) Lincoln (surface lot) <sup>a</sup> Kiggins Bowl (surface lot) <sup>a</sup>

<sup>a</sup> These park and rides are proposed at sites that would not be on the HCT guideway, but would be connected to the HCT guideway via local bus routes.

NOT TO SCALE  
MOS=Minimum Operable Segment



### Kiggins Bowl Terminus

The Kiggins Bowl terminus would route high-capacity transit from the Expo Center, across Hayden Island, over the Columbia River, through downtown Vancouver, and east to cross under I-5 and connect to Clark College. It would then continue north adjacent to I-5 and end at a park and ride at Kiggins Bowl. The guideway would turn east at the Mill Plain station on either 16th Street or McLoughlin Boulevard, and cross under I-5 to the Clark College Park and Ride. The guideway would then continue north on the eastern edge of the current I-5 right-of-way, and end at a new Kiggins Bowl Park and Ride. The Clark College Park and Ride would be a three-level parking structure. The Kiggins Bowl Park and Ride would be a six-level parking structure.

### Lincoln Terminus

The Lincoln terminus would route high-capacity transit from the Expo Center, across Hayden Island, over the Columbia River, through downtown Vancouver, and continue north on local streets to the Lincoln Park and Ride north of 39th Street on Main Street. The guideway would extend north from the Mill Plain station using either Broadway for two-way travel or a couplet on Broadway and Main Street. Either of these alignment options would then merge to a two-way guideway on Main Street north of Fourth Plain Boulevard, and end at a new Lincoln Park and Ride north of 39th Street.

The Lincoln Park and Ride would contain up to two levels below ground and one level at grade or above ground. The footprint of this park and ride could be reduced by providing more spaces below grade or by reducing the total number of parking spaces.

To provide a wider range of access across Clark County, the Lincoln terminus would also include a surface parking lot at Clark College and another surface lot at Kiggins Bowl. Local bus routes would connect these lots to Lincoln Park and Ride or the Mill Plain station for transfer to the high-capacity transit line.

### Clark College Minimum Operable Segment

The Clark College MOS ends the HCT guideway at the Clark College Park and Ride. This terminus option would provide flexibility for future extension, as part of another project, to either the Kiggins Bowl terminus or the Lincoln terminus.

Exhibit 2.3-15

#### Transit Terminus and Alignment Options

##### Lincoln Terminus

- Washington-Broadway Couplet
- Two-way Broadway (south)
- Broadway-Main Couplet
- Two-way Broadway (north)
- Transit Station
- Ⓟ Park and Ride Lot

##### Kiggins Bowl Terminus

- Washington-Broadway Couplet
- Two-way Broadway
- Two-way on McLoughlin Blvd
- Two-way on 16th Street
- Transit Station
- Ⓟ Park and Ride Lot

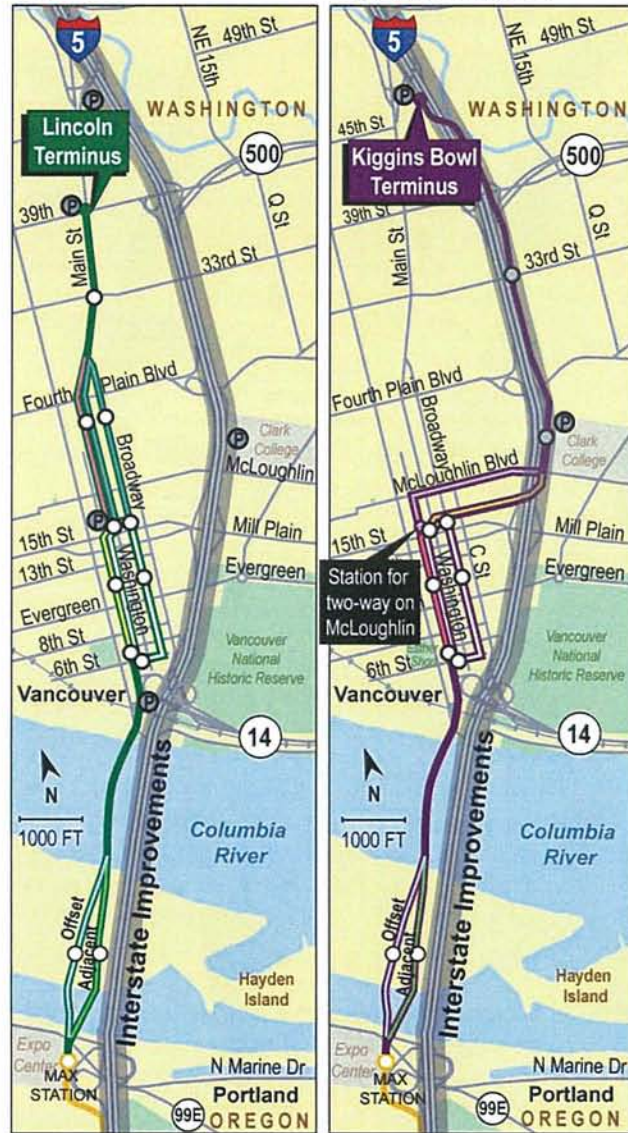




Exhibit 2.3-16

**Minimum Operable Segment (MOS) Options****Mill Plain MOS Alignment Options**

- Washington-Broadway Couplet
- Two-way Broadway

**Clark College MOS Alignment Options**

- Washington-Broadway Couplet
- Two-way Broadway
- Two-way on McLoughlin Blvd
- Two-way on 16th Street

- Transit Station
- Park and Ride Lot



DIMENSIONS ARE APPROXIMATE.

The Clark College MOS would include the same three-level parking structure at Clark College as the Kiggins Bowl terminus. Local buses could carry passengers from a surface lot at Kiggins Bowl to the Mill Plain transit station. The terminus station could be between the park and ride and the highway, as indicated in the graphics, or it could be parallel to McLoughlin, either in the middle or to the side of the street.

**Mill Plain Minimum Operable Segment**

The Mill Plain District MOS would end the transit guideway at the new Mill Plain station between 15th and 16th Streets and between Washington and Main Streets, and could serve as a shortened version of either the Kiggins Bowl terminus or the Lincoln terminus. Future projects could extend the transit guideway to either full-length terminus.

This terminus option would include a Park and Ride structure one block north of the Mill Plain Station, as well as additional Park and Ride surface lots around the SR 14 interchange. Additional Park and Rides at Clark College, Lincoln, and Kiggins Bowl would be connected to the HCT guideway by local bus routes.

**Transit Alignment Options**

This section describes, from south to north, the transit alignment options that are available for each of the four terminus options. Three segments, or geographic sub-areas, of the project area are defined by discrete sets of transit alignment options in each:

- Segment from Delta Park to downtown Vancouver,
- Segment from downtown Vancouver to the Mill Plain District, and
- Segment from the Mill Plain District through North Vancouver.

Any alignment option in one segment can be matched to any alignment option in another segment. The same terminus and alignment options, as well as station locations, are being evaluated for light rail and bus rapid transit.

**DELTA PARK TO DOWNTOWN VANCOUVER**

The transit guideway would start at the existing Expo Center MAX station. The light rail component would extend the existing tracks. Bus rapid transit would entail building bus bays and other modifications for a bus transfer center and a new bus-only guideway north from the Expo



Center. The transit guideway would rise to cross North Portland Harbor to an elevated station on Hayden Island, then cross the Columbia River into downtown Vancouver.

There are two alignment options for running the transit guideway across Hayden Island (Exhibit 2.3-17):

- Offset from I-5, or
- Adjacent to I-5

Either of these can be built with any of the project alternatives and any of the four terminus options. On Hayden Island, the offset option would locate the guideway approximately 450 feet west of I-5, immediately east of Jantzen Beach Mall. The adjacent option would locate transit immediately west of I-5. The offset transit guideway would be in the same location for either the replacement or supplemental crossing.

For the offset option, the Hayden Island station would be located just south of the Tomahawk Island Drive extension and oriented to the existing Jantzen Beach mall entrance. For the adjacent option, the Hayden Island station could be located on the north side of the island near North Hayden Island Drive, in the center, or on the south side at North Jantzen Avenue. Both alignment options would likely use an elevated structure, approximately 25 to 38 feet above grade, although the potential for placing part of the alignment at a similar height but on retained fill will be explored. The design and location of the transit station will be coordinated with the City of Portland's Hayden Island Master Plan, currently under development.

North of the station, transit would continue on an exclusive guideway across the Columbia River before touching down in Vancouver. With the replacement crossing, the transit bridge would touch down on Washington Street, between Fifth and Sixth Streets. A supplemental river crossing would keep the transit bridge elevated farther north, touching down at the intersection of Seventh and Washington Streets.

#### DOWNTOWN VANCOUVER TO MILL PLAIN DISTRICT

There are two alignment options for running high-capacity transit through downtown Vancouver. Either of these can be built with any of the project alternatives and any of the terminus options:

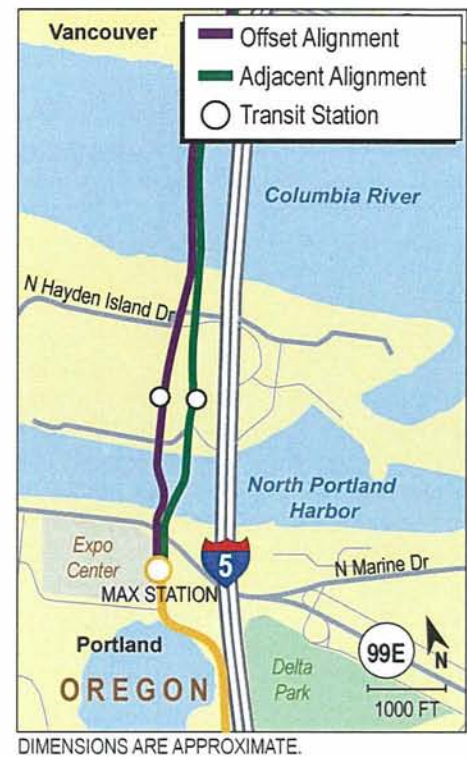
- Two-way transit on Washington Street, or
- Couplet transit on Broadway and Washington Streets.

Both options would have stations at Seventh Street, 12th Street, and Mill Plain station between 15th and 16th Streets and between Main and Washington Streets. Reconfiguring the streets as described below could entail adding or modifying bicycle facilities along these streets in addition to the transit guideway.

The two-way Washington Street option would place the north and southbound transit guideways in the center of Washington Street. Each station would have a single platform between the guideways, and transit would be separated from cars and trucks with a physical barrier such as a curb. This alignment option would allow two-way automobile traffic and, where feasible, on-street parking on blocks without stations. The

Exhibit 2.3-17

#### Hayden Island Transit Alignment Options



#### TERMS & DEFINITIONS

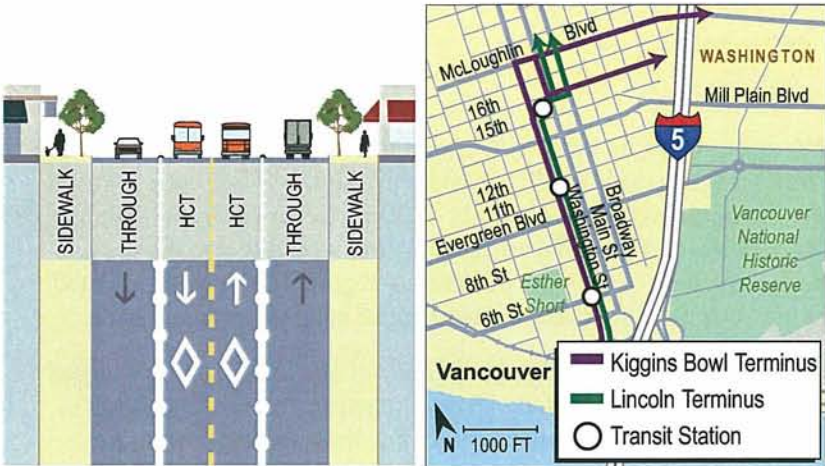
##### Couplet

A couplet is a method of routing two directions of travel on two adjacent, parallel streets, instead of placing both directions of travel on a single street. For example, the Washington-Broadway couplet alignment option would place northbound transit vehicles on Broadway, and southbound transit vehicles on Washington.



Mill Plain station would include space for local buses, providing connections between high-capacity transit and the local bus network.

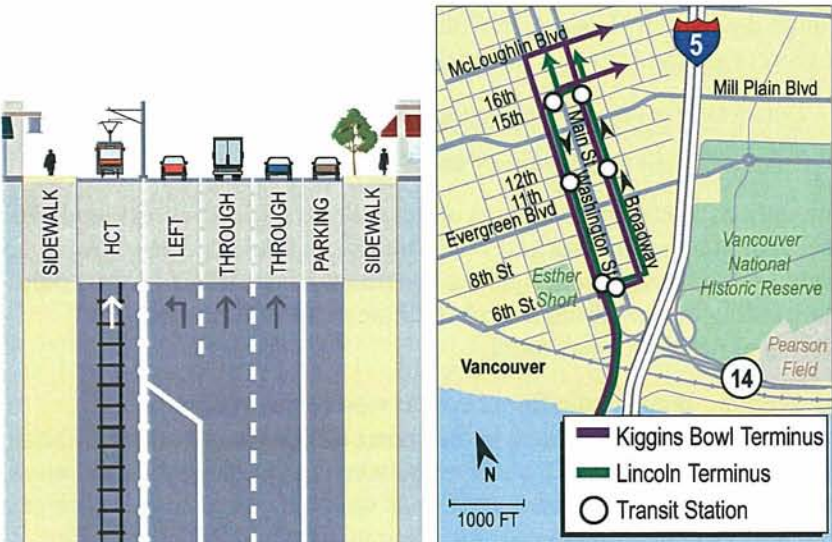
Exhibit 2.3-18  
**Downtown Vancouver, Two-Way on Washington Transit Alignment Option**



CONCEPTUAL DESIGNS / DIMENSIONS ARE APPROXIMATE.

A couplet on Washington and Broadway Streets would route northbound travel on Broadway Street and southbound travel on Washington Street. A replacement river crossing would allow the transit guideway to connect to Broadway as far south as Sixth Street, although it could use Seventh, Eighth, or Ninth Street instead. A supplemental crossing would require the transit guideway to use Seventh, Eighth, or Ninth Street. Light rail would likely run on the left side of the street. Bus rapid transit would run on the right side of the street. One or two lanes of vehicular travel, and left-turn lanes would be next to the transit guideway. On-street parking would be located on blocks without stations.

Exhibit 2.3-19  
**Downtown Vancouver, Washington-Broadway Couplet Transit Alignment Option**



CONCEPTUAL DESIGNS / DIMENSIONS ARE APPROXIMATE.



The Washington and Broadway couplet alignment option would use a slightly different route from the bridge to the beginning of the couplet, depending on whether the replacement or supplemental crossing is chosen. With the replacement crossing, northbound transit could turn east on Sixth, Seventh, or Ninth Street to connect with Broadway. The supplemental crossing would need to turn east at Ninth Street with light rail, but could use Seventh Street with bus rapid transit.

#### NORTHERN VANCOUVER

The Kiggins Bowl and Lincoln terminus options (Exhibits 2.3-20 and 2.3-21) diverge to use significantly different routes north of downtown Vancouver. Each has a pair of alignment options. The Clark College MOS shares the same alignment options as the Kiggins Bowl terminus. The Mill Plain MOS would end south of the northern Vancouver segment, and thus has no alignment options in this area.

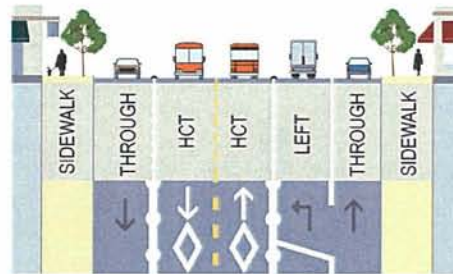
Note that the street configurations described in this section are conceptual; other configurations may be explored during future engineering and evaluation.

Exhibit 2.3-20

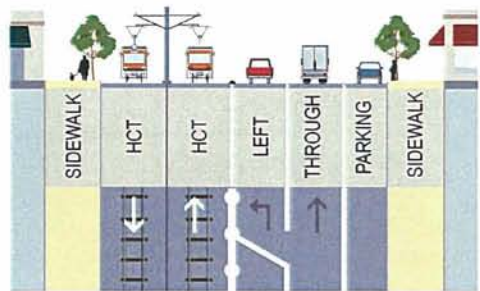
#### Kiggins Bowl Terminus Transit Alignment Options, Two-Way on McLoughlin Blvd or Two-Way on 16th Street



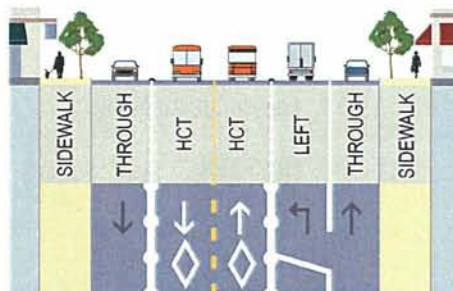
McLOUGHLIN BOULEVARD



16th STREET  
Washington to E Streets



16th STREET  
E to G Streets



MAPS ARE NOT TO SCALE.  
DIAGRAMS ARE CONCEPTUAL DESIGNS.

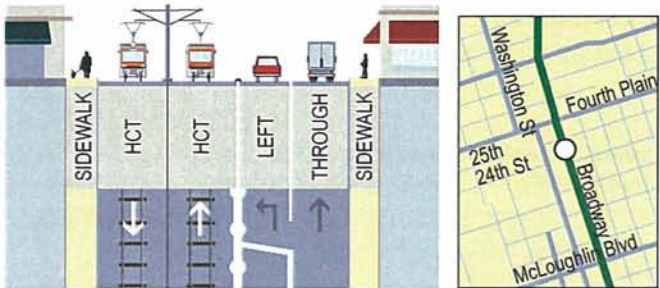
The Kiggins Bowl terminus (and Clark College MOS) has two alignment options for traveling east to cross under I-5 and connect with Clark College. High-capacity transit could travel on 16th Street through a new tunnel under I-5, or on McLoughlin Boulevard and through the existing underpass beneath I-5. The 16th Street alignment option would run on the south side of the street, with one lane for westbound traffic between Washington and E Streets and two lanes for two-way traffic between E and G Streets. The McLoughlin Boulevard alignment would expand the current, 80-foot wide right-of-way to approximately 94 feet to

accommodate a transit guideway in the middle of the road, one traffic lane on either side, and a left turn lane on some blocks.

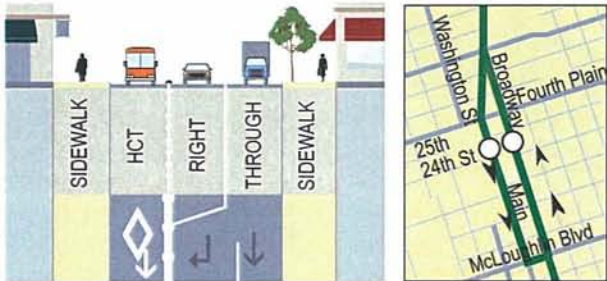
The Lincoln terminus would continue north from the Mill Plain station, using either Broadway for two-way travel or a couplet on Broadway and Main Streets. Either of the alignment options would then merge to a two-way guideway on Main Street at approximately 29th Street and end at the Lincoln Park and Ride north of 39th Street. North of 29th Street, Main Street would be widened from the current 60 feet to 100 feet.

Exhibit 2.3-21  
**Lincoln Terminus Transit Alignment Options**

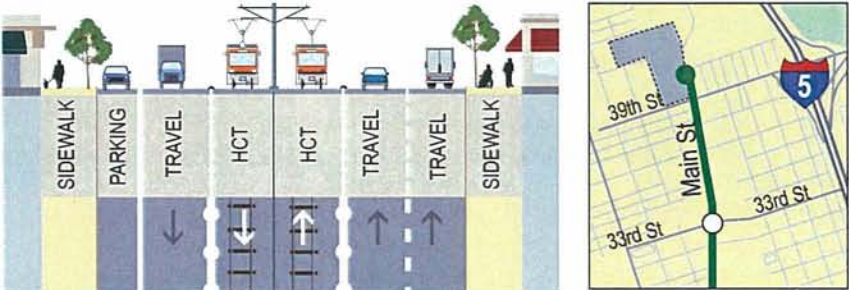
**TWO-WAY ON BROADWAY**



**COUPLET ON BROADWAY AND MAIN**



**UPPER MAIN STREET  
 29th to 39th Streets**



MAPS ARE NOT TO SCALE.  
 DIAGRAMS ARE CONCEPTUAL DESIGNS.



### 2.3.4 Transit Operations

The CRC alternatives include two options for transit operations:

- Efficient transit operations (with Alternatives 2 and 3)
- Increased transit operations (with Alternatives 4 and 5)

These operation components differ in the assumed “headways,” or frequency, of transit vehicles. Headways are expressed as the average number of minutes between vehicle arrivals. For example, a 2.5-minute headway means that there will be, on average, a train or bus stopping at a station every 2.5 minutes. Specific bus routing and headways could vary from the description below (and throughout this chapter), but the basic transit coverage and service levels would be similar.

Efficient operations assume longer headways, or more time between transit vehicles, than Increased operations. The Increased operations component was designed to test how boosting the capacity of the transit system could affect the number of people using transit and the number of cars using I-5, and local streets and the community. Increased operations have been evaluated with Alternatives 4 and 5, while Efficient operations have been evaluated with Alternatives 2 and 3; however, either transit operation level could be paired with either river crossing.

Increased operations would increase the frequency of most bus lines operated in Clark County, and would include six additional local bus routes in outer Vancouver and Clark County that would connect to the high-capacity transit guideway in the project area.

Exhibit 2.3-22 lists the headways for both transit operation options. These headways apply to light rail north of the Expo Center, and to bus rapid transit between the Expo Center and Mill Plain Boulevard, where all three of the bus rapid transit lines would run in the transit guideway. Because light rail trains can carry more people than buses, the trains could come less often and still provide comparable capacity to bus rapid transit.

Exhibit 2.3-22

#### Transit Vehicle Headways in the Guideway (Minutes)

	Efficient Operations (Alternatives 2 and 3)		Increased Operations (Alternatives 4 and 5)	
	BRT <sup>a</sup>	LRT	BRT <sup>a</sup>	LRT
Peak periods <sup>b</sup>	2.5	7.5	1.5	6
Off-peak period	15	15	15	15

Source: CRC Transit Technical Report.

<sup>a</sup> BRT headways include local buses using the guideway.

<sup>b</sup> Peak periods are between 6 a.m. and 10 a.m. on weekday mornings and between 3 p.m. and 7 p.m. on weekday evenings.

Exhibit 2.3-23

**Number of New Transit Vehicles Required (Over No-Build Alternative)**

	Efficient Operations		Increased Operations	
	BRT	LRT	BRT	LRT
New BRT buses	24	N/A	38	N/A
New LRT trains	N/A	14	N/A	18
New local buses	20	0	143	147

Source: CRC Transit Technical Report.

Bus rapid transit with Increased operations would also increase the frequency of the MAX Yellow line from the current 10 minutes to 7.5 minutes. Bus rapid transit with Efficient operations would not change Yellow line headways. The headways on the Yellow line would change to better align the frequencies of the light rail headways for either operations component in the table above.

### 2.3.5 Tolling

Tolling cars and trucks that use the I-5 river crossing is being considered as a method to help fund the CRC project and to encourage the use of alternative modes of transportation. The authority to toll the I-5 crossing is set by federal and state laws. Federal statutes permit a toll-free bridge on an interstate highway to be converted to a tolled facility following the reconstruction or replacement of the bridge, and the CRC project would fall within these conditions.<sup>1</sup> Prior to imposing tolls on I-5, Washington and Oregon departments of transportation (WSDOT and ODOT) would have to enter into a toll agreement with U.S. Department of Transportation. Recently passed state legislation in Washington permits WSDOT to toll I-5 provided that the tolling of the facility is first authorized by the Washington legislature.<sup>2</sup> Once authorized by the legislature, the Washington Transportation Commission has the authority to set the toll rates. In Oregon, the Oregon Transportation Commission has the authority to impose a toll on a facility and to set the toll rate.<sup>3</sup> It is anticipated that prior to tolling I-5, ODOT and WSDOT would enter into a bi-state tolling agreement to establish a cooperative process for imposing tolls, set toll rates, and guide the use of toll revenues.

Four tolling scenarios have been evaluated:

- No toll (part of the No-Build Alternative, and also modeled for Alternative 3 to help determine the traffic effects of tolling the I-5 crossing)
- Standard variable rate on the I-5 crossing (paired with Alternatives 2 and 3)
- Higher variable rate on the I-5 crossing (paired with Alternatives 4 and 5)

<sup>1</sup> 23 USC 129(a)(1)(C).

<sup>2</sup> HB 1773, 2008 Regular Session of the Washington Legislature.

<sup>3</sup> ORS 383.



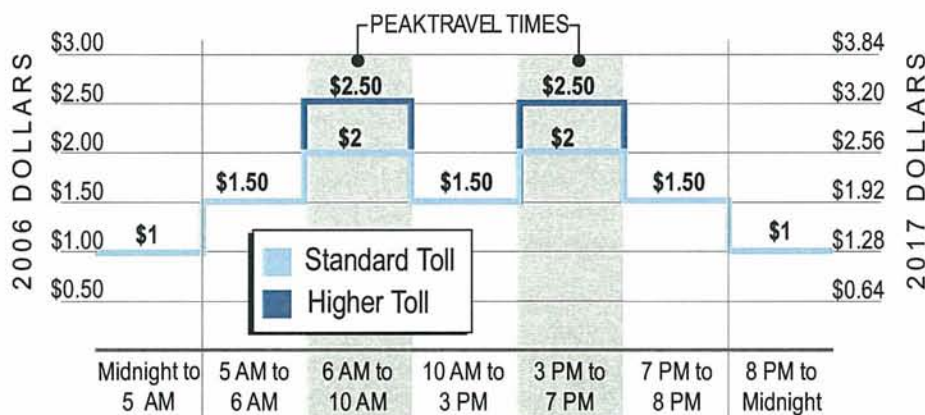
- Standard variable rate on both the I-5 and I-205 crossings (not paired with any build alternative, but evaluated separately to assess potential traffic diversions resulting from tolling the I-5 crossing).

Alternatives 2 and 3 have been evaluated with the “standard” variable rate structure, while Alternatives 4 and 5 have been evaluated with the “higher” variable rate structure (Exhibit 2.2-24). In addition, the project modeled the effect of two other tolling scenarios—no toll, and a toll on both I-5 and I-205—to determine how those scenarios would affect transportation, community and environmental impacts, and toll revenues. All tolling scenarios are assumed to be variable by time of day. Toll rates would be higher during peak travel periods and lower during off-peak periods. Medium and heavy trucks would be charged a higher toll than passenger vehicles.

Tolls would be collected using an electronic toll collection system, and toll collection booths would not be required. Instead, motorists could equip their cars with transponders that would automatically bill the vehicle owner each time they crossed the bridge, while cars without transponders would be tolled by a license-plate recognition system that would bill the address of the owner registered to that license plate.

Exhibit 2.3-24

#### Tolls for Passenger Cars (with Transponders)



### 2.3.6 Transportation System and Demand Management Measures

Early phases of alternative development for the CRC project evaluated a package of aggressive measures for increasing the efficiency of the regional transportation network and for reducing vehicular demand. However, without roadway and transit capacity improvements, these measures cannot meet the project’s purpose and need, because they do not improve traffic safety, improve bicycle and pedestrian facilities on I-5, or reduce the vulnerability of the I-5 crossing to earthquake damage. However, all build alternatives evaluated in this DEIS include transportation system management (TSM) and transportation demand management (TDM) measures to help reduce congestion during the peak travel period, improve efficient use of the transportation network, and provide alternative transportation options to commuters.

*Transportation system management* measures attempt to improve the efficiency of existing roadways. These include a variety of techniques focused on keeping drivers informed and moving as safely, efficiently, and reliably as possible. The No-Build Alternative retains the existing regional approach to transportation system management. In addition to these existing measures, all build alternatives would include:

- Additional traveler information systems in the project area to alert motorists of temporary changes in highway conditions, such as a traffic accident or construction;
- Expanded incident response capabilities;
- Bypass lanes for transit vehicles and other designated vehicles at ramp signals at highway entrances; and
- Expanded traffic monitoring equipment and cameras.

*Transportation demand management* seeks to reduce the number of vehicles using the road system, especially single-occupant vehicles, while providing alternative options to auto travel. The progressive approach to demand management currently in place regionally already contains a mix of features that provide incentives to use alternative modes of transportation. Many of the proposed CRC features described in the previous sections would assist in regional travel demand management. These include:

- A high-capacity transit system with an exclusive right-of-way through the project area;
- An improved path for bicyclists and pedestrians over the Columbia River that complies with modern design standards; and
- A toll collection system for vehicles using the I-5 crossing.

## 2.4 Construction Methods and Duration

In order to understand the types of impacts that could occur during construction, the CRC team developed possible scenarios for construction methods and timelines. These scenarios represent typical methods to construct the various elements of each alternative, and are representative of the type and duration of impacts that could occur during the project construction. Since this project is still early in the design process, many refinements will be made to the construction approach as design progresses. Construction could begin as early as late 2010, but will depend on project financing and approval. Total construction duration for any of the build alternatives is expected to last up to 6 years.

The cities of Portland and Vancouver both have zoning codes that limit the off-site impacts of construction activity. Examples of prohibited off-site impacts include noise, vibration, glare, odor, stormwater, and particulate matter. Depending on the construction requirements, the CRC project may need to obtain variances for some or all of these local codes. The construction durations described below are likely not possible without some variances to these local ordinances.



## 2.4.1 Bridge Construction

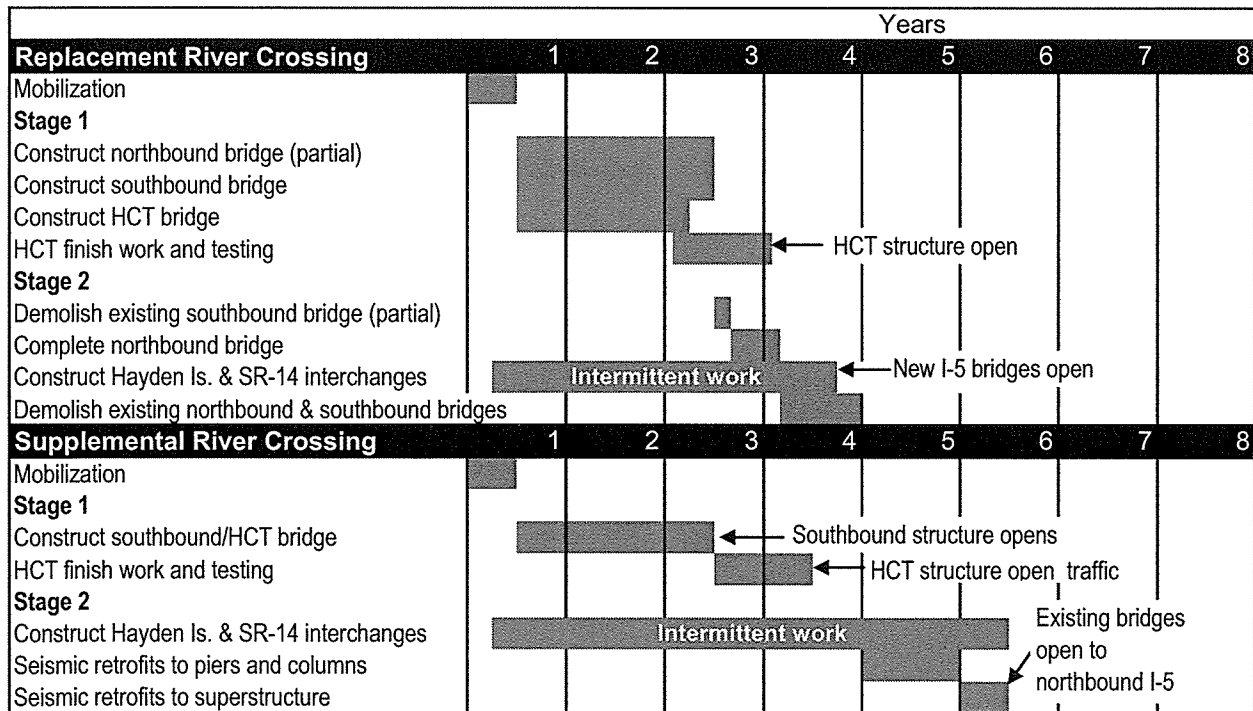
Building a new crossing over the Columbia River will require multiple phases of work over several years. The general sequence of constructing the bridges would likely entail the following steps:

- Initial preparation – mobilize construction materials, heavy equipment and crews; prepare staging areas.
- Installation of piles – drive and/or drill tubes into firm substrate or bedrock to support foundations and structures.
- Bridge piers – construct and anchor concrete foundations on the piles; construct or install pier columns onto these foundations.
- Bridge superstructure – build or install the horizontal structure of the bridge spans across the piers; the superstructure could be steel or reinforced concrete; concrete could be cast-in-place or pre-cast off-site and assembled on site.
- Bridge deck – construct the bridge deck on top of the superstructure.

Exhibit 2.4-1 shows the likely length of time required for each phase of the project, the stages that could overlap, their sequences, and the differing requirements for the replacement and supplemental river crossing options. As shown, for the replacement crossing, the high-capacity transit system could be operational within about three years, and the river crossing and adjacent interchanges would be completed within about four years.

Exhibit 2.4-1

### River Crossing Construction Duration



For the supplemental crossing, transit could be operational within about three and a half years. The southbound highway crossing would be complete in about two and a half years, and the northbound crossing retrofits and all interchange construction would be finished in about five and a half years.

The durations shown in the chart above assume the bridge construction would use pre-cast concrete segments for the bridge deck rather than a cast-in-place technique. Pre-cast segments are sections of the superstructure and bridge deck that are built off-site in a large casting yard and later raised into place after the piers are built. This approach would require a large casting yard with access to the Columbia River. Pre-cast sections of the bridges would be transported, likely by barge, to the bridge site, where cranes would lift and install them. Another construction option is to cast the segments in place rather than off-site. This eliminates the need for a large casting yard, but requires more in-water construction and slightly more overall construction duration than indicated in the chart shown above. The stacked transit/highway bridge, described in Section 2.3.1, could differ from the durations listed in the graphic above.

All build alternatives being evaluated will require staging areas. However, since the bridge type (i.e. concrete segmental, steel beam, steel-concrete composite, etc.) is not known at this time, it is too early in the design process to know the exact size, type and location of the necessary staging areas.

### What is a staging site?

Construction staging areas are areas to be used for the storage of materials and equipment, soil stockpiling, laydown areas, preassembly areas, casting areas, employee parking, etc. Typically, these areas are located as close as possible to the right-of-way.

Depending on anticipated construction methods, some of the desirable characteristics of the staging sites could include:

- A large (at least 15 acres) open site suitable for heavy machinery, material storage, and casting and storage of bridge segments;
- Waterfront property with access for barges to convey material to the construction zone; and
- Roadway or rail access for landside transportation of materials by truck or train.

The appropriate number, size, and location of staging areas will be determined after the bridge type study is done (within the next year). Selection of staging sites will involve coordination with local, state, and federal agencies, tribes, and public stakeholders to ensure that site selection balances construction requirements with environmental and community interests.

### 2.4.2 Highway Construction

Widening I-5 and rebuilding interchanges at Marine Drive, Hayden Island, SR 14, Mill Plain Boulevard, Fourth Plain Boulevard, and SR 500 will disrupt local and regional traffic flow. Typical construction methods could require narrowing lanes and shoulders to accommodate equipment and workers, shortening merge and exit distances, and closing some turning movements and interchanges. For example, during construction of a new SR 14 interchange, connections between downtown Vancouver and SR 14 would likely be rerouted to Columbia Way, and I-5 traffic would use the Mill Plain Boulevard interchange and local streets to access SR 14.



Construction will require staging areas to store construction material, load and unload trucks, and for other construction support activities. Multiple staging areas will be needed, given the linear nature of the CRC project and given that much of it could be under construction at the same time. The existing I-5 right-of-way will likely accommodate most of the common construction staging requirements. Interchange areas at Marine Drive, SR 14, Mill Plain, Fourth Plain and 39th Street have enough room for staging most typical earthwork, drainage, utility, and structure activities. However, some construction staging will likely be needed outside the existing right-of-way, requiring temporary easements from property owners.

### **2.4.3 Transit Construction**

Construction methods and schedules for the transit guideway, stations and park and rides would depend upon the location, major alignment, and transit mode chosen. Even with these variables, the transit guideway on land could be completed prior to finishing the transit bridge, allowing the operation of the full system in approximately three years with the completion of the high-capacity transit bridge.

Light rail would require more construction than bus rapid transit. Utilities (water, sewer, stormwater, electrical, and communications) underneath the roadway would need to be relocated or protected before building the road surface and track to support the weight of a two-car train and allow future access without having to tear up the trackway. Additionally, light rail would require construction of overhead wires to provide electrical power to the trains.

Along all transit alignments, it may be necessary to seek temporary construction easements or small permanent easements on adjacent properties to allow construction workers to encroach on several feet of a property while rebuilding the sidewalk in front of the property or to place specific elements such as an overhead catenary pole behind the sidewalk.

The transit guideway would be on an elevated structure over North Portland Harbor, Hayden Island and the Columbia River. The guideway would touch down on Washington Street, where it would be constructed at grade on local streets through downtown. North of downtown, the Kiggins Bowl terminus and Clark College MOS would continue the guideway at grade, below grade (tunnel), and on an elevated structure. The Lincoln terminus would continue the guideway at grade on local streets to the Lincoln terminus.

For the Kiggins Bowl terminus, north of the Clark College Park and Ride the transit guideway would tunnel under the Fourth Plain interchange. This tunnel would likely be dug as a trench, removing the earth and replacing dirt and other cover after constructing the tunnel. North of Fourth Plain Boulevard, the transit guideway would be in existing I-5 right-of-way, allowing more freedom to construct it and less potential to obstruct traffic or disturb businesses and residents. An elevated structure would be built to carry high-capacity transit over the SR 500 interchange and across I-5 to the Kiggins Bowl Park and Ride. This terminus option would require additional highway construction on I-5 to shift the roadway alignment slightly west.

For the Lincoln terminus, construction on northern Vancouver streets would need to be sensitive to the area's active urban environment. Multiple small work zones could focus construction activity and reduce the duration of disturbances to adjacent businesses and residents. Streets would be open to traffic and pedestrians when possible, but would likely need to close during some construction activities (through pedestrian access would always be maintained except for momentary disruptions). The construction sequencing of the new MAX tracks being built in downtown Portland is a good example of how construction could occur in this area, although the bus rapid transit option would be less disruptive and would require slightly less time to construct.

Roadway construction would include restriping or rebuilding the road surface, rebuilding sidewalks in some sections, and constructing station platforms. Streetscape improvements could include removing, replacing, or adding vegetation, curb extensions, new signs and signals, and other measures to improve access to, and use of, the transit stations. Stations, park and rides, and new structures could require pile driving and earthwork for clearing and grading these sites.

The project may include joint development opportunities, such as working with a developer to build transit-oriented development on or near the alignment. No sites or specific plans have been developed, so no specific site impacts can be analyzed at this time.

Transit construction will also require staging areas. Exact locations have not been determined. Where possible, staging activities will take advantage of land that is already in the public right-of-way or in public ownership and that is not being used for other purposes, such as vacant lots. Sites will be significantly smaller than the anticipated construction staging areas for bridge construction. If any sites are used that are close to transit stations, joint developments may be considered to create transit-oriented development on the site after the construction use is completed.

## 2.5 Alternatives Considered But Not Advanced

This section describes the range of transportation improvements that were initially considered but eliminated during screening and subsequent evaluation due to significant engineering problems, environmental impacts, cost, or failure to meet the project's purpose and need. These transportation improvements include ideas such as a third corridor for crossing the Columbia River (in addition to the current I-5 and I-205 corridors), low-level bridges, tunnels, and multiple transit modes. The process followed to identify and screen alternatives to develop the range of alternatives that are being evaluated in this DEIS complied with US Department of Transportation (USDOT) guidance on linking planning and NEPA requirements.

The following discussion is a chronological description of the transportation improvements evaluated and dropped through the process of developing the range of alternatives evaluated in this DEIS.



### 2.5.1 Early Studies

Elements of the CRC project have been proposed and studied since the early 1990s, as described in Chapter 1. In 2002, the I-5 Transportation and Trade Partnership produced an evaluation of multiple highway, transit and river crossing improvements in this corridor and other parts of I-5. This process gathered public and stakeholder input on issues and potential solutions for transportation problems in the I-5 corridor. The Partnership then made recommendations for improvements and identified the CRC project as a regional priority in its Final Strategic Plan. This led to the initiation of the CRC Environmental Impact Assessment process. A “Notice of Intent” to prepare an environmental impact statement was issued in September 2005.

### 2.5.2 Evaluation Criteria and Initial Component Screening

Starting in October 2005, CRC project staff began working closely with the public, stakeholders, and local jurisdictions to develop the project’s purpose and need (see Chapter 1). In October 2005, the CRC Task Force adopted a “Vision and Values” document that outlined broad goals and priorities, and served as a basis for developing evaluation criteria to measure and compare performance of different alternatives. Based on this document, the project team worked with local agency sponsors, the CRC Task Force, and state and federal permitting agencies to develop the Evaluation Framework, which outlined a process for generating and evaluating possible alternatives. The statement of purpose and need was finished and approved by FHWA, FTA, and the project’s local sponsoring agencies in January 2006.

The project team began the process of developing alternatives by identifying possible transportation components (for example, transit technologies, and river crossing types and locations). Over 70 such components were identified in the 2002 I-5 Transportation and Trade Partnership Final Strategic Plan and through additional public and stakeholder outreach.

Project staff performed two rounds of evaluation and screening to narrow these options. Only transit and crossing components were screened. Other elements that have since been included in the alternatives evaluated in this DEIS, such as pedestrian, bike, and roadway improvements, were advanced without screening. The initial screening in April 2006 eliminated river crossing types and transit modes that did not meet the project’s purpose and need<sup>4</sup>, including:

- A replacement tunnel, which would fail to serve most of the current vehicle trips
- High-level bridges that would encroach on protected airspace for Pearson Airfield
- Transit Modes that do not effectively serve the specific needs of this region, such as high-speed rail, ferry service, monorail, magnetic levitation railway, commuter rail in freight rail corridor, and heavy rail

### CRC Task Force

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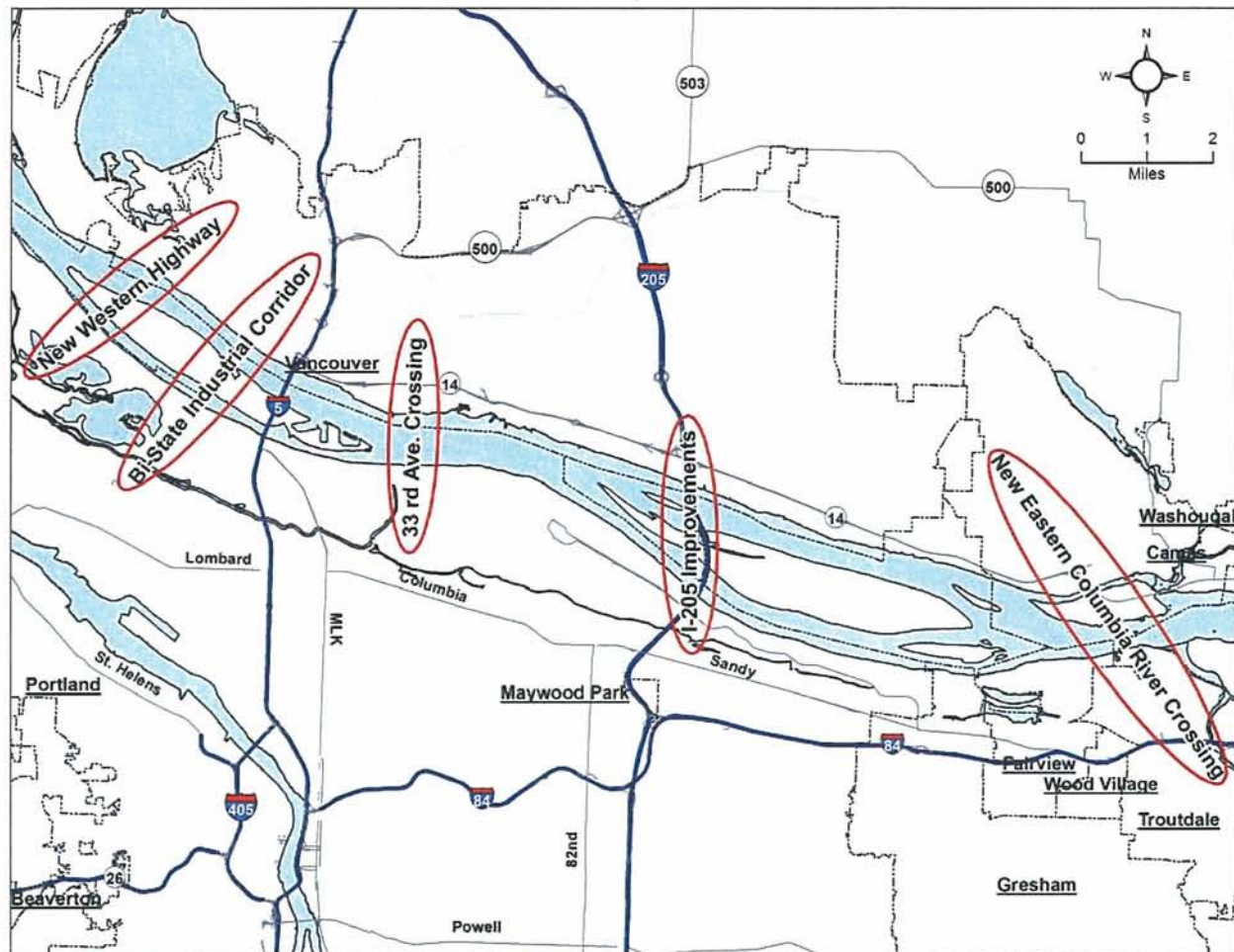
The 39-member CRC Task Force is composed of leaders representing a broad cross section of Washington and Oregon communities. Public agencies, businesses, civic organizations, neighborhoods, and freight, commuter, and environmental groups are represented on the Task Force. This group meets regularly to advise the CRC project team and provide guidance and recommendations at key decision points. The Public Involvement Appendix of this DEIS lists task force members.

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<sup>4</sup> Step A Screening Report, CRC, 2006.

- A third corridor for crossing the Columbia River, which would fail to improve safety and mobility in the existing I-5 corridor

Exhibit 2.5-1

**Alternative Corridors Evaluated During Initial Screening Process**

As shown on Exhibit 2.5-1, five alternate corridors were evaluated during this screening process, located both west and east of the existing I-5 corridor. These alternate corridors included:

- A Western Highway crossing two to three miles west of I-5 that would connect suburban Clark and Multnomah counties
- A Bi-State Industrial Corridor crossing near the BNSF railroad bridge, one mile west of I-5
- A new crossing at 33rd Avenue in Portland, two to three miles east of I-5
- Improvements to I-205 only
- An Eastern Columbia River crossing 10 to 12 miles east of I-5 that would connect Camas/East Clark County to Troutdale

The initial screening process evaluated how well these corridors met the purpose and need of the project by improving congestion, transit performance, freight mobility, safety, bicycle and pedestrian mobility



within the I-5 corridor, and seismic stability of the Columbia River Crossing. While most of these alternatives could provide some degree of regional transportation benefit, they did little or nothing to address this project's purpose and need of improving traffic and transit mobility and safety problems in the I-5 corridor. Therefore, they failed to meet most or all of the elements of the project's purpose and need.

The Bi-State Industrial Corridor is the only alternative corridor that had the potential for improving I-5-related freight mobility, as it connects the industrial areas in Vancouver to those in Portland. Also, the initial traffic analysis indicated that this Industrial Corridor, as well as the Western Crossing, have potential for providing some congestion relief compared to 2030 No-Build conditions.

However, the potential highway transportation benefits of these two alternate corridors would be limited, and are outweighed by the fact that they, in addition to the three other alternate corridors, would fail to improve the stated needs related to transit performance and bicycle and pedestrian travel, and would do nothing to address the safety deficiencies and high crash rates in the I-5 CRC project area.

Appendix C provides a full list of the river crossing and transit components evaluated during the initial round of screening, and the specific reasons for dropping many of these components prior to creating the range of alternatives evaluated in this DEIS.

### **2.5.3 Further Narrowing of Components**

A second round of screening in June 2006 evaluated the performance of the remaining 15 crossing and transit components in relation to criteria specified in the Evaluation Framework.<sup>5</sup> Components were scored on the following project values:

- Community livability and human resources
- Mobility, reliability, accessibility, congestion reduction, and efficiency
- Safety
- Regional economy, freight mobility
- Stewardship of natural resources
- Distribution of benefits and impacts

All of the components that entered this round were advanced for further evaluation. The screening did not highlight any clearly superior options or reveal any new fatal flaws that could not likely be mitigated with design refinements. However, further evaluations and additional information revealed important problems with a streetcar transit mode, low-level bridges, and with a supplemental tunnel river crossing option.

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<sup>5</sup> Step B Screening Report, CRC, 2006.

### **Streetcar**

Further analysis revealed that a streetcar option would not operate at sufficient speeds or provide enough capacity to effectively pass the test posed during first round of screening. The streetcar option had been initially passed on the assumption that it could operate on the existing MAX light rail guideway in Portland, thus providing no-transfer service between Vancouver and downtown Portland. Subsequent analysis indicated that joint light rail and streetcar operations would introduce a serious safety hazard. Streetcar vehicles are less crash-resistant than light rail vehicles, and would be severely damaged in a crash with a light rail vehicle. Furthermore, streetcars have one-third the capacity of a two-car light-rail train, but about the same operating cost.

### **Low-level Bridge**

A new low-level bridge would have required a moveable span to allow passage of large ships, similar to the lift span on the existing I-5 bridges. Operation of a moveable span would disrupt traffic, cause more accidents on the bridges, have a greater impact on navigation, be more expensive to construct, and cost substantially more to maintain and operate. A low-level bridge was dropped from further consideration once project staff determined that a mid-level fixed-span bridge could safely avoid height restrictions imposed by Pearson Field and still provide clearance for river users.

### **Supplemental Tunnel**

A tunnel to supplement the existing I-5 bridges was dropped, as it had marginal transportation benefits, considerably lower safety performance, very high capital cost, and higher community impacts. Nearly half of projected I-5 traffic would still have used the existing I-5 bridges, and so be subject to the same performance and safety problems—bridge lifts, substandard shoulders, and poor sight-distances.

## **2.5.4 Packaging the Most Promising Components**

Early screening efforts identified several promising possibilities for further study. The best river crossing types appeared to be a replacement bridge or a supplemental arterial or highway bridge. Express bus, bus rapid transit, and light rail were the most promising transit modes for meeting the purpose and need of this project.

Project staff created 12 alternative packages by combining different river crossing types and transit modes, as well as specific designs to improve safety, freight movement, highway operations, and bicycle and pedestrian access. These 12 packages were a representative range of the possible combinations of river crossing and transit components that encompassed the range of impacts and transportation performance these components could produce.

Staff designed these packages to assess their performance on criteria from the Evaluation Framework, and to see how individual features performed in different combinations. This assessment focused on river crossing types and transit modes. Elements such as interchange configurations and transit alignments were used to model traffic and transit scenarios, but were not individually evaluated or screened.



Evaluation of these 12 alternative packages revealed that multimodal packages performed best. Alternatives that did not include a combination of both highway and transit improvements, such as just an aggressive TDM/TSM approach or a highway-only investment, were not recommended to be carried into the DEIS. A replacement bridge performed best on nearly all criteria, including traffic performance and impacts to the natural environment. Bus rapid transit and light rail provided the best transit performance, particularly when paired with express bus service. Based on these findings, staff recommended to the CRC Task Force that the DEIS evaluate the following alternatives: 1) No-Build, 2) replacement bridge with bus rapid transit and express bus, and 3) replacement bridge with light rail and express bus. The CRC Task Force recommended further developing these alternatives in preparation for evaluation in the DEIS and undertaking a substantial public involvement effort to gather public input.

In January 2007, the project team launched an intensive public involvement campaign to present the screening results and receive comments on the staff recommendation. Overall, the public and most agencies generally agreed with the recommendation, but some felt they did not include a wide enough range of options, particularly one that would reuse the existing I-5 bridges. Reusing the existing bridges appeared to warrant further evaluation primarily because of the possibility for reduced capital costs compared to replacing the existing bridges. This led the Task Force to explore how the existing I-5 bridges could be reused and still meet this project's purpose and need.

An additional alternative was therefore developed that uses the existing bridges for northbound I-5 traffic, bicycles, and pedestrians. With this alternative a new, supplemental bridge would carry high-capacity transit and southbound I-5 traffic. In March 2007 the CRC partners incorporated the Task Force recommendation into the DEIS range of alternatives. This produced the range of alternatives being evaluated in this DEIS:

- Alternative 1: No-Build
- Alternative 2: Replacement crossing with bus rapid transit
- Alternative 3: Replacement crossing with light rail
- Alternative 4: Supplemental crossing with bus rapid transit
- Alternative 5: Supplemental crossing with light rail

A more detailed description of the process of developing this range of alternatives is given in the Development of the Range of Alternatives memo prepared in June, 2007.<sup>6</sup>

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<sup>6</sup> CRC, Development of the Range of Alternatives, 2007.

## 2.6 Refining Alternatives for Evaluation in the DEIS

This section describes how on-going evaluation of alternatives for the DEIS led to dropping certain options from further consideration.

### 2.6.1 Upstream Replacement Bridge

A replacement river crossing upstream (east) of the existing I-5 bridges was eliminated from further evaluation after analysis revealed that this alignment would pose serious construction difficulties and provide no substantial benefits to offset this problem. The downstream replacement crossing could be finished in approximately five years, with the transit bridge being completed and ready for operation in about three years. The upstream alignment would require approximately four years longer to construct than a downstream alignment because it would need to be built where the existing I-5 bridges are located and would thus require sequential construction and deconstruction of all structures. This would prolong impacts to aquatic species, disrupt river and roadway traffic, and substantially increase capital costs.

The upstream alignment would need to be very close to the existing I-5 alignment to avoid intrusion into the flight paths of aircraft using Pearson Field, while being high enough to afford enough clearance for river navigation. The replacement crossing evaluated in this DEIS crosses downstream (west) of the existing I-5 bridges, placing it farther from Pearson Field and allowing it to be offset farther from the existing I-5 crossing alignment. Placing the new bridges farther from the existing bridges would allow all three bridges (northbound I-5, southbound I-5, and high-capacity transit and bicycle/pedestrian bridge) to be constructed simultaneously. However, an upstream alignment would overlap the existing bridges, requiring each of the three new bridges to be built sequentially.

### 2.6.2 Transit Alignment Options

Project staff identified important problems with three transit alignments through downtown Vancouver that were under consideration:

- Two-way on Broadway south of McLoughlin Boulevard
- Washington Street/Main Street couplet
- Washington Street/Columbia Street couplet

*Two-way Broadway:* For either the replacement or supplemental crossing, the transit guideway would touch down in downtown Vancouver at Washington Street. Routing both directions of transit two blocks east to Broadway would require an east-west connection along Sixth and Seventh Streets. This would require acquiring several properties in downtown Vancouver, while other transit alignment options through downtown (e.g., a two-way Washington route or a Washington-Broadway couplet) avoid nearly all property acquisitions. Furthermore, the sharp turns required for routing transit from the touchdown point to Broadway would require several sharp turns that would be difficult for light rail. Ultimately, the two-way Broadway alignment was dropped because it lacks any unique benefits and would incur these additional impacts.



*Washington Street/Main Street couplet:* This alignment would have caused serious impacts to businesses and traffic connectivity through downtown Vancouver. Main Street is an important north-south arterial that the City of Vancouver plans to extend to the Columbia River. Running transit on this street would preclude this extension and reduce traffic capacity, effectively eliminating this street as an arterial through downtown. In addition, businesses on this street are especially reliant on on-street parking, which would have to be removed on one side of the street to accommodate transit.

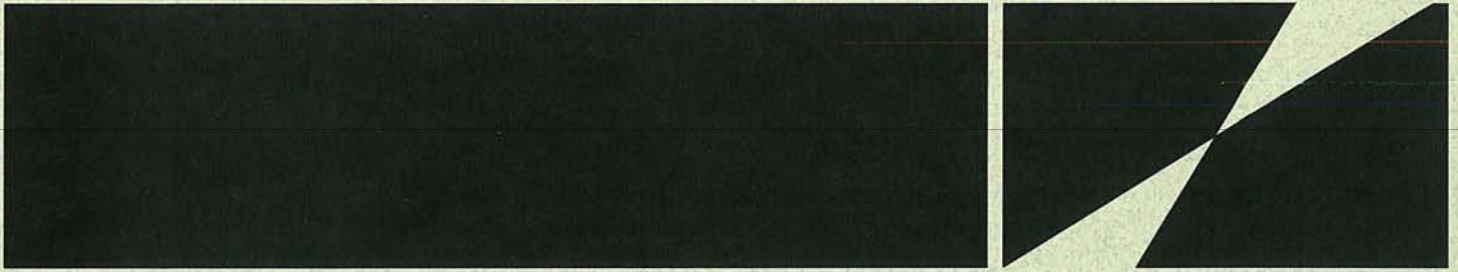
*Washington Street/Columbia Street couplet:* This alignment would have seriously impacted traffic circulation through downtown Vancouver and removed on-street parking vital to retail businesses on Columbia Street. Columbia Street is designated a north-south arterial; running a transit guideway on this road would limit its ability to serve this function. This route would also have affected access to the St. James Catholic Church property, an important historic resource and one of the oldest buildings in downtown Vancouver.

### **2.6.3 Ross Park and Ride**

Project staff initially considered building a 500-space park and ride at the intersection of Highway 99 and E Ross Road, in undeveloped right-of-way adjacent to I-5. Staff later found this site has important environmental constraints, and local zoning restrictions would only allow a small part of the property to be used for parking. These restrictions do not make this site a cost-effective park and ride location, despite its proximity to the endpoints of the proposed transit terminus options.

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## **CHAPTER 3**

### Existing Conditions and Environmental Consequences





## CHAPTER 3

# Existing Conditions and Environmental Consequences

*This chapter describes the likely effects of the project alternatives on the community, cultural resources, and environment. The CRC project team studied current conditions in the project area, and analyzed the impacts of the project alternatives and components.*

*Each of the sections in this chapter summarizes key findings for one or more elements of the environment. Following a brief discussion of existing conditions and methodology, when appropriate, each section summarizes impacts for the No-Build Alternative, the four build alternatives, and the various components and options. As described in Chapter 2, the alternatives consist of combinations of components; these are outlined in Exhibit 3.1.*

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Exhibit 3.1

**Summary of Components in Project Alternatives**

Components	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
<b>Multimodal River Crossing and Highway</b>	Existing	Replacement <sup>a</sup>	Replacement <sup>a</sup>	Supplemental	Supplemental
<b>HCT Mode<sup>b</sup></b>	None	Bus Rapid Transit	Light Rail	Bus Rapid Transit	Light Rail
<b>HCT Terminus</b>	N/A	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS
<b>TDM/TSM</b>	Current Programs	Expanded TDM/TSM programs			
<b>I-5 Bridge Toll</b>	None	Standard rate	Standard rate <sup>c</sup>	Higher rate	Higher rate
<b>Transit Operations</b>	Existing	Efficient	Efficient	Increased	Increased

<sup>a</sup> The Replacement crossing has two designs, a three-bridge design and a Stacked Transit/Highway Bridge (STHB) design; these are described in Section 2.3.1.

<sup>b</sup> HCT Mode also dictates the location of a maintenance base expansion. BRT would entail expanding a bus maintenance facility in eastern Vancouver. LRT would entail expanding the Ruby Junction maintenance base in Gresham. See Section 2.3.2.

<sup>c</sup> Alternative 3 was also evaluated no toll in order to quantify the traffic affects of tolling the I-5 crossing. This is discussed more in Section 2.3.5.

*Following a description of existing conditions and summary of impacts at the alternative level, each section provides more detail on the long-term impacts of the components. The discussion of long-term impacts is followed by a discussion of short-term impacts that would occur during construction. Finally, each section concludes with a discussion of potential mitigation measures.*

*These findings are based on detailed technical reports included as electronic appendices to this DEIS and cited throughout the chapter. All projections and forecasts are for the design year of 2030, unless otherwise stated.*

### 3.1 Transportation

This section describes how the CRC project could affect travel patterns and mobility for cars, trucks, transit vehicles, pedestrians, and bicyclists. Existing conditions for these transportation modes, as well as future conditions in 2030 under the No-Build Alternative, are compared to the effects of the four build alternatives. This comparison illustrates the benefits, as well as potential impacts, to transportation performance from this project. All data in this section comes from the CRC Traffic Technical Report and CRC Transit Technical Report, unless otherwise noted.

#### 3.1.1 Existing Transportation Facilities

The CRC project evaluates potential improvements to I-5 from SR 500/39th Street in Vancouver to near Interstate Avenue/Victory Boulevard in Portland, and the addition of a high-capacity transit system within this same area. Chapter 2 of this DEIS provides descriptions and maps of the highway and transit improvements evaluated by this project.

The following I-5 interchanges are included in the CRC area (Exhibit 3.1-1):

- SR 500/39th Street
- Fourth Plain Boulevard
- Mill Plain Boulevard
- SR 14/City Center
- Hayden Island
- Marine Drive

To build a better understanding of regional traffic conditions, the CRC project team analyzed the I-5 corridor well beyond the project area—from Ridgefield in Clark County to the Marquam Bridge in downtown Portland. This 23-mile segment generally consists of three through-lanes in each direction and includes 23 interchanges. Regional highway analysis also included the I-205 corridor over the Columbia River.

Transit service within the project area is provided by two agencies: TriMet in Oregon and C-TRAN in Clark County, Washington. Existing bi-state transit service includes local fixed-route bus service between Vancouver and the park and ride lot at Delta Park in Portland (with light rail service continuing on to downtown Portland) and commuter-oriented routes from Clark County park and ride lots and transit centers to central Portland or to other light rail stations in Portland.

#### Local Street System

Local traffic impacts are measured by performance standards for intersection levels-of-service, delay, and queuing. WSDOT, ODOT, the City of Vancouver, and the City of Portland have all defined standards for intersections, which were used to analyze the performance results of the CRC project alternatives. Detailed descriptions of these standards can be found in the Traffic Technical Report.

#### TERMS & DEFINITIONS

##### Transportation Terms

**Average** – The average traffic condition is the vehicle flow on a weekday during the average month for a given time period, usually Tuesday, Wednesday, or Thursday.

**Congestion** – For highways, congestion occurs when average speed is below 30 miles per hour.

**Demand** – The total number of users attempting to access the transportation system, including those caught in congestion.

**Peak** – This is a more technical description of “rush hour” when travel patterns generate the most traffic, especially in a particular direction. The a.m. peak is from 6-10 a.m. The p.m. peak is from 3-7 p.m.

**Queuing** – Occurs when traffic lanes cannot accommodate all the vehicles trying to use them, or if the line at an intersection extends into an upstream intersection.

**Throughput** – The amount of users being served at any time by the transportation system.

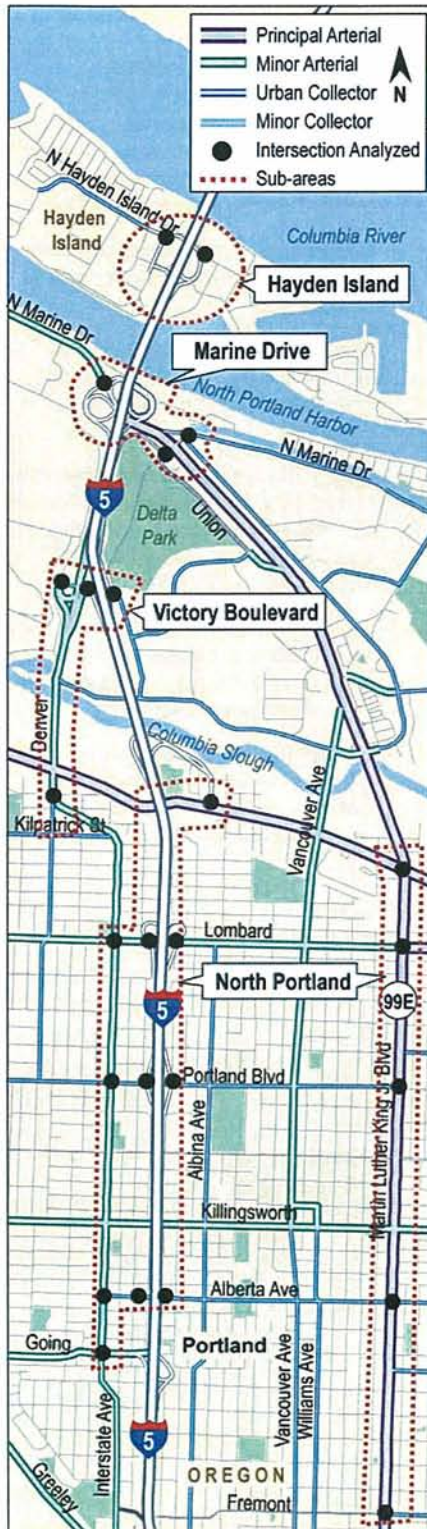
Exhibit 3.1-1  
CRC Project Area



DIMENSIONS ARE APPROXIMATE.



Exhibit 3.1-2

**Portland Interchange Areas**

NOT TO SCALE

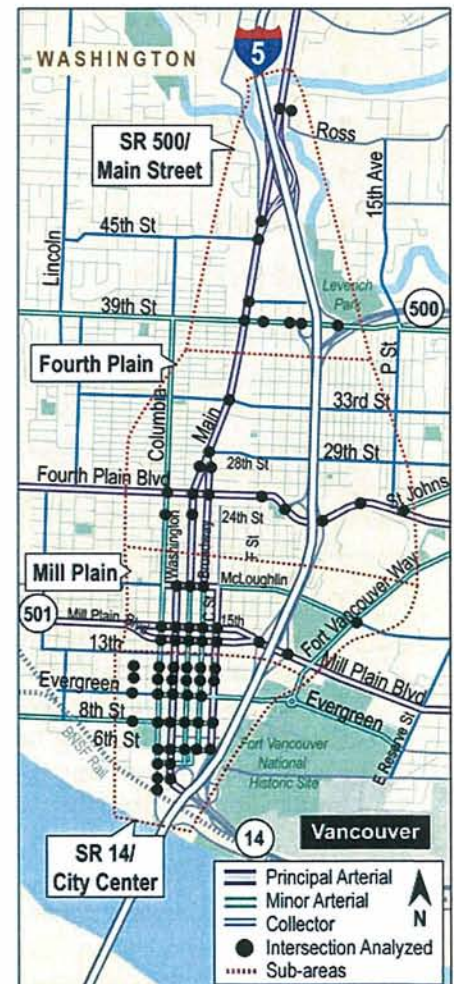
The local street network within the project area was divided into subareas to more closely examine changes in local street operations resulting from the various CRC alternatives (see Exhibits 3.1-2 and 3.1-3). The local street system in Vancouver was divided into four subareas that include 73 key intersections.

- **SR 500/Main Street Interchange Area:** Ten intersections, located primarily along 39th Street, including the ramp terminal at I-5, and the area bordered by P Street to the east, 35th Street to the south, Main Street to the west, and Ross Street to the north.
- **Fourth Plain Boulevard Interchange Area:** Fourteen intersections, located primarily along Main Street and along Fourth Plain Boulevard, including the I-5 ramp terminal, and the area bordered by Q Street to the east, 20th Street to the south, Columbia Street to the west, and 35th Street to the north.
- **Mill Plain Boulevard Interchange Area:** Sixteen intersections located primarily along Mill Plain Boulevard, 15th Street, McLoughlin Boulevard, and the I-5 ramp terminal at Mill Plain Boulevard, and the area bordered by Fort Vancouver Way to the east, 13th Street to the south, Columbia Street to the west, and 20th Street to the north.
- **SR 14/City Center Interchange Area:** Thirty-three local street intersections covering most of the downtown core, bordered by I-5 to the east, the Columbia River to the south, Esther Street to the west, and 13th Street to the north.

The Portland local street system was divided into four subareas that include 25 key intersections:

- **Hayden Island Interchange Area:** The two existing I-5 ramp terminals on Hayden Island.
- **Marine Drive Interchange Area:** The I-5 ramp terminal along Marine Drive, and two other key intersections along Marine Drive and Martin Luther King Jr. Boulevard near the I-5 ramp terminal.
- **Victory Boulevard Interchange Area:** Three intersections along Victory Boulevard that access the I-5 ramp terminals, and the Interstate Avenue/Argyle Street intersection.

Exhibit 3.1-3

**Vancouver Interchange Areas**

NOT TO SCALE



- **North Portland Area:** Sixteen key intersections along Interstate Avenue between Going and Lombard Streets, I-5 ramp terminals at Alberta Street, Portland Boulevard (renamed to Rosa Parks Way), Lombard Street, and Columbia Boulevard interchanges, and along Martin Luther King Jr. Boulevard from Fremont Street to Columbia Boulevard.

## Existing Transit Operations

### TRANSIT MARKETS

As shown in Exhibit 3.1-4, two key transit market areas have been defined for bi-state travel across the Columbia River:

- **Urban Market:** Local and intermediate-distance trips between downtown Vancouver and downtown Portland, with destinations in these two areas and in North Portland, Delta Park, Rivergate, Hayden Island and inner urban areas in and around downtown Vancouver.
- **Suburban Commuter Market:** Long-distance trips from Salmon Creek, East Clark County and outer Clark County to destinations in the inner urban market and downtown Portland.

Exhibit 3.1-5 illustrates the existing transit centers and park and ride locations for TriMet and C-TRAN, while Exhibits 3.1-6 and 3.1-7 summarize the operating characteristics and facilities of these two transit agencies.

### C-TRAN

As of November 2007, C-TRAN operates 10 local bus routes in downtown Vancouver. Three of these local bus routes, route 4 – Fourth Plain, route 37 – Mill Plain, and route 71 – Highway 99, have the highest percentage of bi-state riders and the highest local ridership. In 2004, C-TRAN extended Route 4 to Hayden Island and the light rail station at Delta Park. While crossing the Columbia River, Route 4 operates in general purpose lanes on I-5.

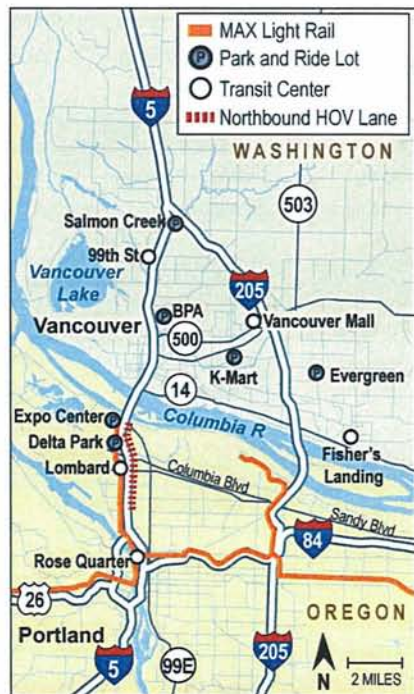
Within the CRC area, C-TRAN also operates three “limited” bus routes: route 44 – Fourth Plain Limited, route 114 – Camas/Washougal Limited, and route 173 – Battle Ground Limited. The 44 is a limited stop version of the local bus route 4, with a peak period headway of 30 minutes. The 44 crosses the Columbia River on I-5 in general purpose lanes and allows a transfer to light rail at Delta Park, but does not stop on Hayden Island. The 114 and 173 also connect to light rail at Delta Park. These routes both have peak headways of 120 minutes. All three of these limited routes make fewer stops and have increased stop spacing than local routes.

The C-TRAN network includes five express bus routes in the I-5 corridor; route 105 – I-5 Express, route 134 – Salmon Creek Express, route 157 – Lloyd District Express, route 190 – Marquam Hill Express, and route 199 – 99th Street Express. These routes travel in general purpose lanes along I-5, but during the afternoon/evening peaks they use the northbound high-occupancy vehicle (HOV) lane on I-5 from Going Street to Marine Drive. Express buses operate on weekdays only and, except for route 105, only during peak periods.

Exhibit 3.1-4  
Transit Travel Markets



Exhibit 3.1-5  
Existing Transit Center and Park and Ride Locations



In addition to service in the I-5 corridor C-TRAN provides express bus service over the Columbia River in the I-205 corridor. Routes include the 65 – Parkrose Limited, 164 – Fisher’s Landing Express, and 177 – Evergreen Express. During the morning peak the 164 and 177 use I-205 but return in the afternoon/evening using the I-5 HOV lane. These buses do not pick up or drop off passengers in the I-5 corridor. Further information related to C-TRAN existing service is included in the Transit Technical Report.

Exhibit 3.1-6

**Summary of 2005 Transit System Operating Characteristics**

Transit Characteristic		TriMet	C-TRAN
Vehicles	Fixed Route Buses	660	111
	Light rail cars	105	N/A
Annual Revenue Hours	Fixed Route Bus	1,873,568	231,191
	Light rail	415,713	N/A
Maintenance Facilities	Buses	3	1
	Light rail	2	N/A

Source: 2005 National Transit Database.

Exhibit 3.1-7

**Existing Transit Facility Summary**

Transit Centers		Parking Spaces Available
Clark	Salmon Creek	493
County I-5	99th Street	600
	BPA	175
	Vancouver Mall	N/A
	K-Mart	100
<b>Total</b>		<b>1368</b>
Clark	Fishers Landing	566
County I-205	Evergreen	271
<b>Total</b>		<b>837</b>
Portland I-5	Expo Center	300
	Delta Park	304
	Lombard	N/A
	Rose Quarter	N/A
<b>Total</b>		<b>604</b>

Source: CRC Transit Technical Report 2008.

**TRIMET**

In the CRC area in north Portland, TriMet operates three local bus routes: Line 6 – Martin Luther King Jr. Boulevard, Line 8 – Northeast 15th Avenue, and Line 16 – Front Avenue/St. Johns. Line 6 runs to Hayden Island. It is one of TriMet’s frequent service lines, with 15-minute headways all day on weekdays and weekends. Line 8 provides service to Middlefield east of I-5 and facilitates a transfer to Line 16, which travels along Marine Drive, stopping at the Expo Center light rail station and the Rivergate area of Portland. Line 8 is also one of TriMet’s frequent service lines. Line 16 operates at 30-minute headways in the weekday peaks.

TriMet also operates the MAX Yellow Line (light rail), which runs through north Portland and includes 10 stations between the Rose Quarter and its terminus at the Expo Center. It runs at approximately 10-minute headways during the peaks and 15-minute headways off-peak.

**3.1.2 Existing Transportation Performance****Existing I-5 and I-205 Performance**

This section summarizes existing traffic performance for the I-5 and I-205 study areas. This data was collected in 2005.

**EXISTING: DAILY TRAFFIC LEVELS**

Average daily traffic volumes represent the average 24-hour weekday traffic on a roadway segment. The I-5 bridges currently carry 135,000 vehicles each day. The I-205 bridges, located six and a half miles to the east, carry 146,000 vehicles each day.

Approximately 11,000 trucks cross the I-5 bridges on the average weekday, accounting for eight percent of all traffic. On the I-205



crossing five percent of all traffic is from trucks, with an average of 7,750 trucks per day. Although the I-5 crossing carries less total traffic than the I-205 crossing, it carries about 42 percent more trucks.

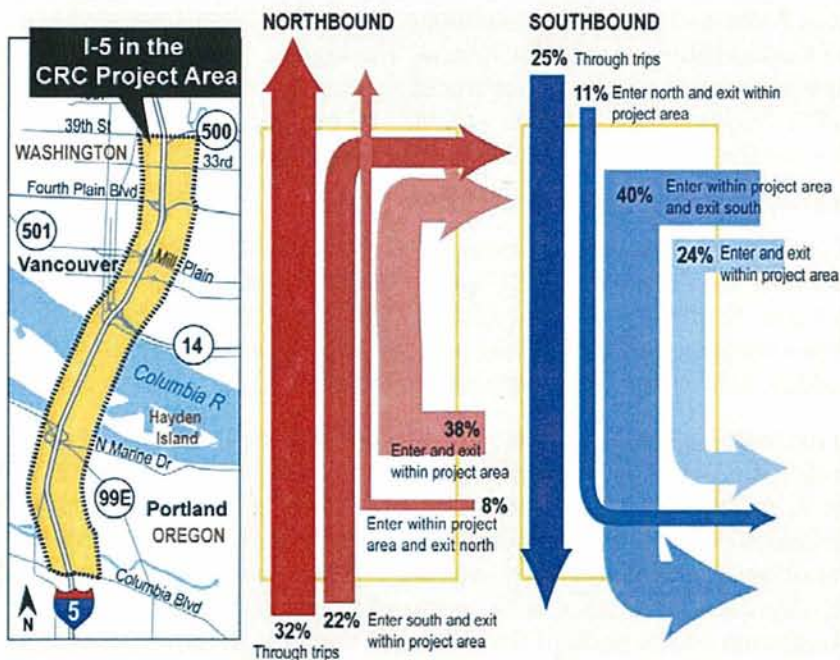
#### EXISTING: I-5 TRAFFIC PATTERNS IN THE CRC PROJECT AREA

The average length of a vehicle trip using the I-5 crossing is about 20 miles during the morning and afternoon/evening peaks. However, most vehicle trips using the crossing are only on I-5 for a short portion of their trip.

Exhibit 3.1-8 illustrates that a majority of vehicles on I-5 during peak travel periods enter and/or exit the freeway within the project area. During the weekday morning peak traffic period (between 6 a.m. and 10 a.m.), only 25 percent of southbound traffic across the bridge travels through the entire project area; the other 75 percent enters and/or exits I-5 within the project area. During the afternoon/evening peak, only 32 percent of northbound traffic across the bridge consists of through-travel; the other 68 percent enters and/or exits I-5 within the project area.

Exhibit 3.1-8

#### Vehicle Trips on I-5 in the CRC Project Area



Source: CRC Traffic Technical Report 2008.

#### EXISTING: PEAK TRAFFIC DEMAND

Peak traffic demand is high within the project area due to the limited number of Columbia River crossings between Vancouver and Portland, and due to I-5's connections with key east-west highways and arterial roadways immediately north and south of the Columbia River (such as SR 14). High traffic demand combined with short spacing between on- and off-ramps results in congestion and safety issues.

Current traffic volumes within the CRC area are typically at their highest on weekdays during the four-hour morning peak (6 a.m. to 10 a.m.) and

#### Traffic Demand vs. Traffic Throughput

The terms "traffic demand" and "traffic throughput," both used throughout this chapter, have different meanings. Traffic demand refers to the total number of motorists attempting to access the transportation system, including those caught in congestion. Traffic throughput is the total number of motorists actually able to travel through the transportation facility. When traffic demand exceeds traffic throughput, congestion occurs and some motorists are forced to take an alternate route or experience delay.



Exhibit 3.1-9  
2005 Vehicle Demand on I-5

Location	Demand
<i>A.M. Peak<sup>a</sup> Demand</i>	
Pioneer St	9,810
SR 14	20,200
Going St	23,295
<i>P.M. Peak<sup>b</sup> Demand</i>	
Pioneer St	9,495
SR 14	14,990
Going St	19,425

Source: CRC Traffic Technical Report.

<sup>a</sup> a.m. peak refers to 6 a.m. to 10 a.m.

<sup>b</sup> p.m. peak refers to 3 p.m. to 7 p.m.

the four-hour afternoon/evening peak (3 p.m. to 7 p.m.), as indicated in Exhibit 3.1-9. During the morning peak, southbound traffic demand is greatest, whereas northbound traffic demand is greatest during the afternoon/evening peak.

Southbound traffic demand during the four-hour morning peak reaches 20,200 vehicles at the I-5 crossing. This demand exceeds the capacity of I-5, resulting in substantial traffic congestion, as discussed later in this chapter. Southbound traffic demand along the 23-mile I-5 study corridor ranges from a low of about 10,000 vehicles near Pioneer Street in Ridgefield to a high of over 23,000 vehicles north of the I-405 split in Portland.

Northbound traffic demand is substantially higher during the four-hour afternoon/evening peak than during the morning peak period. Traffic demand at the I-5 crossing reaches 21,400 vehicles, exceeding the I-5 crossing's capacity and resulting in substantial congestion, as discussed later in this section. Northbound traffic demand along the I-5 corridor ranges from a low of about 7,000 vehicles near 139th Street to a high of almost 24,000 vehicles near Fourth Plain Boulevard.

About 42 percent of daily truck movement across the I-5 bridges occurs from 9 a.m. to 3 p.m. when conditions are generally less congested and are more reliable for truck movement. The highest truck volumes occur between noon and 1 p.m. when trucks account for about 10 percent of traffic demand. The I-5 ramps with the highest truck volumes in the CRC area are the Marine Drive and Mill Plain Boulevard interchanges.

#### EXISTING: TRAFFIC CONGESTION AND TRAVEL TIMES

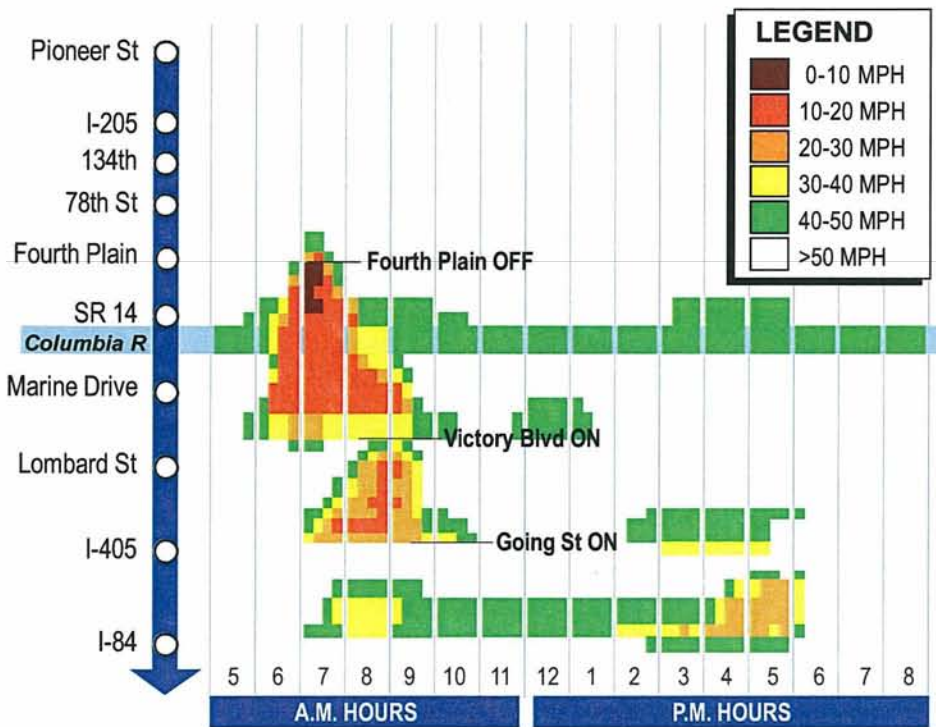
Illustrative profiles of traffic congestion show travel speeds at different locations and times in the CRC area over the 16-hour period from 5 a.m. to 9 p.m. Exhibit 3.1-10 shows southbound traffic, and Exhibit 3.1-11 shows northbound traffic. These profiles help assess early morning, midday, and afternoon/evening effects along the 23-mile study corridor.

In the morning, congestion and queuing occur at the I-5 southbound bridge, the Delta Park southbound lane drop, north of the I-405 split, and the Rose Quarter/I-84 off-ramp. The I-5 crossing is congested because of its limited capacity and the downstream Delta Park bottleneck where I-5 transitions from three lanes to two lanes. This section of the highway will be widened to three lanes, with construction planned to begin in 2008. Congestion occurs north of the I-405 split due to high traffic demand on three lanes that eventually feed both I-5 and I-405.

Midday congestion and queuing occurs along southbound I-5 at the Delta Park lane drop and Rose Quarter/I-84 off-ramp section. This queuing occurs independently of peak period congestion and lasts multiple hours throughout the day. During the afternoon/evening, southbound congestion and queuing occur north of the I-405 split and near the Rose Quarter/I-84 off-ramp.

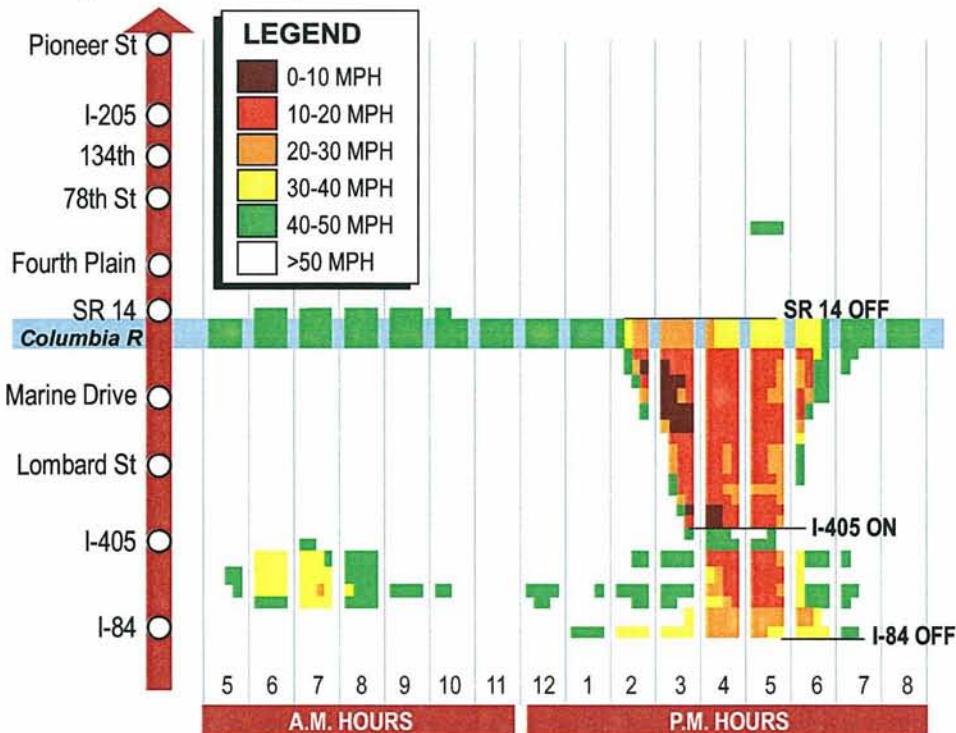
The average morning 2-hour peak southbound travel time between 179th Street and I-84 (16.6 miles) is 31 minutes. The afternoon/evening 2-hour peak northbound travel time between I-84 and 179th Street is 38 minutes.

Exhibit 3.1-10

**Speed Profiles: 5 a.m. to 9 p.m.****Existing 2005 Conditions, Southbound**

Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-11

**Speed Profiles: 5 a.m. to 9 p.m.****Existing 2005 Conditions, Northbound**

Source: CRC Traffic Technical Report 2008.



Northbound I-5 also experiences multiple hours of congestion. During the morning, queuing occurs between the I-84 on-ramp and the I-405 off-ramp. As shown in Exhibit 3.1-11, afternoon/evening congestion and vehicular queuing occurs between the Broadway Avenue on-ramp and the I-405 off-ramp, and at the crossing. The bridge bottleneck is more restrictive and extends longer than the Broadway/I-405 bottleneck.

#### **EXISTING: PEAK TRAFFIC AND PERSON THROUGHPUT**

Capacity constraints along I-5 limit the vehicular and person demand that can be served along the corridor in the peak travel directions.

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Currently, the I-5 bridges are usually congested for two hours in the morning and four hours in the afternoon/evening. I-5 and local streets experience congestion at the same time. This congestion is expected to get worse. More information about future congestion can be found in the No-Build Alternative discussion, later in this chapter.

During the morning peak, southbound vehicle throughput reaches 19,100 vehicles at the I-5 crossing. However, actual southbound vehicle demand is about five percent greater, as the bottleneck at the bridge limits the number of vehicles that can cross during the peak. For the westbound SR 14 to southbound I-5 movement, vehicle demand exceeds the amount of traffic that is served by about 600 vehicles, resulting in congestion and delay on the SR 14 ramp. Some traffic volumes divert to alternative connections (such as downtown Vancouver streets).

Northbound vehicle throughput on I-5 during the afternoon/evening peak reaches 20,500 vehicles at the I-5 crossing. This represents only 96 percent of the actual peak demand (21,400 vehicles).

About 21,400 persons in vehicles and 1,500 persons in buses cross the I-5 bridge southbound during the morning four-hour peak. During the afternoon/evening four-hour peak, about 24,600 persons in vehicles and 1,200 persons in buses travel northbound over the bridge.

#### **Existing Local Street Performance**

This section summarizes existing local street performance for peak hours of travel.

The cities of Portland and Vancouver, WSDOT, and ODOT establish and monitor I-5 ramp and local street performance standards. Established standards include wait time at intersections and standards for queuing. Additional information on performance standards is provided in the Traffic Technical Report.

Local street congestion is most intense near the I-5 ramps and is influenced by the travel direction and length of time that I-5 is congested each day. When I-5 is congested, major arterials that provide east/west connectivity are also congested.

#### **EXISTING: VANCOUVER LOCAL STREETS**

Despite localized vehicle queuing affecting up to 18 local intersections, 71 of the existing 73 study intersections in Vancouver meet performance standards during the morning and 72 intersections meet performance standards during the afternoon/evening peak.

During the morning peak, most traffic travels toward downtown Vancouver from areas to the north and east, and travels away from downtown during the afternoon/evening peak period. Main Street, the only north-south arterial roadway in the Vancouver subareas, carries higher southbound volumes in the morning (78 percent of total morning

traffic volumes) and higher northbound volumes in the afternoon/evening (65 percent of total afternoon/evening traffic volumes).

Freight movements are heaviest within the I-5/Mill Plain Boulevard interchange area and the I-5/Fourth Plain Boulevard interchange area, both serving the Port of Vancouver. I-5 divides the Vancouver local street system, with community connections limited to Columbia Way, Evergreen Boulevard, Mill Plain Boulevard, McLoughlin Boulevard, Fourth Plain Boulevard, 29th Street, 33rd Street, and 39th Street.

In the morning, southbound I-5 is congested, and some commuters seek to bypass congestion on I-5 and SR 14 by circulating through downtown Vancouver to enter southbound I-5 at Washington Street. This adds traffic and congestion on local streets through downtown Vancouver.

#### **EXISTING: PORTLAND LOCAL STREETS**

Despite localized vehicular queuing at 16 intersections, all 25 intersections studied in Portland meet performance standards established by the City of Portland and ODOT during both the morning and afternoon/evening peaks. Most traffic on these local streets travels toward downtown Portland during the morning peak and away from it during the afternoon/evening. Correspondingly, north-south arterials carry higher southbound volumes in the morning and higher northbound volumes in the afternoon/evening. In North Portland, regional east/west travel is strongly toward I-5 and toward downtown Portland in the morning and away from these areas in the afternoon/evening.

Freight movements are heaviest within the I-5/Marine Drive interchange area serving the Port of Portland and Columbia Corridor. Freight movements are also heavy within the I-5/Columbia Boulevard interchange area serving the Columbia Corridor, and the I-5/Going Street interchange serving the Swan Island industrial area.

The Portland local street system is divided by I-5, with community connections across I-5 mostly limited to interchanges, with some local street over-crossings. When I-5 is congested, commuters often travel on roadways parallel to I-5. Many of these motorists then enter I-5 via on-ramps from Victory Boulevard or Marine Drive.

Along Interstate Avenue, the MAX light rail line receives priority over vehicles at traffic signals. This means that light rail trains generally get green lights when they arrive at signalized intersections, which can add to intermittent traffic delays and backups to cross traffic when trains cross at these intersections.

#### **Existing Conditions for Pedestrians and Bicyclists**

Pedestrians and bicyclists often experience difficult conditions when crossing the Columbia River on the I-5 bridges. Sidewalks on the bridges are only about four feet wide and are separated from highway traffic by low barriers. The mixing of pedestrians and bicycles in this narrow facility can cause safety problems. Pedestrians and bicyclists are exposed to high noise levels, exhaust, and debris. The grades on the bridge create high downhill speeds for bicyclists and difficult uphill climbs for some pedestrians and bicyclists.

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More than 97 percent of Vancouver's study intersections meet performance standards today.

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All of Portland's study intersections meet performance standards today.



The designated pedestrian and bicycle route between downtown Vancouver, Hayden Island and Marine Drive area is circuitous and requires users to navigate local street intersections (see Exhibit 3.1-12). On the south side of the Columbia River, connections to the large Portland bikeway network exist via Marine Drive to the west and east, Martin Luther King Jr. Boulevard to the southeast, and Expo Road to the south. Directional or way-finding signing can be confusing or non-existent in some places. Furthermore, the paths connecting the crossing to the larger bikeway network are narrow and place bicyclists close to high speed traffic, which includes a high percentage of heavy vehicles.

Although there are constraints for pedestrian and bicycle travel across the Columbia River and North Portland Harbor, a substantial number of pedestrians and bicyclists use the existing crossing facilities. Year 2007 (September) 14-hour weekday counts (from 6 a.m. until 8 p.m.) showed about 60 pedestrians and 300 bicyclists using the crossing. About twice as many bicyclists use the western bridge's sidewalk, primarily because it connects more directly with bicycle routes to the north and south. About 60 percent of the pedestrians crossing the Columbia River use the western sidewalk.

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Despite constraints, many pedestrians and bicyclists use the existing facilities to cross the Columbia River.

A multi-use pathway is located on the east side of the I-5 crossing of North Portland Harbor. The 14-hour counts showed about 30 pedestrians and 350 bicyclists using the pathway. For comparative purposes, pedestrian and bicycle counts were also conducted on the I-205 crossing. The 14-hour counts showed about 10 pedestrians and 190 bicyclists using the I-205 crossing's multi-use pathway, which meets current standards.

Pedestrian and bicycle planning documents and maps from local jurisdictions were reviewed to develop an understanding of the existing facilities in the CRC area. The maps were aggregated to show all pedestrian and bicycle existing and planned facilities in the CRC area (Exhibit 3.1-12, below).

The Portland Transportation System Plan includes several proposed connections for pedestrians and bicycles, and these connections would improve accessibility and safety for users. Notable among the proposed improvements is the Bridgeton Trail along the Columbia River. This trail would improve the connection to the Marine Drive area from the east and provide users with an off-street multi-use pathway option that could eliminate travel on Marine Drive. Another proposed improvement that would improve the connection from the south is a multi-use pathway along the Columbia Slough and along Whitaker Road.

Numerous connections to regional pedestrian and bikeway facilities exist throughout Vancouver. The waterfront multi-use trail on the north bank of the Columbia River provides vehicle-separated access to the Confluence Land Bridge, Vancouver National Historic Reserve, and points farther east. The existing multi-use trail along Columbia Street enables access through downtown Vancouver and the northwest along 15th Street towards Vancouver Lake. There are a number of east-west streets with bike lanes that cross I-5 and provide access to the Burnt Bridge Creek Greenway Trail and to the larger system of regional trails in Clark County.

Exhibit 3.1-12

**2007 and Proposed Pedestrian and Bicycle Facilities**

DIMENSIONS ARE APPROXIMATE.

Source: Data from published maps and plans from the cities of Portland and Vancouver, WSDOT, ODOT, Clark County, and Metro.

The City of Vancouver has several major streets, such as Columbia Way, that have been identified as future bikeways and bike lanes. These improvements would increase north-south access throughout the city and provide straight line connections to many neighborhoods and parks in Vancouver.

**Existing Traffic Safety and Security**

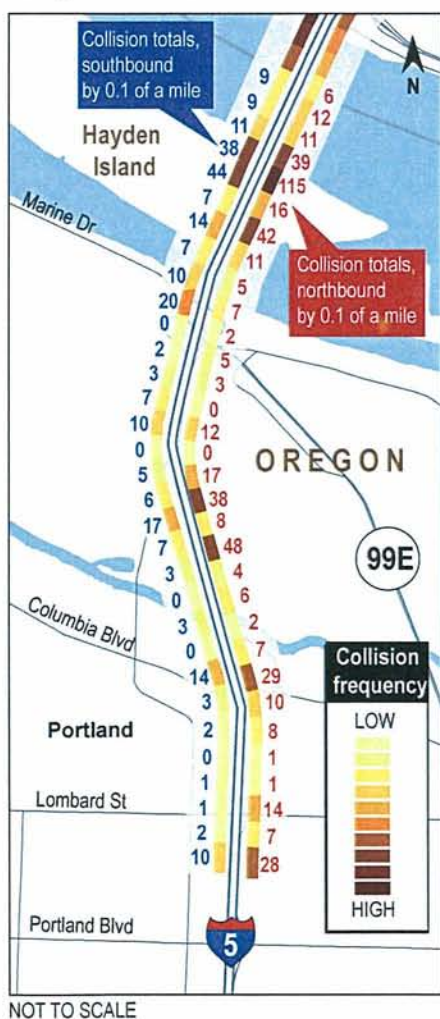
The project's Purpose and Need statement includes provisions to improve river crossing safety and reduce vulnerability to incidents, to improve substandard bicycle and pedestrian facilities, to improve marine navigation, and to reduce the seismic vulnerability of the existing



I-5's collision rate in the CRC project area is double that of similar facilities in Oregon.

Collision rates are measured in million vehicle-miles traveled (mvmt).

Exhibit 3.1-13  
Oregon Collisions



bridges. All of these needs are safety-related, and improved safety is one of the cornerstones of this project.

CRC project staff undertook a comprehensive examination of safety-related conditions. They examined traffic safety using methodologies such as ODOT's Safety Priority Index System (SPIS) and data from WSDOT's High Accident Location and High Accident Corridor records. Project staff compiled a detailed crash analysis using a five-year data set that included all collisions in the CRC area. The data were analyzed by crash type and severity, location, time of day, truck involvement, and the effects of non-standard highway geometrics, bridge lifts, and traffic stops.

#### EXISTING: NUMBER OF VEHICULAR COLLISIONS AND COLLISION RATES

Between January 1, 2002, and December 31, 2006, 2051 collisions were reported on mainline I-5 and its ramps within the CRC area. An average of one reported collision occurred per day. The Washington segment of the CRC area had a crash rate of 1.02 collisions per million vehicle-miles traveled (MVMT). In Oregon, the crash rate was 1.08 collisions per MVMT. This is nearly twice the average rate (0.55 MVMT) experienced on similar urban interstate facilities in Oregon.

#### EXISTING: VEHICULAR COLLISIONS BY TYPE AND SEVERITY

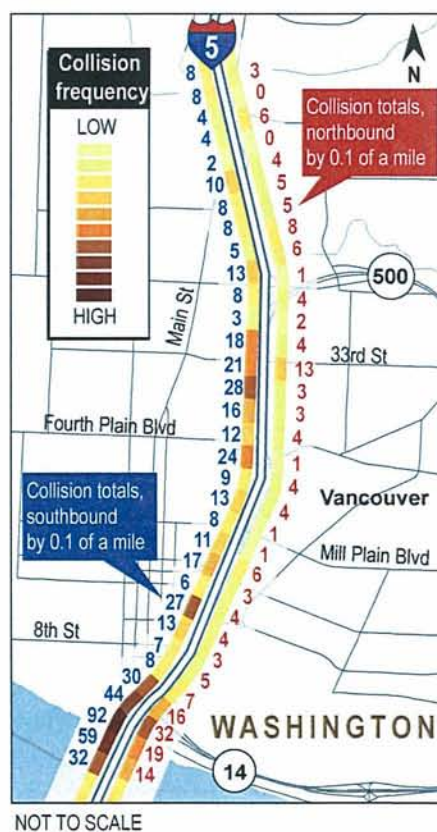
The number, type, and severity of collisions reported in the CRC area between 2002 and 2006 were compiled and plotted by direction (northbound and southbound) in 0.1-mile increments. Four collision types were reported: rear-end, side-swipe, fixed object, and other. Three severity types were reported: property damage only, injury, and fatality. Exhibits 3.1-13 and 3.1-14 show the number of collisions reported within the CRC area in Oregon and Washington, respectively.

Southbound collisions in Washington happened at almost three times the reported northbound rate. Fifty-seven percent were rear-ends, and 15 percent were side-swipes. This reflects recurrent southbound traffic congestion at and near the approaches to the bridge.

In Oregon, northbound collisions occurred at about twice the reported southbound rate, reflecting high northbound congestion levels at and near the bridge approach. Seventy-seven percent of these collisions were rear-ends, and 13 percent were side-swipes.

About 61 percent of the total collisions had property damage only. Injury crashes accounted for almost all remaining collisions, and were more prevalent in the peak direction of travel.

Exhibit 3.1-14  
Washington Collisions



Three fatalities occurred during the five-year study period between 2002 and 2006, representing 0.1 percent of all collisions. The three fatalities involved either a pedestrian or a bicyclist being struck by a vehicle or truck. Two of the three crashes occurred on southbound I-5 near the crossing, one near the Hayden Island southbound on-ramp and one near the southbound SR 14 on-ramp. The third fatality occurred along northbound I-5, near the Victory Boulevard off-ramp.

#### EXISTING: RELATIONSHIP OF VEHICULAR COLLISIONS TO HIGHWAY GEOMETRICS

While the current highway and bridge design generally met design standards applicable at the time of their construction, vehicles have changed and standards have evolved over the years, reflecting continued research in areas such as vehicle operating characteristics, driver expectations, traffic volumes, and physical highway elements.

Non-standard geometric features exist throughout the CRC area, including short ramp merges/acceleration lanes, short ramp diverges/deceleration lanes, short weaving areas, vertical curves (crest and sag curves) limiting sight distance, and narrow shoulders. In the CRC area, there are multiple non-standard features, with the greatest concentration located on the bridge and along its approaches.

The presence of non-standard design features is strongly correlated with the frequency and type of collisions. For example, non-standard acceleration and deceleration lanes at several on- and off-ramps contribute to a high number of rear-end and side-swipe collisions along northbound I-5, particularly at Hayden Island Drive, the downtown Vancouver/City Center off-ramp, and at SR 14. Along southbound I-5, these lanes contribute to a high number of rear-end and side-swipe collisions at Fourth Plain Boulevard, SR 14, Hayden Island Drive, and Victory Boulevard.

Non-standard weaving areas contribute to a high number of rear-end and side-swipe collisions, primarily southbound between SR 500 and Fourth Plain Boulevard, between Mill Plain Boulevard and SR 14, between Hayden Island Drive and Marine Drive, and between Marine Drive and Victory Boulevard.

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Non-standard geometric features are highly correlated with the type and frequency of crashes in the CRC area.

#### EXISTING: VEHICULAR COLLISIONS DURING BRIDGE LIFTS AND TRAFFIC STOPS

The I-5 bridges are equipped with lift spans. Lifting the spans or stopping traffic for maintenance is allowed on weekdays between 9 a.m. and 2:30 p.m., overnight between 6 p.m. and 6:30 a.m., and any time on weekends. Weekday collisions that occurred within a one-hour window of bridge lifts/traffic stops were analyzed for vehicles approaching the bridge.

Northbound collisions are three times more likely when a bridge lift or traffic stop occurs than when it does not. Southbound collisions are four times more likely. Collisions occurring during bridge lifts or traffic stops generally result in a higher rate of rear-end collisions and greater injury frequency than collisions that occur during peaks, when stops and lifts are not allowed.

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Collisions are up to four times more likely to occur during bridge lifts and traffic stops associated with the bridge, and increase substantially during congestion.

#### EXISTING: VEHICULAR COLLISIONS BY TIME OF DAY

The number of reported collisions is generally proportional to prevailing traffic volumes, except during late night periods when fixed-object and

alcohol-related collisions increase. During periods when traffic volumes approach near-congestion or operate at congested levels, collisions increase substantially. Rear-end collisions are the most prevalent in the CRC area, and the higher proportion during congestion could be from existing non-standard design features or vehicular queuing during peak conditions.

#### EXISTING: VEHICULAR COLLISIONS INVOLVING TRUCKS

Collisions involving trucks account for about 12 percent of all collisions reported on I-5 from Lombard Street to Main Street/Hwy 99; this is approximately equal to or higher than the proportion of truck volume to all traffic.

In Oregon, 95 collisions involving trucks were reported. Forty-six percent of these collisions occurred southbound and 54 percent occurred northbound. In Washington, 160 collisions involved trucks. Seventy-two percent occurred southbound and 28 percent occurred northbound.

The rate of side-swipe collisions involving trucks is higher than any other type (39 percent). This is attributed to truck drivers attempting to change lanes in congested traffic and short acceleration/deceleration lanes and weaving sections in the CRC area.

Locations with high numbers of truck-related collisions are the Columbia Boulevard ramps, Victory Boulevard ramps, Hayden Island, and the northbound exit to Marine Drive. The SR 14 westbound to I-5 southbound on-ramp with its short turning radius, steep super-elevation, uphill grade and short merging distance contributes to the higher number of truck-related collisions at the bridge approach.

#### EXISTING: IDENTIFICATION OF SAFETY IMPROVEMENT LOCATIONS ON STATE HIGHWAYS

The Safety Priority Index System (SPIS) is the primary method for identifying locations of frequent crashes on state highways within Oregon. The SPIS score is based on three years of crash data and considers crash frequency, crash rate, and crash severity. ODOT bases its SPIS on 0.10 mile segments, to account for variances in how crash locations are reported. To become an SPIS site, a location must meet one of the following criteria:

- Three or more crashes have occurred at the same location over the previous three years.
- One or more fatal crashes have occurred at the same location over the previous three years.

Each year, a list of the highest scoring 10 percent of SPIS sites is generated, and the top five percent of sites are investigated by the five Regional Traffic Manager's offices. These sites are evaluated and investigated for safety problems. If a correctable problem is identified, a benefit/cost analysis is performed and appropriate projects are initiated.

A search of the ODOT 2004 to 2006 SPIS database revealed five locations (two overlap) within the Oregon section of the CRC area that ranked among the 10 percent highest scored sites in the state. These locations are summarized in Exhibit 3.1-15. Two of these locations are in the top five percent in the state and the other three are in the top 10

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Trucks are involved in 12 percent of collisions in the CRC area.



percent. ODOT does not include the interchange ramps or intersections in the calculations of SPIS rates for the highway.

Exhibit 3.1-15  
ODOT SPIS Locations 2004-2006

Location	Mileposts	Number of Crashes	2007 SPIS Index	SPIS Rank
Hayden Island interchange	307.81 to 308.17	78	77.12	top 5%
North Portland Harbor Bridge	307.66 to 307.84	22	66.01	top 5%
Victory Boulevard interchange	306.63 to 306.75	33	48.67	top 10%
Victory Boulevard interchange	306.59 to 306.69	33	48.67	top 10%
I-5 Bridge Bridgehead	308.14 to 308.24	15	46.05	top 10%

Source: CRC Traffic Technical Report 2008.

The Washington State Department of Transportation (WSDOT) uses two major programs to identify and correct potentially unsafe locations. These are the High Accident Location (HAL) and the High Accident Corridor (HAC) programs.

A HAL location is a location less than one mile long which has experienced a higher than average rate of severe accidents during the previous two years. The severity of an accident, the severity per million vehicles, the roadway access category, and the accumulated severity rate per million vehicle miles are all taken into account to determine HAL locations.

A HAC is a section of state highway one or more miles long, which has a higher than average number of severe accidents over a continuous period of time. For the five-year analysis period, the following statewide benchmark averages are calculated for each of the six roadway access categories:

- Total severity points per mile
- Total accidents per mile
- Severity points per accident per mile

Information provided by WSDOT revealed that within the CRC area, the following five locations met the HAL criteria:

- Westbound SR 14 off-ramp to southbound I-5 on-ramp
- Southbound I-5 off-ramp to eastbound SR 14 on-ramp
- Southbound I-5 off-ramp to Mill Plain Boulevard
- Southbound I-5 off-ramp to Fourth Plain Boulevard
- 39th Street between the southbound and northbound ramp terminals

All of these locations are ramp-related, which supports the conclusion drawn from the crash analysis that there are safety issues with the ramps. There were no HAC locations identified within the CRC area.

Existing Transit Performance

Metrics highlighted in this chapter focus on those that offer the greatest distinction among the CRC alternatives and options. These include mobility, reliability, accessibility, congestion reduction, and efficiency. The Transit Technical Report describes these and other metrics in more detail.

EXISTING: TRANSIT RIDERSHIP AND MODE SPLIT

Nineteen transit vehicles per hour currently provide service over the I-5 bridges during the afternoon/evening peak period.

About 3,300 weekday daily transit passenger trips across the Columbia River used the I-5 corridor in 2006.<sup>1</sup> This includes approximately 1,400 trips on the four C-TRAN express bus routes and 1,900 local bus trips.

During the afternoon/evening peak, 67 percent of the persons crossing the river on I-5 northbound are in single-occupant vehicles (SOVs), 27 percent are in high-occupancy vehicles (HOVs), and six percent use transit. Six percent of the travelers between the Clark County Urban Market and Oregon use transit daily. Three percent of travelers between the Clark County Suburban Commuter Market and Oregon use transit, and one percent of travelers from Oregon to Clark County use transit.

EXISTING: TRANSIT TRAVEL TIME BETWEEN MARKETS

Exhibit 3.1-16 shows existing transit travel times between representative locations in the CRC transit markets. Transit travel times include those for the northbound and southbound peak times. Traveling from Expo Center to downtown Portland on the MAX line takes approximately 30 minutes.

Exhibit 3.1-16  
Existing Average Weekday Transit Travel Times in the I-5 Corridor and CRC Area

Route	Travel Times (in minutes)
<b>Two-Hour Morning Southbound Peak</b>	
Salmon Creek to Pioneer Square (via C-TRAN Route 134)	36
Vancouver Mall to Lombard Transit Center (via LRT & Route 4L)	31
<b>Two-Hour Afternoon/Evening Northbound Peak</b>	
Pioneer Square to Salmon Creek (via C-TRAN Route 134)	44
Lombard Transit Center to Vancouver Mall (via LRT & Route 4L)	48

Source: 2005 CRC VISSIM analysis of I-5 and EMME/2.

EXISTING: OPERATION AND MAINTENANCE COSTS

Exhibit 3.1-17 summarizes the existing annual transit costs for the study area. To provide the existing bi-state transit service, the transit system requires a total of 2,383 weekday platform hours (with 28,668 vehicle miles traveled). This service results in an associated annual cost to operate of nearly \$66 million.

<sup>1</sup> The CRC On-Board Survey (November 2006).

Exhibit 3.1-17

**Transit System Operation and Maintenance Costs**

	Costs in 2007 Dollars
C-TRAN Local Bus	\$21,177,000
C-TRAN I-5 Express Bus	\$4,150,000
TriMet North Portland Local Bus	\$33,111,000
Light Rail (Yellow Line)	\$6,799,000
C-TRAN Limited Stop Bus	\$699,000
<b>Total</b>	<b>\$65,936,000</b>

Source: C-TRAN, 2007 and TriMet, 2007.

**3.1.3 Long-Term Effects from Project Alternatives**

This section discusses the transportation performance effects of the five project alternatives.

**Alternative 1: No-Build**

This section explains how existing transportation conditions would change by 2030 if none of the improvements evaluated by this project occur.

**NO-BUILD: I-5 AND I-205 TRAFFIC LEVELS**

By 2030, average weekday traffic across the I-5 bridges is forecast to reach 184,000 vehicles per day, an increase of 37 percent over current conditions. Daily traffic levels on the I-205 crossing would rise to 210,000 vehicles each day, an increase of 44 percent over current volumes.

Truck volumes on I-5 are projected to increase at a higher rate than general purpose traffic. Truck traffic across the I-5 bridges is estimated to increase by 77 percent over current truck volumes.

By the year 2030 in the CRC area, the I-5 morning peak and afternoon/evening peak travel demand is expected to increase substantially and would continue to be well in excess of the crossing's available capacity, resulting in substantially increased congestion and delay. The highest growth in traffic demand is projected to occur in northern Clark County (double by 2030) and the lowest growth in North Portland (less than five percent).

**NO-BUILD: TRAFFIC CONGESTION AND TRAVEL TIMES**

Illustrative profiles of traffic congestion based on travel speeds were developed for the No-Build Alternative, as shown in Exhibits 3.1-18 and 3.1-19.

**Southbound Peak.** During the morning peak, for vehicle trips from 179th Street to I-84, southbound I-5 travel times would increase over the current 31 minute travel time by 15 minutes (50 percent) due to the increase in forecast congestion levels along I-5. Exhibit 3.1-18 illustrates estimated southbound conditions along the 23-mile I-5 corridor. Southbound congestion and vehicular queuing on the crossing is expected to increase from two hours per day currently to over seven hours under the 2030 No-Build Alternative. One of these hours of

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Traffic across the I-5 bridges in 2030 is forecast at 184,000 vehicles per day, an increase of 37 percent over current conditions.

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Truck traffic is expected to grow twice as fast as general purpose traffic over the next 20 years.

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Daily congestion on the I-5 bridges is expected to rise from 6 hours today to 15 in year 2030.

**Forecast Traffic Data**


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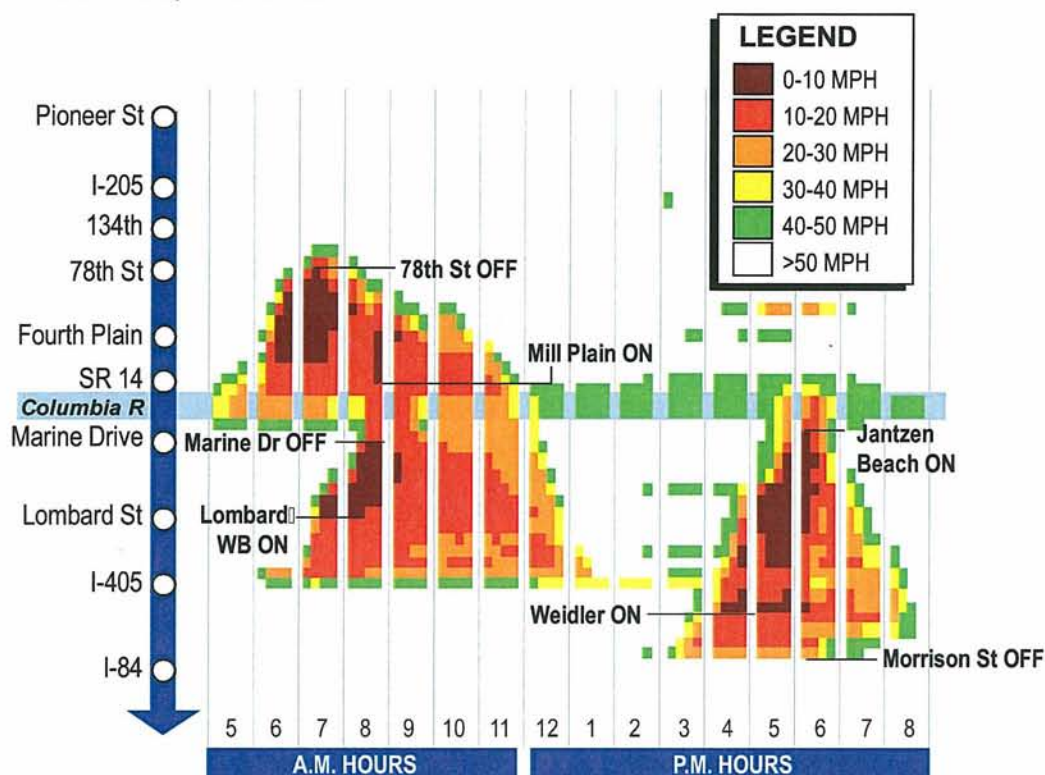
All forecast future traffic data was derived by the CRC project team using well established traffic modeling techniques. A key element in forecasting future travel demand and travel patterns is anticipated growth within the region. This project used regional growth assumptions from local governments that predict the magnitude and location of housing and job growth within the region. More information on these techniques, as well as more detailed traffic data, is contained in the CRC Traffic Technical Report.



southbound congestion would develop during the afternoon/evening peak.

Exhibit 3.1-18

**I-5 Traffic Speeds: 5 a.m. to 9 p.m.  
2030 No-Build, Southbound**



Source: CRC Traffic Technical Report 2008.

The Delta Park project (not part of CRC) will eliminate the Delta Park bottleneck. However, congestion and vehicular queuing would still result through this portion of highway due to the capacity constraint north of the I-405 split. Southbound congestion and vehicular queuing here would increase from 2.5 hours to 11.5 hours under No-Build conditions, with over four of these hours occurring during the afternoon/evening.

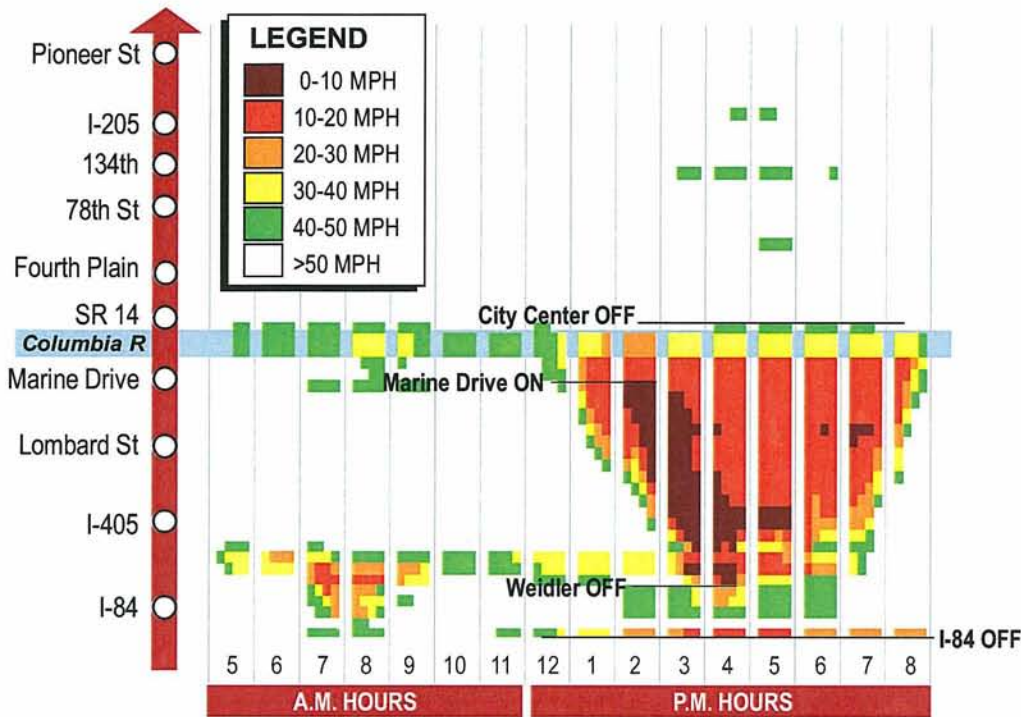
Congestion at the southbound bottleneck near the I-5 lane drop in the Rose Quarter would increase from 2.75 hours to 3.5 hours under 2030 No-Build conditions, despite the planned I-84 off-ramp/Broadway-Weidler Street on-ramp improvements.

**Northbound Peak.** During the afternoon/evening peak, for a vehicle trip from I-84 to 179th Street, northbound I-5 travel times would increase from the current 38-minute travel time by 6 minutes (16 percent) due to increased congestion in the two existing bottleneck locations (Interstate Bridge and the I-405/Rose Quarter section). Exhibit 3.1-19 illustrates estimated northbound conditions along the 23-mile I-5 corridor. Northbound congestion and vehicular queuing on the crossing would increase from four hours to almost eight hours in the year 2030 under the No-Build Alternative, as increased traffic attempts to utilize the existing limited capacity across the bridge.

Northbound congestion near the I-405/Rose Quarter weaving area would increase from approximately 3.25 hours today to nearly seven hours under 2030 No-Build conditions. More than half of the increased congestion (2.5 hours) would occur during the morning peak.

Exhibit 3.1-19

**I-5 Traffic Speeds: 5 a.m. to 9 p.m.  
2030 No-Build, Northbound**



Source: CRC Traffic Technical Report 2008.

Northbound congestion in the highway weaving area on the Marquam Bridge upstream from the off-ramp to I-84 would increase from five to approximately seven hours.

**NO-BUILD: PEAK TRAFFIC AND PERSON THROUGHPUT**

The previously identified constraints along I-5 limit the amount of traffic that could travel along the corridor during the morning and afternoon/evening peaks.

Under the No-Build Alternative, during the morning four-hour peak, southbound vehicle throughput across the bridge would increase over the current 19,100 vehicle throughput by 2,900 vehicles (16 percent). While the Delta Park lane drop bottleneck would be eliminated by widening I-5 southbound from Victory Boulevard to Columbia Boulevard, traffic congestion at the bridge combined with congestion at the southern bottleneck located just north of the I-405 split would limit the throughput across the bridge to 87 percent of its vehicular demand.

Under 2030 No-Build conditions traffic back-ups would occur at three southbound I-5 on-ramps, which would not be able to serve their traffic demand—SR 500/39th Street, Mill Plain Boulevard, and SR 14/City Center. These back-ups would add to congestion on local streets around these interchanges.

During the afternoon/evening peak, northbound vehicle throughput would be similar to existing conditions, with about 20,300 vehicles crossing the northbound bridge. Congestion at the crossing would limit the service volume to 72 percent of northbound vehicular demand.

Under 2030 No-Build conditions traffic back-ups would occur at five northbound I-5 on-ramps (Interstate Avenue/Victory Boulevard, Marine Drive, Hayden Island, Mill Plain Boulevard, and Fourth Plain Boulevard). Although all these ramps currently meet demand, these future back-ups would add congestion on local streets around these interchanges.

For the No-Build Alternative, about 24,600 persons in southbound vehicles would cross during the morning peak, with up to 1,900 persons using transit during this period. About 24,400 persons in northbound vehicles would cross during the afternoon/evening four-hour peak, with up to 2,050 persons using transit during this period.

#### **NO-BUILD: LOCAL STREET PERFORMANCE**

##### **No-Build: Vancouver Local Streets**

Regional travel patterns in 2030 are expected to continue existing commute patterns, with morning traffic traveling toward downtown Vancouver and afternoon/evening traffic traveling toward outlying residential areas in Clark County.

Population and employment growth would spur increased regional travel demand. The City of Vancouver has identified relatively few local street projects within the traffic study subareas that would increase vehicular capacity.

Similar to today, local street congestion would be most intense near the I-5 on- and off-ramps. During congested periods on I-5 (15 hours daily by 2030), nearby local streets would also experience congestion.

By 2030, the No-Build Alternative would result in the following specific effects on local streets in the Vancouver subareas:

- The increased duration of southbound I-5 congestion in the morning would be expected to increase the use of Main Street as a parallel alternate route for commuters destined to downtown Vancouver, as well as those bypassing I-5 congestion north of SR 14 and then entering the highway again at City Center.
- Even with planned widening of Fourth Plain Boulevard to a five-lane roadway between I-5 and the western railroad bridge, 11 of 14 subarea intersections would not operate at acceptable performance standards during the afternoon/evening peak hour.
- While truck-hauled freight trips are forecast to grow at a higher rate than non-truck trips, it would become increasingly difficult for freight trips to occur at times when the transportation system is not congested. This result is not aligned with the region's planned increase in Port of Vancouver activity and associated truck-hauled freight movement.
- The Mill Plain Boulevard interchange would be congested for freight and commuter travel for several hours each day, including the

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Under No-Build conditions, only 46 of 73 intersections (63 percent) in Vancouver would meet performance standards in 2030.

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The term "operating acceptably" is defined by the performance standards set by the local jurisdiction and/or State DOT. For specific information on the performance standards used for this project, see the Traffic Technical Report.



mid-day period between peak commute hours commonly targeted by regional freight movers.

- Local street intersection operations would degrade system-wide and would affect all four Vancouver subareas. During the congested afternoon/evening peak, while all 73 local street intersections analyzed operate acceptably today, only 46 of these intersections would meet performance standards under 2030 No-Build conditions.

#### No-Build: Portland Local Streets

In 2030, the Portland local street system would be configured essentially as it is today. Two exceptions involve minor local street changes along Denver Avenue associated with I-5 widening through Delta Park and signalization of the I-5 southbound and northbound ramp terminals on Alberta Street.

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Under No-Build conditions, seven of 25 study intersections in North Portland would fail to meet operating standards in 2030.

Similar to current conditions, local street congestion would be most intense near the I-5 ramps and would remain influenced by the travel direction(s) and length of time that I-5 is congested each day. In short, when I-5 is congested (up to 15 hours daily), the nearby local street system is expected to be congested.

By 2030, the No-Build Alternative would result in the following specific effects on local streets in the Portland subareas:

- Travel to and from Hayden Island, provided exclusively by the I-5 interchange, would be constrained for several hours each day limiting the number of vehicles able to pass through this interchange.
- The Marine Drive interchange would be congested for several hours each day, including the mid-day period between peak commute hours commonly targeted by regional freight movers.
- While truck-hauled freight trips are forecast to grow at a higher rate than non-truck trips, it would become increasingly difficult for freight trips to occur at times when I-5 is not congested. This result is not aligned with the region's planned increase in port activity and associated truck-hauled freight movement.
- Local street intersection operations would degrade system-wide and would affect all four Portland subareas. During the most congested afternoon/evening peak periods, where all 25 local street intersections operate acceptably under current conditions, only 18 would operate acceptably in 2030.

#### **NO-BUILD: PEDESTRIANS AND BICYCLISTS**

Although pedestrian and bicycle use by 2030 has not been modeled, such trips across the Columbia River are expected to substantially increase as traffic congestion worsens and only limited transit service improvements are provided.

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Without addressing non-standard design and safety features, collisions in the I-5 bridge area are expected to increase 80 percent between today and 2030.

Under the No-Build Alternative, an increased number of pedestrians and bicyclists would face the same or more difficult conditions when crossing the Columbia River. Along the narrow sidewalks, increased collisions could arise between pedestrians and bicyclists. In addition, increased conflicts would result when pedestrians and bicyclists interact

with motor vehicles, such as when accessing the crossing in Vancouver, on Hayden Island, or in the Marine Drive interchange area.

#### NO-BUILD: TRAFFIC SAFETY AND SECURITY

Under No-Build conditions, the number of collisions is predicted to increase substantially by 2030—approximately 80 percent over existing conditions<sup>2</sup>. With existing non-standard features remaining on I-5 and its ramps, traffic levels would increase, the duration of congestion would lengthen, and bridge lifts/traffic stops would continue at their current rate or increase in the future.

#### NO-BUILD: TRANSIT RIDERSHIP AND MODE SPLIT

With the No-Build Alternative, Clark County and Portland would be connected by 24 buses crossing the Columbia River in the corridor during the peak hour in the peak direction. This compares with 19 buses currently providing service in the peak hour. These buses would provide local and express service. No high-capacity transit service would be provided into Clark County under this alternative. Platform hours of service would increase over existing conditions by approximately 10 percent, from 2,383 hours to 2,632 hour per weekday.

With the No-Build Alternative total passenger trips on transit over the I-5 crossing would be about 8,800 daily and 2,508,000 annually. This is an increase of nearly 170 percent over existing ridership of 3,300 daily and 928,000 annual passenger trips.

With the No-Build Alternative, the transit mode split would be 1 percent of the afternoon/evening peak direction trips (up from 6 percent today) within the I-5 corridor. Mode split for single-occupancy vehicles (SOVs) would drop to 54 percent (from 67 percent today). Trips via high-occupancy vehicles would increase to 33 percent (from 29 percent today).

Daily transit mode split between the Clark County Urban and Suburban transit markets and markets in Oregon would both be 12 percent. This doubles the current mode split between the Clark County Urban Market and Oregon, and quadruples the current mode split between the Clark County Suburban Market and Oregon. The daily transit mode split from markets in Oregon to Clark County would be 3 percent, (three times the existing mode split of 1 percent). The increase in transit mode split for the No-Build Alternative is attributable to the much slower travel times anticipated for drivers by the year 2030 due to increased congestion.

#### NO-BUILD: TRANSIT TRAVEL TIMES

With the No-Build Alternative, during peak travel periods the speed of transit vehicles would average 10 mph throughout the corridor and 7.5 mph within downtown Vancouver, lower than the current 8.3 mph average travel speed in downtown Vancouver.

During the afternoon/evening peak periods, average northbound travel times between major transit travel markets would increase over existing conditions (Exhibit 3.1-20). Trips between Pioneer Courthouse Square and the Salmon Creek Park and Ride are expected to increase by

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Between 2006 and 2030, total transit trips over the I-5 crossing are expected to increase by nearly 170 percent on an average weekday.

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The transit share of trips between the Clark County Urban transit market and Oregon would double from 2006 to 2030 with the No-Build Alternative.

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<sup>2</sup> Source: Traffic Technical Report.

approximately four minutes over existing conditions (from 44 minutes). Trips between the Lombard transit center and the Vancouver Mall would increase by nine minutes (from 48 minutes).

During the morning peak hours, southbound travel times would increase by nearly 19 minutes over the current 37 minutes for trips between the Salmon Creek Park and Ride and Pioneer Courthouse Square. Average travel times between Lombard Transit Center and the Vancouver Mall would remain roughly the same.

Exhibit 3.1-20

**No-Build Average Weekday Transit Travel Times in the I-5 Corridor and CRC Area**

Transit Characteristic	Location	Travel Times (in minutes)
Two-Hour a.m. Peak/Peak Direction	Salmon Creek to Pioneer Square (via C-TRAN Route 134)	56
	Vancouver Mall to Lombard Transit Center (via LRT & Route 4L)	31
Two-Hour p.m. Peak/Peak Direction	Pioneer Square to Salmon Creek (via C-TRAN Route 134)	48
	Lombard Transit Center to Vancouver Mall (via LRT & Route 4L)	57

Source: 2005 CRC VISSIM analysis of I-5 and EMME/2.

**NO-BUILD: TRANSIT OPERATIONS AND MAINTENANCE COSTS**

With the No-Build Alternative, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of about \$70 million. This compares with a current annual operating cost of nearly \$66 million. This relatively minor increase in operating costs is based on the assumption that worsening congestion from No-Build conditions would result in increased ridership.

**Alternative 2: Replacement Crossing with Bus Rapid Transit**

This section explains how existing transportation conditions would change if Alternative 2, a replacement crossing with bus rapid transit, were selected and constructed. Exhibit 3.1-21 summarizes predicted year 2030 transportation performance under Alternative 2.



Exhibit 3.1-21

**Alternative 2: Replacement Crossing with Bus Rapid Transit**

<b>Alternative 2: Replacement Crossing with Bus Rapid Transit</b>				
<b>Metric</b>	<b>Kiggins Bowl Terminus (A) <sup>a</sup></b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C) <sup>d</sup></b>	<b>Mill Plain MOS (D) <sup>d</sup></b>
<b>People over the I-5 Crossing during peak periods<sup>a</sup></b>				
In cars	34,400 (NB)	34,400 (NB)	34,400 (NB)	34,400 (NB)
On transit	6,100 (NB)	6,100 (NB)	6,100 (NB)	6,100 (NB)
<b>Vehicles over the I-5 crossing each weekday</b>	178,000	178,000	179,500	179,500
<b>Hours of congestion per day</b>	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours
<b>Pedestrian and bicycle connections</b>	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.
<b>Transit mode split in p.m. peak<sup>b</sup></b>	20%	19%	17%	21%
<b>Transit travel time from Mill Plain station to Expo Center</b>	8 min	8 min	8 min	8 min
<b>Annual transit operations and maintenance costs (\$ million)<sup>c</sup></b>	\$74.9	\$75.1	\$74.9	\$74.9
<b>Traffic safety and security</b>	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.
<b>Transit safety and security</b>	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.

<sup>a</sup> Total number of people in cars and on transit vehicles using the I-5 crossing traveling north (NB) during the afternoon/evening peak period.

<sup>b</sup> Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

<sup>c</sup> Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

<sup>d</sup> Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

**ALTERNATIVE 2: I-5 AND I-205 TRAFFIC LEVELS**

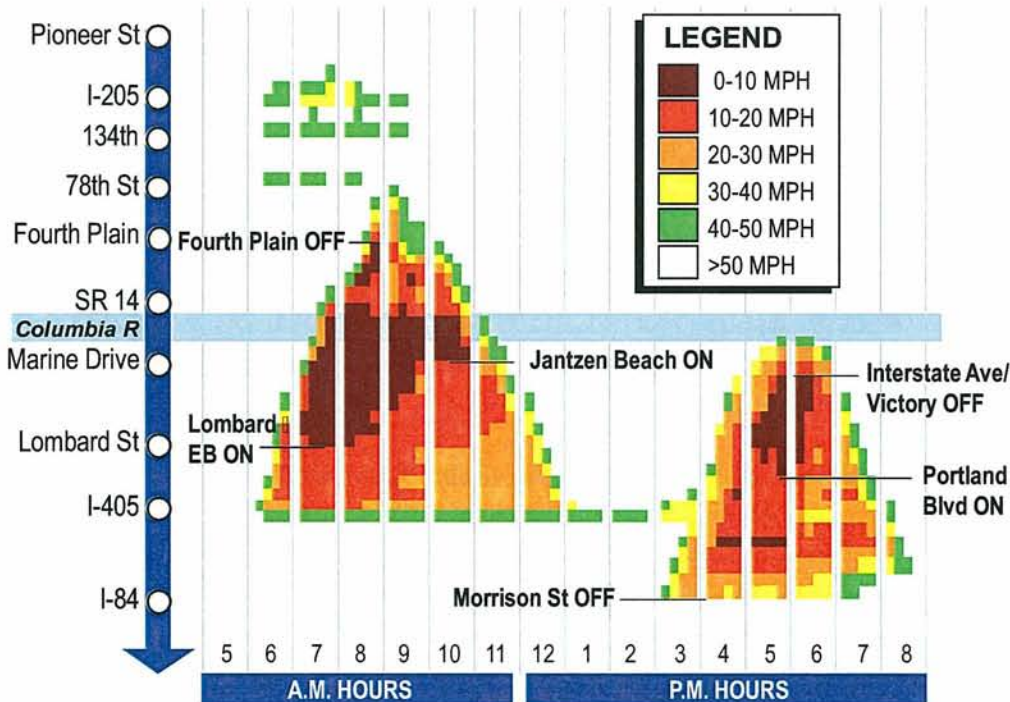
With Alternative 2, the 2030 average weekday traffic across the I-5 crossing is expected to be 178,000 vehicles. This is lower than the 184,000 daily vehicle trips predicted under the No-Build Alternative because of the introduction of high-capacity transit and a toll at the I-5 crossing.

Daily traffic volume on I-205 would increase slightly from 210,000 vehicles per day with the No-Build Alternative to 213,000 vehicles with Alternative 2, potentially adding to congestion on I-205.

**ALTERNATIVE 2: TRAFFIC CONGESTION AND TRAVEL TIMES**

Exhibit 3.1-22 portrays estimated year 2030 southbound conditions for Alternatives 2 and 3. As shown, Alternative 2 would reduce the duration of southbound congestion in the vicinity of the I-5 crossing to 3.5 hours from 7.25 hours for the No-Build Alternative. Southbound traffic queues would no longer extend beyond Fourth Plain Boulevard for multiple hours each day. The traffic congestion remaining at the bridge would result from the existing downstream bottleneck on I-5 north of the I-405 split. Alternative 2 would not exacerbate or worsen this existing bottleneck, although the CRC improvements would enable an increase in vehicle throughput of about 6 percent along I-5 just north of I-405.

Exhibit 3.1-22

**Speed Profiles: 5 a.m. to 9 p.m.****2030 Replacement Bridge Alternatives 2 and 3, Southbound**

Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-23 shows estimated year 2030 northbound conditions for Alternatives 2 and 3. This alternative would eliminate the northbound I-5 crossing bottleneck. Northbound traffic queues would no longer extend to I-405 for multiple hours each day. Alternative 2 would likely reduce the duration of congestion at the I-5 crossing from 7.75 hours under the

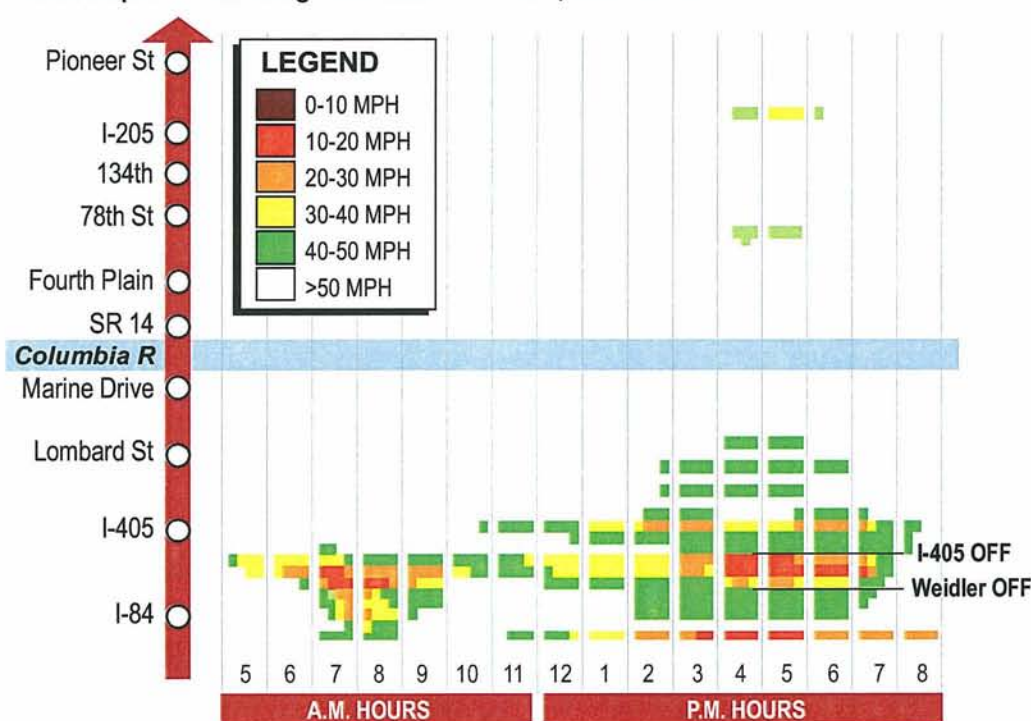
No-Build Alternative to no delay (with a margin of error of 2 hours). This is an estimate, as the model output shows no delay at the I-5 crossing.

Vehicle travel time estimates were developed for peak travel directions. Compared to the No-Build Alternative, Alternative 2 would decrease travel time for southbound trips along I-5 from 179th Street to I-84 during the morning peak by 5 minutes over the 46 minute travel time for the 2030 No-Build Alternative (12 percent). Vehicles traveling northbound along I-5 from I-84 to 179th Street during the afternoon/evening peak would experience a travel time decrease of 18 minutes over the 44 minute travel time for the 2030 No-Build Alternative (40 percent).

Exhibit 3.1-23

Speed Profiles: 5 a.m. to 9 p.m.

2030 Replacement Bridge Alternatives 2 and 3, Northbound



Source: CRC Traffic Technical Report 2008.

#### ALTERNATIVE 2: PEAK TRAFFIC AND PERSON THROUGHPUT

During the four-hour morning peak, southbound vehicle throughput across the I-5 bridge with Alternative 2 is forecast to increase by 2,000 vehicles, an increase of 9 percent, compared to 2030 No-Build conditions of 22,100 vehicles. While the southbound bridge bottleneck would be eliminated with either crossing, recurrent traffic congestion from the downstream bottleneck located just north of the I-405 split would limit the traffic volume served across the I-5 bridge to about 95 percent of demand.

Under No-Build conditions, three southbound ramps in the CRC area would have vehicle back-ups during the four-hour morning peak, while with Alternative 2, all southbound on-ramp traffic demand would be served; this would be due primarily to reduced congestion.



During the four-hour afternoon/evening peak, northbound vehicle throughput across the I-5 bridge with Alternative 2 would increase by 8,100 vehicles (40 percent) compared to 2030 No-Build conditions of 21,000 vehicles. Alternative 2 would remove the northbound bottleneck at the I-5 crossing, resulting in higher vehicle throughput for northbound I-5. The number of northbound on-ramps in the CRC area unable to serve their traffic demand during the afternoon/evening peak would decrease from five under No-Build conditions to two (Mill Plain Boulevard and Fourth Plain Boulevard) with Alternative 2.

With Alternative 2, in the year 2030 about 27,400 persons in southbound vehicles would use the I-5 crossing during the morning peak, an increase of 11 percent over No-Build conditions. With the provision of high-capacity transit, up to 7,550 persons using transit are forecast to cross during this period. In the northbound direction, about 34,400 persons would use the I-5 crossing during the afternoon/evening four-hour peak, an increase of 30 percent over No-Build conditions. With the provision of high-capacity transit, up to 7,250 persons using transit are forecast to cross during this period.

#### ALTERNATIVE 2: LOCAL STREET PERFORMANCE

##### Alternative 2: Vancouver Local Streets

Local street intersection operations would improve system-wide relative to the No-Build Alternative. For example, during the afternoon/evening peak under No-Build conditions, 46 of the 76 local study intersections in Vancouver would operate acceptably. Alternative 2 would improve local street operations, resulting in 67 of 76 intersections operating acceptably.

Alternative 2 would reduce the duration of southbound congestion during the morning peak, which would also reduce congestion on most Vancouver local streets.

Traffic volumes along key east-west local streets between 39th Street and Mill Plain Boulevard would increase by 5 to 15 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Kaufman and P Streets would decrease by up to 30 percent.

Traffic traveling to or from downtown Vancouver on SR 14 would be able to use two access points—one along Columbia Street at Fourth Street and the other along Washington Street. The two access points would support better dispersion of traffic without overloading downtown intersections.

##### Alternative 2: Portland Local Streets

Portland's local street operations would improve system-wide relative to No-Build conditions. For example, during the afternoon/evening peak under No-Build conditions, 18 of 25 local street intersections would operate acceptably. Alternative 2 would add 12 new study intersections (primarily in the Hayden Island and Marine Drive interchange areas) and would result in a total of 35 of 37 intersections operating acceptably.

The increased capacity provided on I-5 under Alternative 2 would draw traffic from nearby parallel roadways back to I-5. Traffic volumes along key east-west local streets between Columbia Boulevard and Going Street would decrease by 5 percent relative to No-Build conditions, while

traffic volumes on key north-south local streets between Greeley Avenue and Martin Luther King Jr. Boulevard would decline by up to 15 percent.

The duration of congestion periods along northbound I-5 during the afternoon/evening peak at the river crossing would decrease from eight hours under No-Build conditions to less than two hours with Alternative 2. This would also reduce congestion on north-south local streets.

#### ALTERNATIVE 2: PEDESTRIANS AND BICYCLES

Alternative 2 would substantially improve pedestrian and bicycle connectivity within the CRC area by providing a continuous grade-separated multi-use pathway from downtown Vancouver to the Marine Drive area, without requiring pedestrian and bicycle users to navigate Hayden Island at-grade.

Alternative 2 includes a multi-use pathway west of and adjacent to the transit guideway. The pathway would be continuous and above-grade from approximately Sixth Street in Vancouver to just north of Marine Drive, then pass under Marine Drive and connect to the Expo Center. The pathway would be a minimum of 16 feet wide between its barriers and could separate pedestrian and bicycle traffic through pavement markings.

Alternative 2 would provide access to Vancouver via a ramp to a roadway in the downtown area. A second potential connection in Vancouver, closer to the Columbia River, would provide access (with an elevator) to waterfront attractions and the multi-use path along the shore. On Hayden Island, the pathway would be accessible via an elevator and stairs located at the high-capacity transit station. In addition, potential stairs at the north and south ends of the island could be provided. Note that Hayden Island access points are being studied as a part of the City of Portland's separate Hayden Island planning efforts.

At the Marine Drive interchange, the multi-use path would have access to the Expo Center transit station and to the 40 Mile Loop trail pathway running along North Portland Harbor. Additional connections to Delta Park and bicycle routes along Union Court and Martin Luther King Jr. Boulevard would be maintained or improved with off-street facilities, ramps and stairs. Bicyclists and pedestrians would be able to cross North Portland Harbor on a new pathway along the high-capacity transit guideway on the west side of I-5. The connections proposed by the CRC project would be coordinated with ongoing planning efforts in Vancouver, Hayden Island and near Marine Drive.

#### ALTERNATIVE 2: TRAFFIC SAFETY AND SECURITY

The replacement river crossing with BRT alternative would address most of the existing non-standard features and remove the lift spans, resulting in substantially improved vehicle and freight safety.

#### ALTERNATIVE 2: TRANSIT RIDERSHIP AND MODE SPLIT

This alternative would include 40 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Fourteen 60-foot, dual-door BRT buses would also operate over the river during the peak hour, in the peak direction. Platform hours of service would increase over No-Build

conditions by approximately 7 percent, from 2,632 to 2,819 hours per weekday.

Alternative 2 would generate 16,800 daily passenger trips on transit over the I-5 crossing and 4,828,000 trips annually. This is an increase of nearly 90 percent over the No-Build Alternative.

Nineteen percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between the Clark County Inner Urban and Oregon markets would be 15 percent, for travel between Clark County Suburban and Oregon markets it would be 13 percent, and for travel between Oregon and Clark County markets it would be 6 percent.

#### **ALTERNATIVE 2: TRANSIT TRAVEL TIMES**

Buses using the transit guideway would travel through the CRC area at an average speed of 14.5 mph. Buses could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/evening peak in 13 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Courthouse MAX station) could make this trip in 43 minutes.

#### **ALTERNATIVE 2: TRANSIT OPERATIONS AND MAINTENANCE COSTS**

With Alternative 2, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of about \$75 million. This compares with a current annual operating cost of nearly \$66 million and \$70 million for the No-Build Alternative.

#### **ALTERNATIVE 2: TRANSIT SAFETY AND SECURITY**

BRT would cross several intersections at grade, where the higher number of transit vehicles associated with this mode would interact with automobile and truck traffic, bicycles, and pedestrians, potentially increasing the risk of collision. The Kiggins Bowl terminus would include fewer at-grade intersections than the Lincoln terminus, potentially improving the risk of collisions involving transit.

Transit security on vehicles and at stations and park and ride lots will also be addressed during the planning, design, construction and operational phases of the project. Station security may be more challenging with the Kiggins Bowl terminus. Stations at Clark College, Rose Village, and Kiggins Bowl would be in the highway right-of-way, an environment that provides less non-transit activity and visibility and may decrease security.

#### **Alternative 3: Replacement Crossing with Light Rail**

This section explains how existing transportation conditions would change if Alternative 3, a replacement crossing with light rail, were selected and constructed. Exhibit 3.1-24 summarizes predicted year 2030 transportation performance under Alternative 3.



Exhibit 3.1-24

**Alternative 3: Replacement Crossing with Light Rail**

<b>Alternative 3: Replacement Crossing with Light Rail</b>				
<b>Metric</b>	<b>Kiggins Bowl Terminus (A) <sup>e</sup></b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C) <sup>d</sup></b>	<b>Mill Plain MOS (D) <sup>d</sup></b>
<b>People over the I-5 Crossing during peak periods<sup>a</sup></b>				
In cars	34,400 (NB)	34,400 (NB)	34,400 (NB)	34,400 (NB)
On transit	7,250 (NB)	7,250 (NB)	7,250 (NB)	7,250 (NB)
<b>Vehicles over the I-5 crossing each weekday</b>	178,000	178,000	179,500	179,500
<b>Hours of congestion per day</b>	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours
<b>Pedestrian and bicycle connections</b>	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.
<b>Transit mode split in p.m. peak<sup>b</sup></b>	22%	21%	19%	23%
<b>Transit travel time from Mill Plain station to Expo Center</b>	7 min	7 min	7 min	7 min
<b>Annual transit operations and maintenance costs (\$million)<sup>c</sup></b>	\$74.0	\$73.3	\$72.7	\$72.6
<b>Traffic safety and security</b>	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.
<b>Transit safety and security</b>	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.

<sup>a</sup> Total number of people in cars and on transit vehicles using the I-5 crossing traveling north during the afternoon/evening peak period.

<sup>b</sup> Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

<sup>c</sup> Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

<sup>d</sup> Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

Alternative 3 would have highway, local street, and bicycle and pedestrian traffic physical improvements similar to those described in detail for Alternative 2.

**ALTERNATIVE 3: TRAFFIC SAFETY AND SECURITY**

Alternative 3 would improve I-5 vehicle safety in the same manner as Alternative 2. Likewise, the trade-offs from transit termini would be the same as those described above for Alternative 2.

**ALTERNATIVE 3: TRANSIT RIDERSHIP AND MODE SPLIT**

This alternative would include 17 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Eight two-car light rail trains would also operate over the river during each peak hour in the peak direction.

Alternative 3 would generate 20,800 daily passenger trips on transit over the I-5 crossing and 6,673,000 trips annually. This is an increase of over 130 percent over the No-Build Alternative.

Twenty-one percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between Clark County Inner Urban and Oregon markets would be 20 percent, for travel between Clark County Suburban and Oregon markets it would be 15 percent, and for travel between Oregon and Clark County markets it would be 8 percent.

**ALTERNATIVE 3: TRANSIT TRAVEL TIMES**

Light rail could travel through the transit guideway at an average speed of 17.3 mph. Light rail trains could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/evening peak in 12 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Square MAX station) could make this trip in 40 minutes, because light rail could make this trip without a transfer at the Expo Center station.

**ALTERNATIVE 3: TRANSIT OPERATIONS AND MAINTENANCE COSTS**

With Alternative 3, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of about \$73 million. This compares with a current annual operating cost of nearly \$66 million and \$70 million for the No-Build Alternative.

**ALTERNATIVE 3: TRANSIT SAFETY AND SECURITY**

Light rail would cross several intersections at grade. Train frequency would generally be fairly low compared to the BRT frequency in Alternative 2, thus potentially reducing the risk of collision with other vehicles. However, because trains have substantial mass, collisions could potentially be severe.

Light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Light rail vehicles using this maintenance facility would not be carrying passengers. The proposed expansion is unlikely to have an adverse effect on safety or security.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

This section explains how existing transportation conditions would change if Alternative 4, a supplemental crossing with bus rapid transit,

were selected and constructed. Exhibit 3.1-25 summarizes predicted year 2030 transportation performance under Alternative 4.

Exhibit 3.1-25

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit</b>				
<b>Metric</b>	<b>Kiggins Bowl Terminus (A) <sup>e</sup></b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C) <sup>d</sup></b>	<b>Mill Plain MOS (D) <sup>d</sup></b>
<b>People over the I-5 Crossing during peak periods<sup>a</sup></b>				
In cars	25,700 (NB)	25,700 (NB)	25,700 (NB)	25,700 (NB)
On transit	5,900 (NB)	5,900 (NB)	5,900 (NB)	5,900 (NB)
<b>Vehicles over the I-5 crossing each weekday</b>	165,000	165,000	166,500	166,500
<b>Hours of congestion per day</b>	10.75 hours	10.75 hours	10.75 hours	10.75 hours
<b>Pedestrian and bicycle connections</b>	Improvements over the river but has at-grade crossings on Hayden Island.	Improvements over the river but has at-grade crossings on Hayden Island.	Improvements over the river but has at-grade crossings on Hayden Island.	Improvements over the river but has at-grade crossings on Hayden Island.
<b>Transit mode split in p.m. peak<sup>b</sup></b>	33%	32%	30%	34%
<b>Transit travel time from Mill Plain station to Expo Center</b>	14 min	14 min	14 min	14 min
<b>Annual transit operations and maintenance costs (\$million)<sup>c</sup></b>	\$114.1	\$114.4	\$114.2	\$114.1
<b>Traffic safety and security</b>	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.
<b>Transit safety and security</b>	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.

<sup>a</sup> Total number of people in cars and on transit vehicles using the I-5 crossing traveling north during the afternoon/evening peak period.

<sup>b</sup> Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

<sup>c</sup> Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

<sup>d</sup> Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

**ALTERNATIVE 4: I-5 AND I-205 TRAFFIC LEVELS**

Alternative 4 would result in 11 hours of congestion at the I-5 river crossing. By 2030, about 165,000 (166,500 with either MOS) vehicles



would use the I-5 river crossing each day, and 219,000 vehicles would use the I-205 crossing. The supplemental crossing with bus rapid transit (BRT) would address some of the existing non-standard features, but would retain the lift spans, resulting in fewer safety improvements. Alternative 4 would increase vehicle delay and queuing at some local street intersections due to a reduction in lane capacity along the guideway. BRT vehicles and local bus service would be allowed to enter and exit the guideway, causing additional delay to local street traffic. Reduced connectivity to the SR 14 interchange would also increase delays for vehicles in the vicinity of lower downtown Vancouver.

With Alternative 4, the 2030 average weekday traffic across the I-5 crossing is expected to be 165,000 vehicles. This is lower than the 184,000 daily vehicle trips predicted under the No-Build Alternative because of the introduction of high-capacity transit and a toll at the I-5 crossing.

However, more traffic would shift to I-205 under this alternative. The daily volume on I-205 would increase from 210,000 vehicles per day under year 2030 No-Build conditions to 219,000 vehicles with Alternative 4, adding to congestion problems on I-205.

#### **ALTERNATIVE 4: TRAFFIC CONGESTION AND TRAVEL TIMES**

Exhibit 3.1-26 portrays estimated year 2030 southbound conditions for Alternatives 4 and 5. As shown, Alternative 4 would reduce the duration of southbound congestion in the vicinity of the I-5 crossing from 7.25 hours to 3.75 hours. Downstream congestion arising along I-5 just north of the I-405 split would continue.

Alternative 4 would decrease travel time for southbound trips during the morning peak by five minutes (12 percent) for trips along I-5 from 179th Street to I-84, compared to the 46-minute travel time for the 2030 No-Build Alternative.

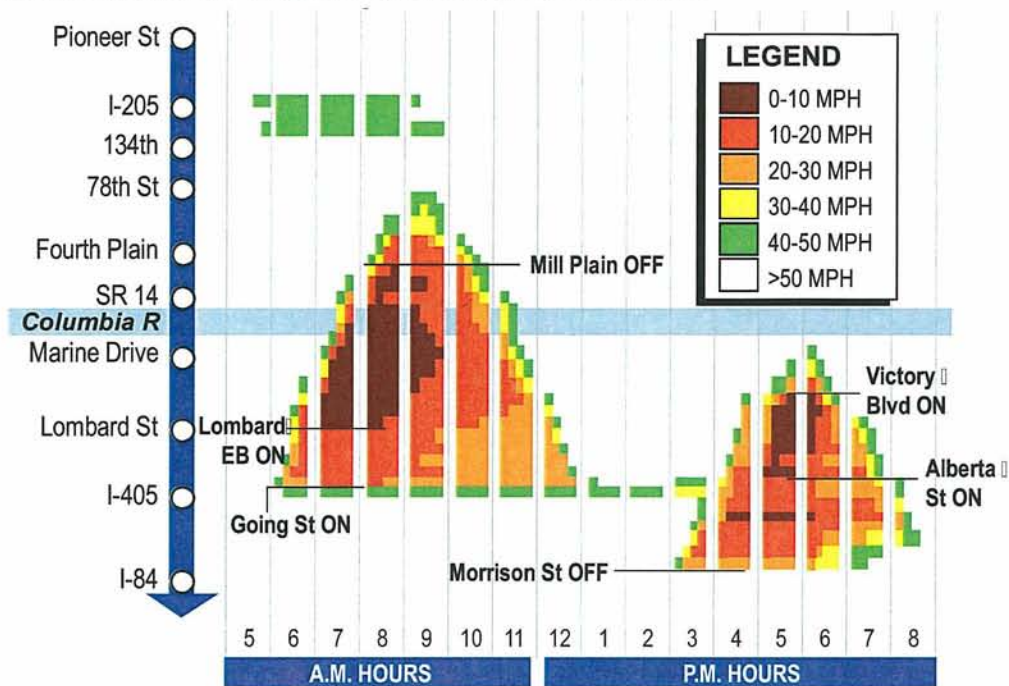
Exhibit 3.1-27 shows estimated year 2030 northbound conditions for Alternatives 4 and 5. As shown, northbound traffic would experience congested conditions on I-5 approaching the crossing. Since Alternative 4 would use both existing bridges for northbound I-5 traffic, travel lanes on I-5 must physically separate or diverge in advance of the two structures, then reconnect where the crossing touches down. This arrangement would require all northbound traffic accessing I-5 from Marine Drive and Hayden Island to use the existing eastern bridge. All northbound traffic on I-5 traveling from south of Marine Drive and destined for SR 14, City Center, Mill Plain Boulevard, or Fourth Plain Boulevard would have to use the eastern bridge.

Due to substantial traffic maneuvers in advance of the I-5 “diverge” point, as well as the high traffic demand for the eastern bridge and the extensive weaving that would result within the eastern travel lanes, vehicular back-ups would result on the eastern bridge and on I-5 downstream of the divergence. Traffic congestion would result in these locations for about seven hours each weekday afternoon/evening.

Exhibit 3.1-26

Speed Profiles: 5 a.m. to 9 p.m.

2030 Supplemental Bridge Alternatives 4 and 5, Southbound

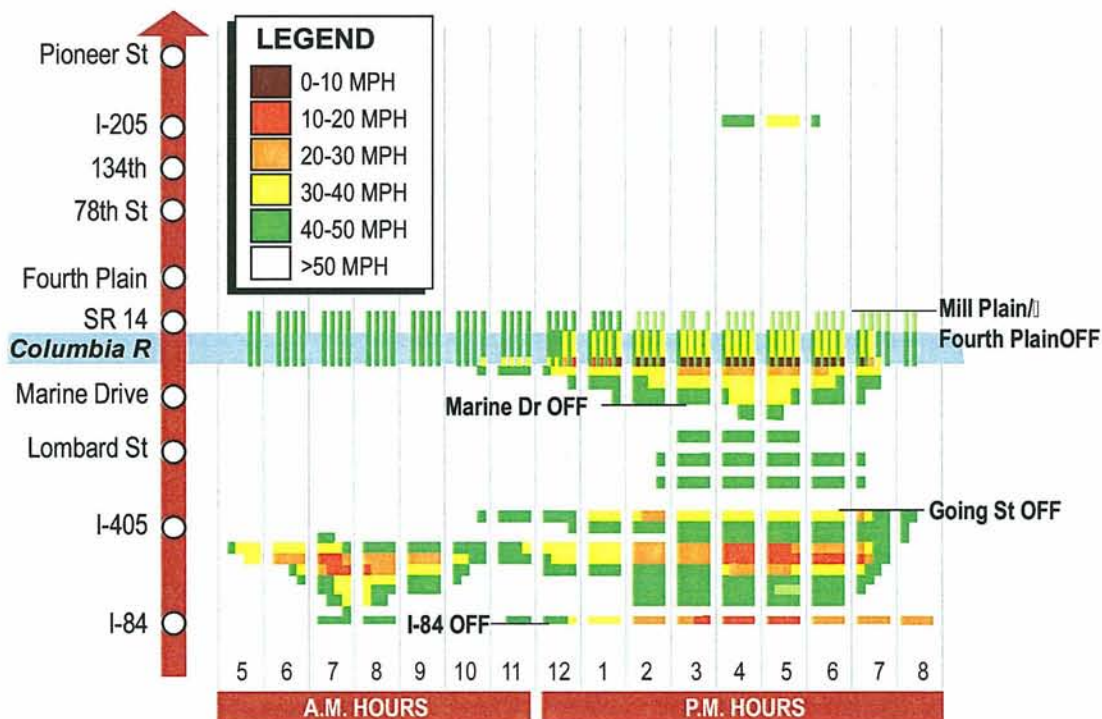


Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-27

Speed Profiles: 5 a.m. to 9 p.m.

2030 Supplemental Bridge Alternatives 4 and 5, Northbound



Source: CRC Traffic Technical Report 2008.

As a side effect of the northbound congestion associated with Alternative 4, only 45 to 55 percent of the traffic demand attempting to access northbound I-5 from the Marine Drive and Hayden Island on-ramps during the afternoon/evening peak would be served. The highway's traffic congestion would limit the number of vehicles that could enter the highway from these locations, resulting in ramp back-ups and local street congestion, as further described below.

Northbound travel times would improve for motorists using the through lanes (western bridge) by about 17 minutes, or 39 percent, compared to 2030 No-Build conditions. However, northbound vehicles using the eastern bridge (those entering the highway from Marine Drive or Hayden Island, and those exiting the highway to SR 14, City Center, Mill Plain Boulevard, and Fourth Plain Boulevard) would experience substantial delays during the seven hours of congestion expected to occur with a supplemental river crossing. Northbound travel times would improve for motorists using the eastern bridge by about 15 minutes, or 34 percent, compared to 2030 No-Build conditions. About half of the afternoon/evening travel demand from Marine Drive and Hayden Island would not be able to access the highway and would experience high delays on the highway ramps and along the local street system. Transit buses would benefit from reduced travel times and greater reliability.

#### ALTERNATIVE 4: PEAK TRAFFIC AND PERSON THROUGHPUT

During the four-hour morning peak, southbound vehicle throughput across the I-5 bridge with Alternative 4 is forecast to increase by 1,200 vehicles (5 percent) over 2030 No-Build conditions of 22,100 vehicles. While the southbound bridge bottleneck would be eliminated, recurrent traffic congestion from the downstream bottleneck located just north of the I-405 split would limit the traffic volume served across the southbound bridge to about 95 percent of demand.

While under No-Build conditions three southbound ramps in the CRC area would have vehicle back-ups during the four-hour morning peak, all southbound on-ramp traffic demand would be served under Alternative 4, primarily due to reduced congestion.

During the afternoon/evening peak, northbound vehicle throughput across the I-5 bridges would increase by 1,100 vehicles (6 percent) over 2030 No-Build conditions of 21,000 vehicles, as the result of the slightly higher capacity of the new four-lane northbound system. However, the separation between travel lanes in advance of, across and downstream of, the two existing bridges, combined with the short on-ramp spacing between Marine Drive and Hayden Island, would result in traffic congestion lasting throughout the day.

Because of the northbound traffic congestion that would result across the existing eastern bridge, at the highway "diverge" point, and downstream of the diverge, only 45 percent of Hayden Island's on-ramp demand would be served during the afternoon/evening peak. Only 55 percent of Marine Drive's on-ramp demand would be able to access northbound I-5. This would result in back-ups along the ramps and on the adjacent local street systems.

For Alternative 4, about 26,400 persons in southbound vehicles would cross during the morning peak, an increase of 7 percent over No-Build



conditions. Up to 8,450 persons would use transit during this period. Due to the level of congestion that would be experienced at the I-5 river crossing with Alternative 4, about 25,700 persons in northbound vehicles would cross during the afternoon/evening four-hour peak, an increase of 5 percent compared to No-Build conditions. However, up to 7,350 persons using transit would cross during this period.

#### ALTERNATIVE 4: LOCAL STREET PERFORMANCE

##### Alternative 4: Vancouver Local Streets

Since Alternative 4 would reduce the duration of southbound congestion during the morning peak, the duration of congestion on most local Vancouver streets would also decline.

Increased capacity provided on I-5 would draw some traffic from nearby roadways back to I-5. Traffic volumes along key east-west local streets between 39th Street and Mill Plain Boulevard would increase by 5 to 15 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Kaufman and P Streets would decrease by up to 30 percent.

For Alternative 4, only the Columbia Street intersection connection would be feasible for inbound SR 14 traffic to access downtown Vancouver. An additional 800 vehicle trips per hour would access Columbia Street during the morning peak, resulting in local street congestion and intersection failures in lower Vancouver.

For Alternative 4, only the Columbia Street intersection would be feasible for outbound SR 14 traffic from downtown Vancouver. An additional 800 vehicles per hour would try to use Columbia Street during the afternoon/evening peak, resulting in local street congestion and intersection failures in lower Vancouver. About 10 additional intersections in lower downtown Vancouver would experience level-of-service or vehicle queuing deficiencies.

This alternative would increase the frequency of bus service compared to Alternative 2. Increasing the frequency of buses would moderately increase delays for local traffic on cross streets of the transit guideway.

##### Alternative 4: Portland Local Streets

The increased capacity provided on I-5 under Alternative 4 would draw traffic from nearby parallel roadways back to I-5. Traffic volumes along key east-west local streets between Columbia Boulevard and Going Street would decrease by 5 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Greeley Avenue and Martin Luther King Jr. Boulevard would decline by up to 15 percent.

For Alternative 4, northbound traffic congestion near the crossing would decrease from eight hours under No-Build conditions to seven hours. Because of northbound traffic backups with Alternative 4, congestion would occur at I-5 interchange ramps (at Marine Drive and Hayden Island) and on local streets in the vicinity of these interchanges.

Alternative 4 would improve local street intersection operations in the north Portland and Victory subareas, but would degrade intersection operations in the Marine Drive and Hayden Island areas. Alternative 4 would add 12 new study intersections, but during the afternoon/evening

peak only 29 of 37 would operate acceptably, compared to 18 of 25 intersections operating acceptably under No-Build conditions.

#### ALTERNATIVE 4: PEDESTRIANS AND BICYCLISTS

Alternative 4 would substantially improve pedestrian and bicycle connectivity within the CRC area, although it would continue to require users traveling across Hayden Island to navigate at-grade streets and intersections. Alternative 4 was evaluated with a widened sidewalk on the existing eastern bridge in order to accommodate both pedestrians and bicyclists in a safe manner. Ramps would connect this widened pathway with Columbia Way in Vancouver and with Tomahawk Island Drive on Hayden Island. An above-grade multi-use pathway on the western bridge would connect Tomahawk Island Drive and Marine Drive. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through at-grade intersections.

Today, pedestrians and bicyclists cross North Portland Harbor on a multi-use pathway on the east side of the harbor bridge. The proposed crossing for Alternative 4 would remove access at this location and require users to access the new pathway along the high-capacity transit alignment. Once on Hayden Island, the new pathway would require additional time for users to access the proposed pathway on the east side of the east bridge over the Columbia River. Connections to the crossing would require that pedestrians and bicyclists leave the grade-separated pathway and drop down to Hayden Island, then travel on sidewalks before they could access the southern end of the new cantilevered pathway on the existing northbound I-5 bridge. A potential mitigation measure to alleviate some of this circuitous routing would be to construct a pedestrian pathway on the east side of the harbor bridge.

#### ALTERNATIVE 4: TRAFFIC SAFETY AND SECURITY

The supplemental river crossing with BRT alternative would address some of the existing non-standard features and add new mainline merge and diverge areas, but would retain the existing bridges for northbound Interstate traffic, resulting in fewer safety improvements.

#### ALTERNATIVE 4: TRANSIT RIDERSHIP AND MODE SPLIT

Since Alternative 4 includes Increased transit operations, it would provide very frequent bus service, with 43 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Twenty-four 60-foot dual door rapid transit buses would cross the river during each peak hour in the peak direction.

Alternative 4 would generate 19,800 daily passenger trips using transit over the I-5 crossing and 5,701,000 such trips annually. This is an increase of 125 percent over the No-Build Alternative.

Thirty-three percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between Clark County Inner Urban and Oregon markets would be 18 percent, for travel between Clark County Suburban and Oregon markets it would be 15 percent, and for travel between Oregon and Clark County markets it would be 8 percent.

**ALTERNATIVE 4: TRANSIT TRAVEL TIMES**

Buses using the transit guideway would travel through the CRC area at an average speed of 13.1 mph. Buses could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/evening peak in 19 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Square MAX station) could make this trip in 48 minutes.

**ALTERNATIVE 4: TRANSIT OPERATIONS AND MAINTENANCE COSTS**

With Alternative 4, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of \$114 million. Increased transit operations packaged with this alternative would require substantially more operating and maintenance costs than the No-Build Alternative, which would cost \$70 million.

**ALTERNATIVE 4: TRANSIT SAFETY AND SECURITY**

BRT would cross several intersections at grade, and the very high number of transit vehicles associated with the Increased transit operations provided by this alternative, would interact with automobile and truck traffic, bicycles, and pedestrians, potentially increasing the risk of collision. The Kiggins Bowl terminus would include fewer at-grade intersections than the Lincoln terminus, potentially improving the risk of collisions involving transit. Transit security on vehicles and at stations and park and ride lots is also addressed during the planning, design, construction and operational phases of the project. Station security may be more challenging with the Kiggins Bowl terminus. Stations at Clark College, Rose Village, and Kiggins Bowl would be in the highway right-of-way, an environment that provides less non-transit activity and visibility and may decrease security.

**Alternative 5: Replacement Crossing with Light Rail**

This section explains how existing transportation conditions would change if Alternative 5, a supplemental crossing with light rail, were selected and constructed. Exhibit 3.1-28 summarizes predicted year 2030 transportation performance under Alternative 5.



Exhibit 3.1-28

**Alternative 5: Supplemental Crossing with Light Rail**

<b>Alternative 5: Supplemental Crossing with Light Rail</b>				
<b>Metric</b>	<b>Kiggins Bowl Terminus (A) <sup>a</sup></b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C) <sup>d</sup></b>	<b>Mill Plain MOS (D) <sup>d</sup></b>
<b>People over the I-5 Crossing during peak periods<sup>a</sup></b>				
In cars	25,700 (NB)	25,700 (NB)	25,700 (NB)	25,700 (NB)
On transit	7,350 (NB)	7,350 (NB)	7,350 (NB)	7,350 (NB)
<b>Vehicles over the I-5 crossing each weekday</b>	165,000	165,000	166,500	166,500
<b>Hours of congestion per day</b>	10.75 hours	10.75 hours	10.75 hours	10.75 hours
<b>Pedestrian and bicycle connections</b>	Improvements but has at-grade crossings on Hayden Island.	Improvements but has at-grade crossings on Hayden Island.	Improvements but has at-grade crossings on Hayden Island.	Improvements but has at-grade crossings on Hayden Island.
<b>Transit mode split in p.m. peak<sup>b</sup></b>	37%	36%	34%	38%
<b>Transit travel time from Mill Plain station to Expo Center</b>	8 min	8 min	8 min	8 min
<b>Annual transit operations and maintenance costs (\$ million)<sup>c</sup></b>	\$106.5	\$105.5	\$104.7	\$104.5
<b>Traffic safety and security</b>	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.
<b>Transit safety and security</b>	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.

<sup>a</sup> Total number of people in cars and on transit vehicles using the I-5 crossing traveling north during the afternoon/evening peak period.

<sup>b</sup> Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

<sup>c</sup> Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

<sup>d</sup> Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

Alternative 5 would have highway, local street, and bicycle and pedestrian traffic improvements similar to those described for Alternative 4.

**ALTERNATIVE 5: TRAFFIC SAFETY AND SECURITY**

Alternative 5 would improve I-5 vehicle safety and aviation and navigation safety and efficiency in the same manner as Alternative 4.

Likewise, the trade-offs from transit termini would be the same as those described above.

#### **ALTERNATIVE 5: TRANSIT RIDERSHIP AND MODE SPLIT**

Since Alternative 5 includes Increased transit operations, it would include more buses and trains operating within the CRC area. This alternative would include 20 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Ten two-car light rail trains would also operate over the river during each peak hour in the peak direction.

Alternative 5 would generate 23,100 daily passenger trips using transit over the I-5 crossing and 7,411,000 such trips annually. This is an increase of more than 160 percent over the No-Build Alternative.

Thirty-seven percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between Clark County Inner Urban and Oregon markets would be 22 percent, for travel between Clark County Suburban and Oregon markets it would be 16 percent, and for travel between Oregon and Clark County markets it would be 10 percent.

#### **ALTERNATIVE 5: TRANSIT TRAVEL TIMES**

Light rail trains could travel through the transit guideway at an average speed of 17.3 mph. Light rail trains could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/evening peak in 12 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Square MAX station) could make this trip in 40 minutes.

#### **ALTERNATIVE 5: TRANSIT OPERATIONS AND MAINTENANCE COSTS**

With Alternative 5, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of \$106 million. The Increased transit operations packaged with this alternative would require substantially more operating and maintenance costs than the No-Build Alternative, which would cost \$70 million.

#### **ALTERNATIVE 5: TRANSIT SAFETY AND SECURITY**

Light rail would cross several intersections at grade. Train frequency would generally be fairly low compared to the BRT frequency in Alternative 4, and thus potentially reducing the risk of collision with other vehicles. However, because trains have substantial mass, collisions could potentially be severe.

Light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Light rail vehicles using this maintenance facility would not be carrying passengers. The proposed expansion is unlikely to have an adverse effect on safety or security.

### **3.1.4 Long-term Effects from Project Components**

This section describes the transportation effects of the project components that are part of the CRC alternatives. Each component that

affects transportation performance is discussed below in terms of the same performance metrics used for alternatives in the previous section.

### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The river crossing type influences all metrics for traffic performance and for bicycle and pedestrian connections. For transit, the river crossing only has a substantial influence on transit operating and maintenance costs.

#### MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: I-5 AND I-205 TRAFFIC LEVELS

The performance results described in this section assume that tolling would be included in the CRC project and that it would be collected at the I-5 crossing using an electronic toll collection system, as described in Chapter 2.

As shown in Exhibit 3.1-29, with the replacement crossing, the 2030 average weekday traffic across the I-5 crossing is expected to be 178,000 vehicles. For the supplemental crossing, the average daily traffic is estimated to be 165,000 vehicles. Both these volumes are lower than the 184,000 daily vehicle trips expected under No-Build conditions, because providing high-capacity transit and charging tolls would reduce vehicle trips.

The supplemental crossing would carry less traffic than the replacement crossing because it has less capacity. However, more traffic would shift to I-205 with the supplemental crossing. The daily volumes on I-205 would increase from 210,000 vehicles per day under No-Build conditions to 219,000 vehicles with the supplemental crossing and 213,000 vehicles with the replacement option, adding to congestion problems on I-205.

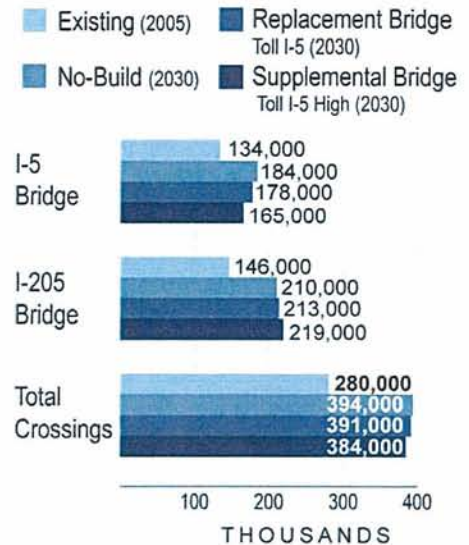
#### MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRAFFIC CONGESTION AND TRAVEL TIMES

Illustrated profiles of traffic congestion based on travel speeds were developed for the replacement and supplemental crossings. Exhibits 3.1-22 and 3.1-26 (earlier in this section) portray estimated year 2030 southbound conditions for the replacement and supplemental crossings, respectively.

As shown in Exhibit 3.1-30, the replacement bridge would reduce the duration of southbound congestion in the vicinity of the I-5 crossing from 7.25 hours to 3.5 hours. Southbound traffic queues would no longer extend beyond Fourth Plain Boulevard for multiple hours each day. The traffic congestion remaining at the crossing would result from the existing downstream bottleneck on I-5 north of the I-405 split. The replacement crossing would not exacerbate or worsen this existing bottleneck, although the associated improvements would enable an increase in vehicle throughput of about 6 percent along I-5 just north of I-405.

Southbound traffic conditions would be similar to those for the supplemental crossing, as shown in Exhibit 3.1-30. The supplemental crossing would reduce the duration of southbound

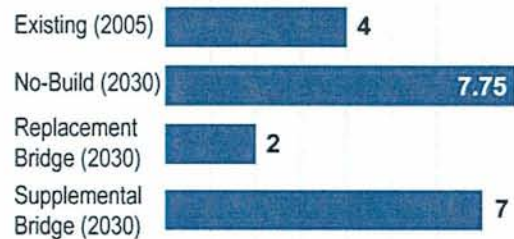
Exhibit 3.1-29  
Columbia River Crossing  
Vehicle Trip Comparison



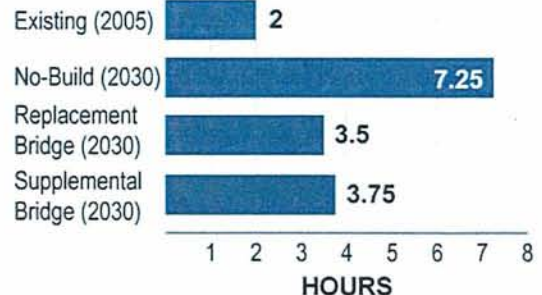
Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-30  
Hours of Congestion

#### Daily Northbound Congestion Hours of Congestion at the I-5 Bridge



#### Daily Southbound Congestion Hours of Congestion at the I-5 Bridge



Source: CRC Traffic Technical Report 2008.



congestion in the vicinity of the I-5 crossing from 7.25 hours to 3.75 hours. Downstream congestion arising along I-5 just north of the I-405 split would continue.

Exhibits 3.1-23 and 3.1-27 (earlier in this section) show estimated year 2030 northbound conditions for the replacement and supplemental crossings. The replacement crossing would eliminate the northbound I-5 crossing bottleneck. Northbound traffic queues would no longer extend to I-405 for multiple hours each day. The replacement crossing would reduce the duration of congestion at the I-5 crossing from 7.75 hours to less than 2 hours each day.

As shown in Exhibit 3.1-27, northbound traffic would experience congested traffic conditions on I-5 approaching the supplemental crossing. Since the supplemental crossing uses both existing bridges for northbound I-5 traffic, travel lanes on I-5 must physically separate or diverge in advance of the two structures and then reconnect where the crossing touches down. This arrangement would require all northbound traffic accessing I-5 from Marine Drive and Hayden Island to use the existing eastern bridge. In addition, all northbound traffic on I-5 traveling from south of Marine Drive to SR 14, City Center, Mill Plain Boulevard, or Fourth Plain Boulevard would have to use the eastern bridge.

Due to substantial traffic maneuvers as traffic approaches the I-5 “diverge” point, as well as the high traffic demand for the eastern bridge and the extensive weaving that would result in the eastern travel lanes, vehicular back-ups would result on the eastern bridge and on I-5 downstream of the divergence. These locations would be congested about seven hours each weekday afternoon/evening.

As a side effect of the northbound congestion associated with the supplemental crossing, only 45 to 55 percent of the traffic demand attempting to access northbound I-5 from the Marine Drive and Hayden Island on-ramps during the afternoon/evening peak would be served. The highway’s traffic congestion would limit the number of vehicles that could enter the highway from these locations, resulting in ramp back-ups and local street congestion, as further described below.

Vehicle travel time estimates were developed for peak travel directions. Compared to the No-Build Alternative, the replacement and supplemental crossings would decrease travel time for southbound trips during the morning peak by five minutes, or 12 percent, for trips along I-5 from 179th Street to I-84.

Under the replacement crossing, vehicles traveling northbound along I-5 from I-84 to 179th Street during the afternoon/evening peak would experience a travel time decrease of 18 minutes, or 40 percent, compared to No-Build conditions.

For the supplemental crossing, northbound travel times would improve for motorists using the through lanes (i.e., the western northbound bridge) by about 15 minutes, or 34 percent, compared to No-Build conditions. However, due to the seven hours of congestion expected to occur on the eastern northbound bridge, northbound vehicles using the eastern bridge (those entering the highway at Marine Drive or Hayden Island, and those exiting the highway at SR 14, City Center, Mill Plain

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Reconfiguration of the existing bridges under the supplemental crossing alternatives, requiring a split in northbound I-5, would result in seven hours of daily congestion, one hour less than No-Build conditions.

Boulevard, or Fourth Plain Boulevard) would experience substantial delays. Northbound travel times would improve for motorists using the eastern bridge by about 15 minutes, or 34 percent, compared to 2030 No-Build conditions. About half of the afternoon/evening travel demand from Marine Drive and Hayden Island would not be able to access the highway and would experience high delays on the highway ramps and along the local street system.

#### MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: MANAGED LANES

Managed lanes are a fairly common feature on major highways in large metropolitan areas. In contrast with general purpose lanes open to all users, managed lanes are for preferential or exclusive use and are most often reserved for high-occupancy vehicles (HOVs). On some highways, managed lanes can be used by motorcyclists and certain hybrid vehicles. Some areas of the country are experimenting with truck-only managed lanes.

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Managed lanes on I-5 in the CRC area would not offer sufficient operational benefit.

Managed lanes are intended to save time for bus riders, carpoolers, and motorcyclists by enabling them to bypass areas of traffic congestion. Managed lanes increase highway efficiency by moving more people in fewer vehicles than full, general purpose lanes. These lanes allow more reliable highway travel times and help carpools and buses stick to their schedules. Managed lanes reduce single-occupant vehicle trips, overall highway demand, and the burden on the environment from greenhouse gas emissions. Managed lanes are a crucial component of sustainable transportation alternatives to solo driving.

On I-5 a managed lane exists northbound between Going Street and Marine Drive. The 3.2-mile lane is reserved for high-occupancy vehicle (HOV) use between 3 p.m. and 6 p.m. on weekdays. During this three-hour period, only vehicles with two or more people, buses, and motorcyclists are allowed to use the lane.

The No-Build, replacement, and supplemental crossing alternatives all assume that this HOV lane, the majority of which is located south of the project area, would remain in place through the year 2030.

Including managed lanes on I-5 within the CRC area would not offer operational benefits for most users, including carpools or trucks. This is due to a number of factors.

- Because of the substantial amount of traffic entering from on-ramps or exiting to off-ramps within the project area, many users would not be inclined to navigate to and from a managed lane located to the inside of the highway.
- A managed lane for southbound users would transition into a general purpose lane just south of the CRC area, but traffic is expected to back up in that general purpose lane throughout most of the morning peak period, which would cause congestion and back-ups within the managed lane.
- A managed lane for northbound users would not offer enough time savings to be effective. For example, under the replacement crossing all of the general purpose lanes are forecast to operate at nearly free-flow conditions, with less than two hours congestion.

For the above reasons, it is likely that only a small portion of all HOV-eligible users would use an inside managed lane along I-5 within the CRC area. If managed lanes were positioned to be the outside lanes on the highway instead of the inside lanes, the substantial volumes of traffic entering from on-ramps and/or exiting to off-ramps within the CRC area would create congestion and conflicts with managed lane users.

While managed lanes would not offer operational benefits for most users in the project area, the replacement crossing could be flexible enough to allow future managed lanes within the project area to connect with a potential system-wide network of managed lanes north and south of the CRC area (e.g., between 179th Street and I-405).

#### MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: PEAK TRAFFIC AND PERSON THROUGHPUT

The replacement crossing would provide greater throughput than the supplemental crossing.

During the four-hour morning peak, southbound vehicle throughput on the I-5 crossing under the replacement and supplemental crossings is forecast to increase by 2,000 vehicles (9 percent) and 1,200 vehicles (5 percent) respectively, compared to No-Build conditions. While the southbound bridge bottleneck would be eliminated with either crossing, recurrent traffic congestion from the downstream bottleneck located just north of the I-405 split would limit the traffic volume served across the I-5 bridge to about 95 percent of demand for either crossing.

During the four-hour afternoon/evening peak, northbound vehicle throughput across the replacement crossing would increase by 8,100 vehicles (40 percent) compared to No-Build conditions. The replacement crossing would remove the northbound bottleneck at the I-5 bridge, resulting in higher vehicle throughput for northbound I-5. With a supplemental crossing during the afternoon/evening peak, northbound vehicle throughput across the I-5 bridge would increase by 1,100 vehicles (6 percent) compared to No-Build conditions, as the result of the slightly higher capacity of the new four-lane northbound system. However, the separation of northbound travel lanes using the two existing bridges, combined with the short on-ramp spacing between Marine Drive and Hayden Island, would result in traffic congestion lasting throughout the day. This congestion would result in substantial delays and queuing around the Hayden Island and Marine Drive interchanges.

#### MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: LOCAL STREET PERFORMANCE

The river crossing choice principally influences local street traffic around the SR 14/City Center, Hayden Island, and Marine Drive interchanges.

##### Multimodal River Crossing and Highway Improvements: Vancouver Local Streets

Since both river crossing types would reduce the duration of southbound congestion during the morning peak, the duration of congestion on most local Vancouver streets would also decline.

The increased capacity provided on I-5 by either crossing would draw similar traffic levels from nearby roadways back to I-5. Traffic volumes along key east-west local streets between 39th Street and Mill Plain



Boulevard would increase by 5 to 15 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Kaufman and P Streets would decrease by up to 30 percent.

With a replacement crossing, inbound SR 14 traffic to downtown Vancouver would be able to use two access points—one along Columbia Street at Fourth Street and the other along Washington Street. The two access points would support better dispersion of traffic without overloading downtown intersections. For the supplemental crossing, only the Columbia Street intersection connection would be feasible. An additional 800 vehicle trips per hour would access Columbia Street during the morning peak, resulting in local street congestion and intersection failures in lower Vancouver.

The replacement crossing would enable outbound SR 14 traffic from downtown Vancouver to use two access points—one along Columbia Street at Fourth Street and the other along Main Street at Fifth Street. For the supplemental crossing, only the Columbia Street intersection would be feasible. An additional 800 vehicles per hour would try to use Columbia Street during the afternoon/evening peak, resulting in local street congestion and intersection failures in lower Vancouver.

With a replacement crossing, local street intersection operations would improve system-wide relative to the No-Build Alternative. For example, during the afternoon/evening peak under No-Build conditions, 46 of the 76 local study intersections would operate acceptably in Vancouver. The replacement bridge would improve local street operations, resulting in 67 of 76 intersections operating acceptably.

A supplemental crossing would result in local street performance similar to that with a replacement crossing, with the exception of the local street congestion and intersection failures in lower downtown Vancouver as a result of limited SR 14 connections. With a supplemental crossing, about 10 additional intersections in lower downtown Vancouver would experience level-of-service or vehicle queuing deficiencies, compared to the replacement crossing.

#### Multimodal River Crossing and Highway Improvements: Portland Local Streets

There are three options being considered for the Marine Drive interchange, as discussed and illustrated in Chapter 2. Because Marine Drive is heavily used by trucks, the effect of the design of this interchange is critical to truck traffic.

Maintaining the existing Marine Drive interchange location would allow trucks to continue to operate at 45 mph with good sight and stopping distances.

The southern realignment option would realign Marine Drive south of the Expo Center, reducing sight and stopping distances and requiring trucks to slow to below the existing 45 mph speed. However, this realignment would move the Marine Drive interchange farther south and increase the distance to the Hayden Island interchange, allowing more space for vehicles to merge onto and off of the freeway. This extra distance is particularly important for trucks.

The diagonal realignment option would slightly decrease sight and stopping distances, but much less so than a southern realignment. This diagonal realignment would not improve (increase) distances between the Marine Drive and Hayden Island interchanges, as would the southern realignment.

The increased capacity provided on I-5 under all build alternatives would draw similar traffic levels from nearby parallel roadways back to I-5. Traffic volumes along key east-west local streets between Columbia Boulevard and Going Street would decrease by 5 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Greeley Avenue and Martin Luther King Jr. Boulevard would decline by up to 15 percent.

The duration of congestion along northbound I-5 at the river crossing during the afternoon/evening peak would decrease from eight hours under No-Build conditions to two hours with a replacement crossing. This would also reduce north-south congestion on local streets.

For the supplemental crossing, northbound traffic congestion near the bridge would decrease from eight hours under No-Build conditions to seven hours, as discussed earlier. Because of northbound traffic back-ups under the supplemental crossing, about 50 percent of the traffic demand to northbound I-5 from Hayden Island and Marine Drive and Hayden Island would go unserved, resulting in congested ramp terminals and local streets in the vicinity of these interchanges.

The replacement crossing would include auxiliary lanes directly connecting Hayden Island and Marine Drive, but the supplemental crossing would not. With a supplemental crossing, all vehicle trips between Hayden Island and Marine Drive would need to travel on I-5 to either Vancouver or Victory Boulevard and turn around. This would add traffic to I-5 and local intersections, further affecting traffic operations.

Portland's local street operations would improve system-wide under the replacement crossing relative to No-Build conditions. For example, during the afternoon/evening peak under No-Build conditions 18 of 25 local street intersections would operate acceptably. The replacement bridge would add 12 new study intersections (primarily in the Hayden Island and Marine Drive interchange areas) and would result in a total of 35 of 37 intersections operating acceptably.

The supplemental crossing would improve local street intersection operations in the North Portland and Victory subareas, but would degrade intersection operations in the Marine Drive and Hayden Island areas. During the afternoon/evening peak, 18 of 25 local street intersections would operate acceptably under No-Build conditions. The supplemental crossing would add 12 new study intersections, but only 29 of 37 would operate acceptably.

#### MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: PEDESTRIANS AND BICYCLISTS

The replacement crossing was evaluated with a multi-use pathway west of and adjacent to the transit guideway. As discussed in Chapter 2, pathways could be located on both sides of the river crossing. The pathway would be continuous and above-grade from approximately Sixth

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With a replacement river crossing, 35 of 37 study intersections would operate acceptably in Portland during the afternoon/evening peak period.

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With a supplemental river crossing, 29 of 37 study intersections would operate acceptably in Portland during the afternoon/evening peak period.

Street in Vancouver to just north of Marine Drive. It would pass under Marine Drive and connect to the Expo Center. The pathway would be a minimum of 16 feet wide between its barriers and could separate pedestrian and bicycle traffic through pavement markings.

The replacement crossing would provide access to Vancouver via a ramp to a roadway in the downtown area. A second potential connection in Vancouver, closer to the Columbia River, would provide access to waterfront attractions and the multi-use path along the shore with an elevator. On Hayden Island, the pathway would be accessible via an elevator and stairs located at the high-capacity transit station. In addition, potential stairs at the north and south ends of the island could be provided. Note that Hayden Island access points are being studied as a part of the City of Portland's separate Hayden Island planning efforts.

At the Marine Drive interchange, the multi-use path would have access to the Expo Center transit station and to the 40-Mile Loop trail running along North Portland Harbor. Additional connections to Delta Park and bicycle routes along Union Court and Martin Luther King Jr. Boulevard would be maintained or improved with off-street facilities, ramps and stairs. The connections proposed by the CRC project would be coordinated with ongoing planning efforts that affect Vancouver, Hayden Island and the Marine Drive area.

Today, pedestrians and bicyclists cross North Portland Harbor on a multi-use pathway on the east side of the harbor bridge. The proposed crossing for the replacement bridge would remove access at this location and require users to travel out of direction to access the new pathway along the high-capacity transit alignment. A potential mitigation measure to alleviate this circuitous routing would be to construct a pedestrian pathway on the east side of the harbor bridge. In addition, a longer-range measure to install a pedestrian sidewalk on the east side of the eastern span of the replacement crossing could be considered.

The supplemental crossing was evaluated with a widened sidewalk on the existing eastern bridge in order to accommodate both pedestrians and bicyclists in a safe manner. Ramps would connect this widened pathway with Columbia Way in Vancouver and with Tomahawk Island Drive on Hayden Island. An above-grade multi-use pathway on the western bridge would connect Tomahawk Island Drive and Marine Drive. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through at-grade intersections.

Today, pedestrians and bicyclists cross North Portland Harbor on a multi-use pathway on the east side of the harbor bridge. The supplemental river crossing would remove access at this location and require users to travel out of direction to access the new pathway along the high-capacity transit guideway. Once on Hayden Island, the new pathway would require additional time for users to access the proposed pathway on the east side of the east bridge over the Columbia River. Connections to the bridge would require that pedestrians and bicyclists leave the high-capacity transit guideway pathway and drop down to Hayden Island, then travel on sidewalks before they could access the southern end of the new, cantilevered pathway on the existing northbound I-5 bridge. As with the replacement crossing, a potential



mitigation measure to alleviate some of the circuitous routing would be to construct a pedestrian pathway on the east side of the harbor bridge. A longer-range measure to help avoid these issues would be a new cantilevered pathway on the west side of the existing southbound bridge.

The stacked transit/highway bridge design for the replacement crossing would accommodate transit beneath the highway deck of the new western bridge and place the multi-use pathway under the northbound bridge. As with the supplemental crossing, ramps to the east of I-5 would connect the pathway to Columbia Way in Vancouver and Tomahawk Island Drive on Hayden Island. An above-grade multi-use pathway would be provided west of I-5, alongside the high-capacity transit guideway between Tomahawk Island Drive and Marine Drive. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through at-grade intersections.

Alternatively, the stacked transit/highway bridge design could locate the pathway under the traffic deck of the southbound bridge. This would enable a more direct pathway similar to that proposed under the replacement crossing standard design. Further evaluation would be required to determine if this option is feasible due to potential bridge loading issues with highway and transit loads combined on one structure. Suspending the pathway under an edge of a bridge would shorten connections, as the pathway's elevation would be lower than the roadway deck.

For all build alternatives, connections consisting of ramps, stairs, or elevators would connect with existing and planned sidewalks and pathways in Vancouver, Hayden Island, and near Marine Drive. The connections would be coordinated with ongoing planning in those areas and would be ADA compliant.

#### MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRAFFIC SAFETY AND SECURITY

The replacement crossing would substantially improve traffic safety within the CRC area, eliminating the lift span and most of the non-standard design features for the I-5 mainline and ramps. In contrast, the supplemental crossing would result in substantial northbound congestion at the bridgehead, increasing the likelihood of collisions compared to the replacement crossing.

The supplemental crossing would not provide the same level of safety benefits as the replacement crossing. It would address some of the existing non-standard geometric and safety design elements by including highway and interchange enhancements affecting southbound I-5. However, it would not eliminate bridge lifts for northbound traffic or non-standard ramp features such as short merging and diverging areas for northbound traffic.

The supplemental crossing would create a northbound mainline "diverge" point near Marine Drive, which is an atypical design and would result in traffic turbulence and weaving for both passenger vehicles and trucks at and in advance of the divergence.

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The replacement crossing would substantially improve traffic safety compared to the supplemental crossing.

## MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRANSIT OPERATIONS AND MAINTENANCE COSTS

The average annual operating cost of the replacement crossing would be \$50,000, whereas a supplemental crossing would require, on average, about \$750,000 each year to operate and maintain the structures. These costs are for all bridges included in each crossing, so they would be spread between both highway and transit elements of the project. The substantially lower cost to operate the replacement crossing would reduce the overall cost of operating the transit element of this project and improve the transit cost-effectiveness.

A replacement crossing could further reduce transit costs. After the DEIS is issued, a bridge type study will evaluate multiple bridge types, including a Stacked Transit/Highway Bridge (STHB) design. The STHB design has the potential to reduce cost because it would allow high-capacity transit to operate on a shared bridge with highway traffic. This would eliminate the need for a third bridge to carry transit, bicyclists and pedestrians, potentially reducing construction costs and improving the overall cost effectiveness for the transit element of this project.

## MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRANSIT SAFETY AND SECURITY

Transit would be placed on a new bridge with either crossing and so would be unaffected by bridge lifts retained by the supplemental crossing. Thus, there is no difference in transit safety or security between crossing alternatives. For transit, one configuration is not inherently safer than the other.

With the shared transit/highway bridge design for the replacement crossing, transit would be placed the lower level of the bridge inside the structural elements supporting the traffic deck. There is a potential that if an event should damage one level (such as an explosion that potentially affected the structural integrity of the bridge), the other level would sustain damage more easily than if the traffic and transit crossings were placed on separate structures.

## Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

The selection of BRT or light rail does not have a substantial effect on I-5 crossing traffic performance or bicycle and pedestrian connections. Transit mode does have important effects on local traffic and, of course, on transit performance.

### TRANSIT MODE: LOCAL STREET PERFORMANCE

#### Transit Mode: Vancouver Local Streets

In Vancouver, local street performance would degrade on streets where light rail trains receive traffic signal pre-emption. Signal pre-emption would increase delays for motor vehicles crossing the light rail guideway. BRT would not have traffic signal pre-emption (with three to five times more buses using the transit guideway than light rail trains, traffic signal pre-emption for buses would result in substantial traffic congestion on Vancouver's local streets). However, due to the added buses, bus "bunching" would likely occur, resulting in some congestion on streets in downtown Vancouver.

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All numbers and discussion in the Transit Mode section are for Efficient transit operations. Increased transit operations would change the value of some data in this section, but the relationship between BRT and light rail would generally be similar. The Efficient and Increased transit operating options are compared later in a separate section.

Transit Mode: Portland Local Streets

Neither mode would cause local street traffic impacts in Portland north of the Expo Center station, because the guideway would be elevated. South of the Expo Center station, either transit mode would increase the number of peak trains operating along the existing MAX Yellow Line from 10 trains per hour to 16 trains per hour with Efficient operations. Increased transit operations would increase the number to 20 trains per hour.

The traffic effects of an increased number of trains would be limited to local streets along the Interstate Avenue corridor. Because trains receive traffic signal priority at signalized intersections, pre-empting vehicular traffic traveling on cross-streets, an increase in the number of trains would increase vehicle delays. Additional impacts would result under Increased transit operations. In the Rose Quarter/Steel Bridge area in Portland, adding light rail vehicles may require modifications to signals, street geometry, or traffic and pedestrian movements to optimize transit and traffic performance.

**TRANSIT MODE: TRANSIT RIDERSHIP AND MODE SPLIT**

As noted in Exhibit 3.1-31, BRT would result in a higher number of transit vehicles operating in the transit guideway through the project area than would light rail. BRT would also have slightly more weekday and annual platform hours than light rail.

Exhibit 3.1-31

**Transit Vehicles and Platform Hours of Service**

Transit Characteristic	No-Build	BRT	Light Rail
Standard 40-foot Buses	24	43	17
Articulated 60-foot Buses	0	24	0
LRT Two-Car Trains	0	0	10
<b>Total Transit Vehicles</b>	<b>24</b>	<b>54</b>	<b>25</b>
Weekday Platform Hours	2,600	2,800	2,700
Annual Platform Hours	799,000	851,000	823,000

Source: CRC Transit Technical Report 2008.

Light rail would attract 30 to 40 percent more annual riders over the Columbia River than BRT.

As illustrated in Exhibit 3.1-32, all of the build alternatives would at least double transit ridership crossing the Columbia River, compared to the No-Build Alternative. Light rail would attract approximately 30 to 40 percent more annual riders across the Columbia River than BRT. Integration with the existing MAX system is an important benefit of light rail, and would help attract additional transit riders. This integration allows riders to travel between Vancouver and Portland without a transfer. To get to destinations in central or north Portland, BRT riders would have to transfer to the Yellow Line or a TriMet local bus line at the Expo Center station.



Exhibit 3.1-32

**Comparison of Transit Ridership**

	No-Build	BRT	LRT
Daily Express and Local Bus	8,827	11,330	2,182
Daily High-Capacity Transit	N/A	5,443	18,606
<b>Total Daily Passenger Trips</b>	<b>8,827</b>	<b>16,773</b>	<b>20,788</b>
Annual Express and Local Bus	2,508,134	3,227,309	552,000
Annual High-Capacity Transit	N/A	1,600,837	6,121,000
<b>Total Annual Passenger Trips</b>	<b>2,508,134</b>	<b>4,828,146</b>	<b>6,673,420</b>

Source: 2007 travel demand forecasting outputs.

As illustrated in Exhibit 3.1-33, BRT would have nearly 50 percent higher transit mode split than the No-Build Alternative. In the afternoon/evening peak, 19 percent of the trips over the I-5 crossing would be by transit, 53 percent by SOVs, and 28 percent by HOVs. Light rail would further increase transit mode split to 21 percent of afternoon/evening peak hour trips over the I-5 crossing. The slightly higher transit mode split for light rail directly corresponds to the greater ridership attracted by light rail, as discussed earlier.

Exhibit 3.1-33

**Comparison of Transit Mode Split over the I-5 Columbia River Crossing**

	No-Build	BRT	LRT
P.M. peak direction SOV <sup>a</sup>	54%	53%	50%
P.M. peak direction HOV <sup>a</sup>	33%	28%	29%
P.M. peak direction transit	13%	19%	21%

Source: 2007 travel demand forecasting outputs.

<sup>a</sup> SOV – Single-Occupancy Vehicle, HOV – High-Occupancy vehicle.

Similar to the mode split over the river, both BRT and light rail would increase the transit mode split for commutes between target markets compared to the No-Build Alternative, and light rail would provide a greater increase than BRT (Exhibit 3.1-34).

Transit mode share at the crossing would be 50 percent higher with BRT and 60 percent higher with light rail compared to the No-Build Alternative.

Exhibit 3.1-34

**Daily Transit Mode Split by Transit Market (Home Based Work Trips)**

	No-Build	BRT	LRT
Clark County Inner Urban Transit Market to Markets in Oregon	12%	15%	20%
Clark County Suburban Commuter Market to Markets in Oregon	12%	13%	15%
Markets in Oregon to Clark County	3%	6%	8%

Source: CRC Transit Technical Report 2008.

TRANSIT MODE: TRANSIT TRAVEL TIMES

Exhibit 3.1-35 below shows that both BRT and light rail would increase the average transit vehicle speed through the CRC area, compared to No-Build. BRT would be slightly slower than light rail in the exclusive guideway because it would not have signal priority, there would be more variation in operator performance, dwell times at transit stations would be slightly longer, and acceleration would be slower. Signal priority in downtown Vancouver would not be possible for BRT because the high service frequencies would disrupt cross-traffic flow. As a result, BRT would be approximately one minute slower than light rail through the CRC area.

Exhibit 3.1-35  
Transit Travel Speeds and Vehicle Hours of Delay

	No-Build	BRT	LRT
P.M. Peak Transit Vehicle Travel Speed in Miles Per Hour (MPH)			
Through CRC area	10 mph	14.5 mph	17.3 mph
Downtown Vancouver	7.5 mph	9.6 mph	12.9 mph

Source: CRC Transit Technical Report 2008.

In most instances, light rail would provide better travel times than BRT (Exhibit 3.1-36). BRT buses would travel with general traffic outside the CRC area, and thus would be subject to congestion-induced delays before they enter the exclusive guideway in the CRC area. Such delays could cause buses to miss schedules and increase travel times. As modeled, LRT frequencies have no identified impact on LRT travel times or on operations through the Rose Quarter/Steel Bridge area. Additional analysis may show some impacts which could be mitigated with modifications to signals, street geometry, traffic and pedestrian movements, or improvements to the trackway on or near the bridge, to optimize transit system performance.

Exhibit 3.1-36

**Comparison of Average Weekday Transit Travel Times (Minutes)**

	No-Build	BRT	LRT
Northern Terminus to Expo Center	N/A	13	12
Northern Terminus to Pioneer Square	N/A	43	40
Northern Terminus to Lombard Transit Center	N/A	23	18
Downtown Vancouver (7th St. and Washington St.) to Pioneer Square	N/A	35	32
Pioneer Square to Salmon Creek (via C-TRAN Route 134)	48	32	32
Lombard Transit Center to Vancouver Mall (via Route 4L)	57	40	39
Hayden Island to 99th Street Transit Center (via 71L)	40	24	32
Salmon Creek to Pioneer Square (via C-TRAN Route 134)	56	51	51
Vancouver Mall to Lombard Transit Center (via Route 4L)	31	37	34
99th Street Transit Center to Hayden Island (via 71L)	41	24	19

Source: CRC Transit Technical Report 2008.

**TRANSIT MODE: TRANSIT OPERATIONS AND MAINTENANCE COSTS**

As illustrated in Exhibit 3.1-37, BRT would be less expensive to construct but more expensive to operate than light rail. Although the BRT system would require the purchase of more transit vehicles than light rail, the additional expense of constructing the light rail guideway would ultimately require 22 percent more capital cost. However, the lower number of vehicles required for light rail would mean that annual operating and maintenance costs for light rail would be \$1.8 million less than BRT. Light rail is more cost-effective because it attracts more riders, can carry more riders with fewer vehicles, and is therefore cheaper per passenger.

Exhibit 3.1-37

**Transit Mode Costs<sup>a</sup>**

	No-Build	BRT	LRT
Operation and Maintenance Cost	\$70 Million	\$75 Million	\$73 Million
Capital Cost (Millions) <sup>b</sup>	\$0	\$600 - \$750	\$780 - \$940
Cost-Effectiveness <sup>c</sup>	N/A	\$15.09	\$11.55

Source: CRC Transit Technical Report 2008.

<sup>a</sup> These costs are for the Lincoln terminus. The Kiggins Bowl terminus would have different costs, but the relationship between BRT and light rail would be the same.

<sup>b</sup> The capital cost range is based on a risk assessment, and includes contingency.

<sup>c</sup> Incremental capital and operational cost per incremental passenger over the No-Build Alternative.



## TRANSIT MODE: TRANSIT SAFETY AND SECURITY

The introduction of fixed guideway transit service to Hayden Island and Clark County would introduce a new travel mode into an already busy transportation system. All build alternatives would cross several intersections at grade, where transit vehicles would interact with automobile and truck traffic, bicycles, and pedestrians, potentially increasing the risk of collisions. Intersection crossings would be controlled by traffic signals to direct safe transit, pedestrian, bicycle, and auto movements. Signage would increase the awareness of the new guideway by clearly delineating the guideway and adjacent streets and by warning pedestrians when trains would be approaching.

Many similar intersections exist today on TriMet's light rail system. Transit would operate at the speed limits designated for vehicles on adjacent streets in the at-grade sections of the guideway. Designated pedestrian crossing areas would provide safe crossing opportunities. Light rail vehicles would have a high-intensity light that would remain on at all times, and operators would sound the train horn if they saw vehicles or pedestrians in the guideway.

Despite these safety precautions, crashes could still occur. For example, although left turns across the guideway would not be allowed away from signalized intersections, they may be attempted illegally by some drivers. Because of similarities in construction and operation of the guideway, BRT would likely have crash rates at its at-grade street crossings similar to those for light rail.

Light rail on the stacked transit/highway bridge would control safety access better than BRT.

According to recent data collected by the Federal Transit Administration (FTA) on safety incidents (such as collisions) that occurred with light rail, 34 percent were at at-grade intersections. However, with safety measures such as signal controls to clearly delineate right-of-way at intersections, and the implementation of adequate active and passive signage, collisions can be minimized. Collisions on TriMet's light rail system have decreased over the years with the addition of positive traffic control and signage. Also, rates have dropped as travelers have become more aware of the system and its potential conflicts with vehicles and pedestrians. This is true even as the number of system miles has increased. Other transit systems have experienced similar decreases as they have matured. For example, recent studies of at-grade crossings on the Blue Line in Los Angeles and the St. Louis light rail system indicate that these locations have collision rates substantially lower than typical rates at high-volume signalized intersections that carry only general purpose motor vehicle traffic.

Interactions with other vehicles increase as the number of transit vehicles using an at-grade crossing or intersection increases. Therefore, safety equates to alternatives with fewer vehicles, or with more vehicles in a designated guideway separated from other traffic. For this reason, both light rail and BRT options have the potential to improve safety over the No-Build Alternative. The light rail mode would have fewer total transit vehicles, but a greater number of fixed route buses in mixed traffic on downtown city streets. With BRT, there would be a lower number of

fixed route buses in mixed traffic on downtown Vancouver streets (because they would operate in the guideway), but BRT options would have the highest total number of vehicles.

Expanded transit maintenance bases associated with either mode are not expected to differ in safety and security concerns. Both C-TRAN and TriMet have reduced their use of hazardous materials required for vehicle maintenance, lowering the risk of exposure or environmental contamination at the maintenance bases from historic levels.

If light rail is chosen for the transit mode, overhead wires should not be installed above roadway lighting fixtures, in order to reduce the potential hazard to aircraft from hard-to-see structures above the roadway.

In addition to considerations for building safety into the design and operation of high-capacity transit systems, transit security on vehicles and at stations and park and ride lots would also be addressed during the planning, design, construction and operational phases of the project.

TriMet is currently developing a plan for enhancing safety and security. This plan would be updated annually and would address system-wide security goals, reductions in crime and the perception of crime, improved awareness and involvement in security issues by agency employees and the public, incorporating better approaches to security into design and construction practices, and enhancing emergency preparedness. TriMet has budgeted resources to address safety and security, and works closely with local agency partners and the Department of Homeland Security. In construction of the Clackamas County Green Line, TriMet has integrated crime prevention into environmental design, including good lighting, clear sight lines, clearly defined public travel routes, reduced station clutter and closed caption television. Similar measures would be undertaken for the selected high-capacity transit mode.

Light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Light rail vehicles using this maintenance facility would not be carrying passengers. Thus, the proposed expansion is unlikely to have an adverse effect on safety or security.

### **Transit Terminus Options (with all Alternatives)**

#### **KIGGINS BOWL TERMINUS AND LINCOLN TERMINUS**

Both transit terminus options would result in similar traffic performance for the I-5 crossing (see Exhibit 3.1-38).

#### **Kiggins Bowl and Lincoln: Local Street Performance**

However, the four terminus options would have different effects on local streets in Vancouver. The Kiggins Bowl and Lincoln terminus options would each operate high-capacity transit from the MAX Yellow Line Station at Expo Center to a terminus north of downtown Vancouver.

The Lincoln terminus would operate on local streets throughout Vancouver. The Kiggins Bowl terminus north of Mill Plain Boulevard would operate in a separated guideway running adjacent to I-5. The Lincoln terminus would have more impact on local streets and would require the elimination of a greater number of parking spaces. Both

options would include park and ride facilities that are discussed in greater detail in the Transit section of this DEIS.

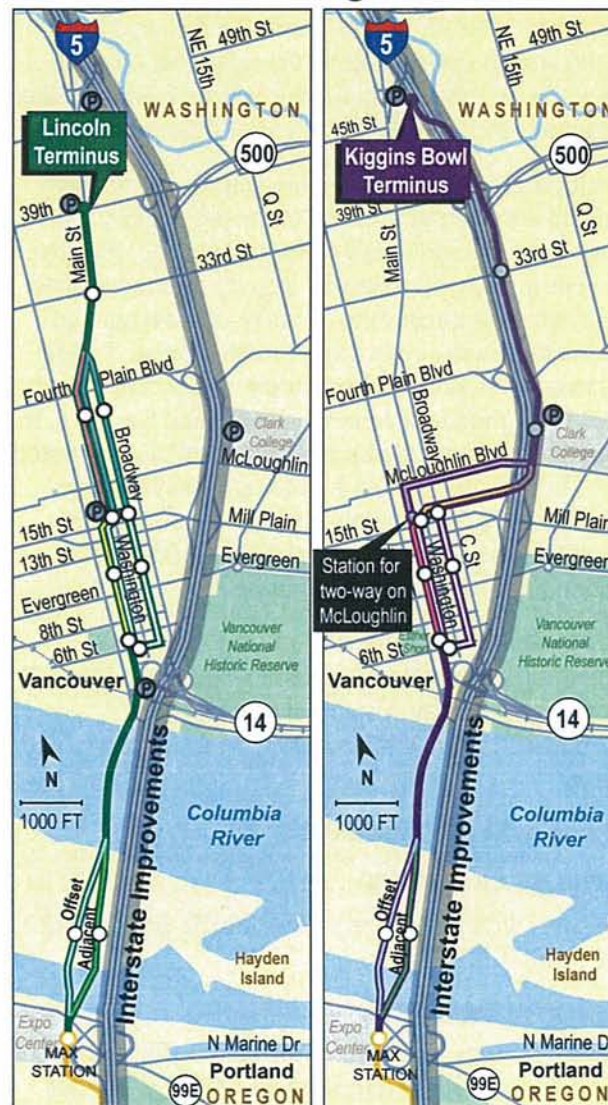
Exhibit 3.1-38

**Transit Terminus and Alignment Options****Lincoln Terminus**

- Washington-Broadway Couplet
- Two-way Broadway (south)
- Broadway-Main Couplet
- Two-way Broadway (north)
- Transit Station
- Ⓟ Park and Ride Lot

**Kiggins Bowl Terminus**

- Washington-Broadway Couplet
- Two-way Broadway
- Two-way on McLoughlin Blvd
- Two-way on 16th Street
- Transit Station
- Ⓟ Park and Ride Lot



DIMENSIONS ARE APPROXIMATE.

A reduction in travel lanes on Main Street, associated with the Lincoln terminus, would adversely impact local street operations.

The Kiggins Bowl terminus would include two park and ride facilities. The Kiggins Bowl Park and Ride would generate about 925 morning and 850 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride would generate about 725 morning and 715 afternoon/evening peak hour vehicle trips. As part of the Kiggins Bowl terminus, Main



Street would be widened north of 45th Street to accommodate the traffic levels expected to access the Kiggins Bowl Park and Ride during peak hours. The overall increase in traffic levels generated by the Kiggins Bowl Park and Ride would result in increased traffic congestion and vehicular queuing at nearby intersections.

A key impact to local street performance with the Lincoln terminus is that transit, which would run within the street right-of-way, would require the elimination of two vehicular travel lanes (one per direction) along Main Street between 29th Street and the Lincoln Park and Ride. As Main Street is the only principal north-south arterial in northern Vancouver west of I-5, reductions in vehicular travel lanes on Main Street would adversely affect local street travel. The lower number of travel lanes would reduce capacity and likely increase congestion and delay in northern Vancouver.

The Lincoln terminus would include three park and ride facilities. The Kiggins Bowl Park and Ride would generate about 85 morning and 75 afternoon/evening peak hour vehicle trips. The Lincoln Park and Ride structure would generate about 1,200 morning and 1,200 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride surface lot would generate about 225 morning and 230 afternoon/evening peak hour vehicle trips.

To accommodate the additional traffic generated by the Lincoln Park and Ride during peak hours, Main Street would be widened north of 39th Street. The overall increase in traffic levels generated by the proposed park and ride facilities would result in increased congestion and queuing at nearby intersections, including those along 39th Street, Main Street between 39th Street and Mill Plain Boulevard, and Broadway Street between Main Street and Mill Plain Boulevard.

#### Kiggins Bowl and Lincoln: Transit Performance

Kiggins Bowl and Lincoln terminus options have very similar transit performance characteristics, despite their different routes and guideway characteristics in northern Vancouver. Key measures of transit performance such as ridership and travel times are very similar for both terminus options. Overall, the primary difference in transit performance between these terminus options is cost. (Differences for other elements of the environment, such as land use, are discussed in other sections of this chapter.)

As illustrated in Exhibit 3.1-39, the Lincoln terminus would be less expensive to construct than the Kiggins Bowl terminus, as it would not require a new tunnel underneath I-5 to connect to the Clark College Park and Ride, or an elevated structure to cross back over I-5 to connect to the Kiggins Bowl Park and Ride. The Lincoln terminus would also be 25 percent less expensive to maintain and operate because the Kiggins Bowl terminus would have a longer and more complex transit guideway.

Exhibit 3.1-39

**Transit Terminus Characteristics and Performance**

Characteristic		Kiggins Bowl terminus	Lincoln terminus	Clark College MOS	Mill Plain MOS
Daily Passenger Trips on Transit over alignment		21,100	20,800	18,200	19,100
Annual Passenger Trips on Transit over alignment		6,780,000	6,670,000	5,820,000	6,110,000
Peak/Peak Direction Mode Split over I-5 river crossing	SOV	50 percent	50 percent	52 percent	50 percent
	HOV	29 percent	29 percent	29 percent	27 percent
	Transit	21 percent	21 percent	19 percent	23 percent
Transit Accessibility	Clark County households within ½ mile of HCT station	5 percent	5 percent	4 percent	3 percent
	Clark County employment within ½ mile of HCT station	11 percent	11 percent	10 percent	9 percent
Estimated Capital Cost		<b>\$1,068.8M</b>	<b>\$879.3M</b>	<b>\$674.9M</b>	<b>\$615.8M</b>
Annual Operating Cost (Increment over the No-Build)		<b>\$4,240,000</b>	<b>\$3,510,000</b>	<b>\$2,950,000</b>	<b>\$2,830,000</b>
Annualized Cost per Transit Guideway River Crossing		<b>\$13.67</b>	<b>\$11.55</b>	<b>\$10.38</b>	<b>\$8.91</b>

Source: CRC Transit Technical Report 2008.

Note: Data presented in this table is for light rail. The relationship between alignments and MOS options would be the same for BRT.

**Kiggins Bowl and Lincoln: Transit Safety and Security**

Safety factors for the transit terminus options are dictated by the environment they traverse. Fully grade-separated sections are inherently safer since there is no interaction with other vehicles, bicycles, or pedestrians at intersections. However, stations located in secluded areas or away from busy environments could increase passenger security concerns.

The CRC project will work with emergency service providers to allow transit guideways adjacent to traffic lanes to be used for emergency passage around congestion, where feasible.

Because the Kiggins Bowl terminus would have fewer at-grade crossings than the Lincoln terminus, there would be fewer interactions between high-capacity transit and automobile traffic, bicycles, or pedestrians. This would reduce the potential safety issues due to traffic conflicts.

The Kiggins Bowl terminus would be fully grade-separated from Clark College to Kiggins Bowl. While this is safer in terms of interaction between traffic and transit, the station environment is less conducive to security. The Clark College station would be placed in a retained cut 30 to 38 feet below the surface with very little visibility from McLoughlin Boulevard and no visibility from any other street or from I-5. The Rose Village station would be placed at highway level, which is below the neighborhood level. This location can only be viewed by motorists traveling on I-5 at highway speed or by pedestrians crossing the 33rd Street bridge on the north side. At its terminus, the elevated guideway would cross over I-5, entering the Kiggins Bowl station at the fifth floor of a six-story parking structure. Visibility of this station is only possible from the adjacent bus transfer area. The lack of visibility of these stations creates an environment that could make security problematic.

The three stations in northern Vancouver for the Lincoln terminus (25th Street, 33rd Street, and Lincoln stations) would all be built at neighborhood grade near commercial buildings and residences, creating a high visibility environment. The guideway, however, would be adjacent to travel lanes, and transit vehicles would interact with traffic and pedestrians at each intersection.

#### **CLARK COLLEGE MINIMUM OPERABLE SEGMENT**

Both the Clark College and Mill Plain MOS (minimum operable segment) terminus options would result in similar highway performance for I-5 within the CRC area (see Exhibit 3.1-40). Highway vehicle travel demand would be consistent for both short terminus options and full-length alignments.

For safety and security, there is little difference between the Clark College and Mill Plain MOS terminus options. The routes differ only in the extension past the Mill Plain transit center to Clark College. The Clark College MOS would be at-grade between the Mill Plain transit center and the proposed terminus at the Clark College Park and Ride. This would increase the potential for collisions involving transit compared to the Mill Plain MOS, although it would be less than the Lincoln terminus. The Clark College Park and Ride would have limited visibility from surrounding areas, potentially increasing security risks.

#### **Clark College Minimum Operable Segment: Local Street Performance**

The Clark College MOS would include two park and ride facilities with about 1,300 parking spaces. Parking facilities would include a surface lot at Kiggins Bowl and a parking structure at Clark College. The Kiggins Bowl lot would connect to the high-capacity transit station via shuttle bus. The Kiggins Bowl Park and Ride would generate about 85 morning and 75 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride would generate about 725 morning and 715 afternoon/evening peak hour vehicle trips.

Impacts from the Clark College MOS terminus would be similar to those from the Kiggins Bowl terminus. However, the roadway improvements proposed on Main Street north of 45th Street under the Kiggins Bowl terminus would not be necessary with the Clark College MOS, as the Kiggins Bowl Park and Ride facility would only be a surface lot, rather than a six-level parking structure.

The Clark College MOS would not require the elimination of two vehicular travel lanes (one in each direction) along Main Street between 29th Street and the Lincoln Park and Ride lot. Maintaining the four vehicular travel lanes on Main Street would improve local street operations in northern Vancouver compared to the Lincoln terminus.

#### **TERMS & DEFINITIONS**

##### **Traffic Term**

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**Minimum Operable Segments (MOS)** are shorter, fully evaluated, less expensive options compared to the full-length alignments.

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Exhibit 3.1-40

**Minimum Operable Segments (MOS)**

**Mill Plain MOS Alignment Options**

- Washington-Broadway Couplet
- Two-way Broadway
- Transit Station
- Ⓟ Park and Ride Lot

**Clark College MOS Alignment Options**

- Washington-Broadway Couplet
- Two-way Broadway
- Two-way on McLoughlin Blvd
- Two-way on 16th Street
- Transit Station
- Ⓟ Park and Ride Lot



DIMENSIONS ARE APPROXIMATE.

**Clark College Minimum Operable Segment: Parking and Access Impacts**

The Clark College MOS would have the same parking and access impacts between Fifth and G Streets as the Kiggins Bowl terminus (see Exhibit 3.1-41). However, these impacts vary, based on the packaging of the four alignment options discussed below. Routing high-capacity transit along the Broadway-Washington couplet in downtown Vancouver would require removing fewer on-street parking spaces; however, this option would entail greater loss of access to surface lots that serve downtown businesses. Additionally, the Clark College MOS would provide half as much new parking at park and ride lots. Adjustments in lane configurations could reduce or mitigate these impacts, but would be unlikely to change the relationship between alignment options.

Exhibit 3.1-41

**Clark College MOS Parking and Access Impacts**

	2-way Washington to 2-way 16th	2-way Washington to 2-way McLoughlin	Downtown Couplet to 2-way 16th	Downtown Couplet to 2- way McLoughlin
<b>Parking</b>				
Total	205	237	310	342
Parking Lost	151	197	123	169
Percent	74%	83%	40%	49%
<b>Access Points</b>				
Total	46	51	61	66
Points Lost	11	0	31	20
Percent	24%	0%	51%	30%
<b>Loading Zones</b>				
Total	5	5	2	2
Loading Zones Lost	0	0	1	1

Source: CRC Land Use Technical Report 2008.

**Clark College Minimum Operable Segment: Transit Ridership and Mode Split**

The shortened guideway with the Clark College minimum operable segment (MOS) terminus option, and the fewer number of high-capacity transit stations, would reduce the percent of Clark County households and employment within one-half mile of a high-capacity transit station. Four percent of Clark County households (compared to 5 percent with the Kiggins Bowl terminus) and 10 percent of employment (compared to 11 percent with the Kiggins Bowl terminus) would be within one-half mile of a station.

With this configuration, the number of daily and annual passenger trips on transit over the Columbia River within the I-5 corridor would be approximately 13 percent less than with the Kiggins Bowl terminus—18,200 trips compared to 21,100. The reduction in trips on transit could be attributed to the diminished accessibility of the high-capacity transit line to northern Vancouver and Clark County which would result from shortening the length of the guideway and reducing the number of park

The Clark College MOS would attract about 13 percent fewer daily transit trips than the full length I-5 alignment.

and ride spaces. With the Clark College MOS there would be 1,100 spaces at the Clark College Park and Ride lot and 150 spaces at a satellite surface lot at Kiggins Bowl, for a total of 1,250 spaces, about half that of the Kiggins Bowl terminus.

The Clark College MOS terminus would have a peak period/peak direction transportation mode split comparable to the Kiggins Bowl terminus. Peak period/peak direction traffic over the Columbia River would be made up of 52 percent SOV, 29 percent HOV, and 19 percent transit. With the full length of the Kiggins Bowl terminus, the mode split would be 50 percent SOV, 29 percent HOV, and 21 percent transit.

**Clark College Minimum Operable Segment: Transit Operations and Maintenance Costs**

Because the transit guideway of the Clark College MOS would be about 1.5 miles shorter than the Kiggins Bowl terminus, the transit capital cost would be approximately 36 percent less. For light rail, the reduction in capital costs is because fewer light rail vehicles would need to be purchased.

Although the transit capital cost would be less, the annual operating costs would be similar to the Kiggins Bowl terminus. For light rail, because the length of the MOS would be one-third less than the Kiggins Bowl terminus, the cost to operate light rail to the Clark College Park and Ride terminus would be correspondingly less. However, the cost to operate the rest of the transit network (such as the limited stop buses and C-TRAN's local buses) would be similar to the cost for the Kiggins Bowl terminus. Therefore, the total cost to operate light rail on the Clark College MOS would only be marginally less than the Kiggins Bowl terminus.

Conversely, BRT operating costs would actually be slightly higher with the Clark College MOS than with the Kiggins Bowl terminus. The BRT lines would have the same routes and headways as the Kiggins Bowl terminus, but the bus routes would extend outside of the exclusive guideway for a greater portion of their travel, slightly increasing the amount of congestion the BRT lines would be subject to. This would increase the total number of platform hours required for BRT compared to the Kiggins Bowl terminus, and increase BRT operating costs with the Clark College MOS more than \$1 million each year.

The Clark College MOS would be more cost efficient than the Kiggins Bowl terminus despite attracting fewer transit trips and having negligible, or somewhat higher, operating and maintenance costs. Because the capital cost to construct the Clark College MOS is lower, the total annualized cost per transit rider over the river crossing for the Clark College MOS would be \$10.38, whereas for the Kiggins Bowl terminus it would be \$13.67.

**MILL PLAIN MINIMUM OPERABLE SEGMENT**

**Mill Plain Minimum Operable Segment: Local Street Performance**

The Mill Plain MOS terminus option would include eight park and ride facilities with approximately 2,700 parking spaces. Satellite parking lots would be located north and east of downtown and would have access to high-capacity transit stations via shuttle buses. The Kiggins Bowl Park and Ride surface lot would generate about 85 morning and 75 afternoon/evening peak hour vehicle trips. The Lincoln Park and Ride

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The Mill Plain MOS would increase vehicle trips to and from downtown Vancouver by approximately 750 vehicles per hour, increasing delays and queuing on local streets.



would generate about 600 morning and 590 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride surface lot would generate about 250 morning and 230 afternoon/evening peak hour vehicle trips.

The Mill Plain MOS would not require the elimination of two vehicular travel lanes (one in each direction) along Main Street between 29th Street and the Lincoln Park and Ride. Maintaining four vehicular travel lanes on Main Street would improve local street operations in northern Vancouver compared to the Lincoln terminus.

In addition to the three satellite lots, five park and ride sites (two structures and three surface facilities) would be located along the transit guideway in downtown Vancouver. The Mill Plain Park and Ride structure would be located between 16th and 17th Streets and Broadway and Main Streets. This park and ride would generate about 255 morning and 230 afternoon/evening peak hour vehicle trips. The second park and ride structure would be located between Fourth and Fifth Streets and Washington and Columbia Streets. It would generate 305 morning and 275 afternoon/evening peak hour vehicle trips. In addition, three adjacent surface lots would be located near the SR 14 interchange (bounded by Fifth Street on the north, the railroad tracks on the south, I-5 on the east, and Columbia Street on the west), generating 255 morning and 235 afternoon/evening peak hour vehicle trips.

The total number of vehicle trips within downtown Vancouver would increase with this alignment. The park and ride facilities in downtown Vancouver would generate an additional 805 morning and 740 afternoon/evening peak hour vehicle trips. As a result, the traffic impacts to downtown streets would be exacerbated more than with the other three terminus options, resulting in further increased vehicle delays and queuing on local streets. Limited access points to each of the park and ride lots (one per location) would reduce the arrival and departure capacities and would likely cause increased congestion on local streets near the lots.

#### **Mill Plain Minimum Operable Segment: Parking and Access Impacts**

The Mill Plain MOS would have varying impacts to on-street parking and access in downtown Vancouver, depending on the alignment option (see Exhibit 3.1-44). The two-way Washington alignment option would impact more parking than the couplet. Approximately 79 percent of on-street parking would be lost with the two-way Washington option; with the couplet only 39 percent on each street would be lost. With regard to access, the Washington-Broadway couplet would lose 59 percent of its access points, as opposed to the 15 percent loss expected with the two-way Washington option. One loading zone in this area would be lost with the Washington-Broadway couplet alignment option.

The Mill Plain MOS would end the guideway near 17th Street and, based on the alignment options, could provide additional park and ride spaces. The two-way Washington Street option would terminate at a mid-block station (Mill Plain Station) between 15th and 16th Streets (two additional

Exhibit 3.1-42

#### **Mill Plain MOS Parking and Access Impacts**

	<b>Washington-Broadway Couplet</b>	<b>2-way Washington</b>
<b>Parking</b>		
Total	281	150
Parking Lost	109	119
Percent	39%	79%
<b>Access Points</b>		
Total	44	27
Points Lost	26	4
Percent	59%	15%
<b>Loading Zones</b>		
Total	4	5
Zones Lost	1	0

Source: Land Use Technical Report 2008.

blocks northeast of this station would be used for turn-around). This option would provide 564 new park and ride spaces in a parking structure on 17th Street. The Washington-Broadway couplet would not provide new parking, but instead would use this block to turn from Broadway Street to the Mill Plain Station. Adjustments in lane configurations could reduce or mitigate these impacts but are unlikely to change the relationship between alignment options.

#### **Mill Plain Minimum Operable Segment: Transit Ridership and Mode Split**

The shortened guideway and the lower number of high-capacity transit stations provided by the Mill Plain MOS terminus options would reduce the percentage of Clark County households and employment within one-half mile of a high-capacity transit station. For this terminus, 3 percent of Clark County households (compared to 5 percent for the Kiggins Bowl or Lincoln terminus) and 9 percent of employment (compared to 11 percent for the Kiggins Bowl or Lincoln terminus) would be within one-half mile of a high-capacity transit station.

Daily and annual passenger trips on transit over the Columbia River within the I-5 corridor would be approximately 9 percent less than the Lincoln terminus—19,100 trips compared to 20,800. The reduction in trips on transit could be attributed to the diminished accessibility of the high-capacity transit line to northern Vancouver and Clark County from shortening the length of the guideway and reducing the number of park and ride spaces. With the Lincoln terminus, there would be 1,800 park and ride spaces directly on the guideway alignment. With the Mill Plain MOS, there would be 1,100 spaces at two joint-use parking structures in downtown Vancouver, plus two additional satellite lots, for a total of 2,758 spaces.

The Mill Plain MOS would likely have a peak period/peak direction mode split comparable to that for the Lincoln terminus. With the Mill Plain MOS the peak period/peak direction mode split would be 50 percent SOV, 27 percent HOV and 23 percent transit. With the Lincoln terminus, the mode split would be 50 percent SOV, 29 percent HOV, and 21 percent transit.

#### **Mill Plain Minimum Operable Segment: Transit Operations and Maintenance Costs**

Because of the shorter transit guideway, capital costs to construct the Mill Plain MOS would be approximately 42 percent and 30 percent less than for the Kiggins Bowl or Lincoln terminus, respectively. Annual operating costs would not be reduced as much for the Mill Plain MOS, as the cost to operate the rest of the transit network (such as the limited stop buses and C-TRAN local buses) would be similar to the other terminus options.

With the Mill Plain MOS, the new BRT lines would follow the same route and have the same headways as the other terminus options, but would extend outside the exclusive guideway and would travel in mixed traffic for a greater distance. This would slightly increase the amount of congestion the BRT lines could be subjected to, which would increase the total number of platform hours required. For this reason, the BRT operating costs with the Mill Plain MOS would be \$5.1 million, nearly the same as the cost to operate as BRT with the Lincoln terminus (\$5.3 million).

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The Mill Plain MOS would attract about 9 percent fewer daily transit trips than the Vancouver alignment.

The Mill Plain MOS would be more cost-effective than either the Kiggins Bowl or Lincoln terminus, despite attracting fewer transit trips and having negligible, or somewhat higher, operating and maintenance costs. Because the capital cost to construct the Mill Plain MOS would be lower, the total annualized cost per transit rider over the river crossing for the Mill Plain MOS would be \$8.91, compared to \$13.67 for the Kiggins Bowl terminus and \$11.55 for the Lincoln terminus.

### Transit Alignment Options (with all Alternatives)

Following is an evaluation of how each of the alignment options would affect local streets, and any parking or access impacts resulting from these different alignments.

#### OFFSET OR ADJACENT

The transit alignment options in Oregon—either offset from or adjacent to I-5 on Hayden Island—would not substantially affect transit performance metrics such as ridership, travel times, or operating and maintenance costs (see Exhibit 3.1-43). These alignment options would have a minor (less than 1 percent) effect on transit capital costs.

#### Offset or Adjacent: Local Street Performance

The transit alignment options between Delta Park and South Downtown Vancouver would be grade-separated and would not impact local street operations.

#### Offset or Adjacent: Parking and Access Impacts

On Hayden Island there would be no impact to on-street parking. Both the offset and adjacent options would run west of I-5, connecting the existing Expo Center light rail station with downtown Vancouver. Both options assume one station on Hayden Island. Approximately 15 off-street spaces would be lost with either high-capacity transit option, based on the likely placement of support pillars for the aboveground transit guideway. With either the offset or adjacent alignment option, existing parking that serves businesses near southbound I-5 would be lost due to the shift and widening of I-5. There is likely to be minimal loss of access to other businesses with either option.

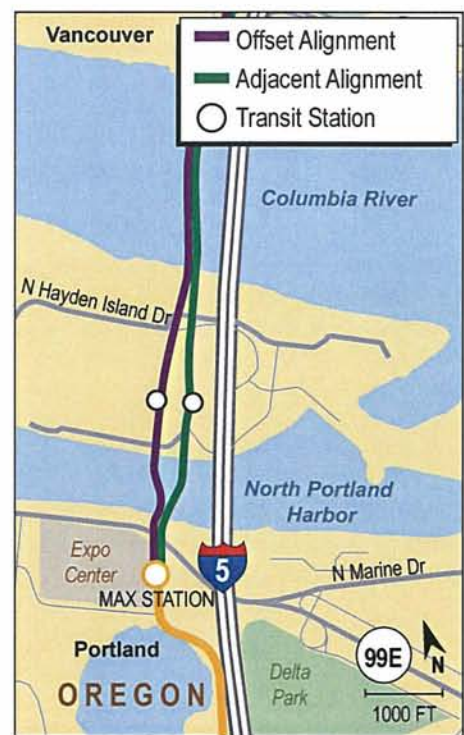
#### Offset or Adjacent: Safety and Security

Both alignment options are grade-separated and so would have similar safety concerns. Station placement for the offset alignment option may be better integrated with the urban environment. This station setting would be visible from all sides, unlike the adjacent option station which is next to the I-5. The lack of visibility creates an environment that makes security problematic.

#### TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

The two transit alignment options in downtown Vancouver (two-way travel on Washington Street or a couplet on Washington and Broadway) would not affect transit performance metrics such as ridership, travel times, or operating and maintenance costs. However, the couplet on Washington and Broadway would cost approximately 35 percent more to construct than the two-way Washington alignment. However, this difference is only for the construction costs of the transit guideway in downtown Vancouver, not for the total transit costs of this project, so it would not have as dramatic an impact on overall construction costs. All

Exhibit 3.1-43  
**Delta Park to South Downtown  
Alignment Options**



DIMENSIONS ARE APPROXIMATE.



transit construction costs discussed elsewhere in this section assume a two-way Washington alignment option.

**Two-Way Washington or Washington-Broadway Couplet: Local Street Performance**

From south downtown Vancouver to Mill Plain, transit would run either two-way on Washington Street or via a Washington Street and Broadway Street one-way couplet system. The two-way Washington Street configuration would accommodate two-way high-capacity transit operations and two-way (one travel lane in each direction) vehicular operations along Washington Street.

Due to reduced traffic lane capacity, downtown streets generally south of Mill Plain Boulevard, east of Columbia Street, and west of C Street would experience moderately increased vehicle delays and queuing impacts in comparison to No-Build conditions. With light rail service, signal pre-emption for transit would cause additional delay and queuing.

The Washington-Broadway one-way couplet would accommodate southbound transit and two southbound vehicular travel lanes along Washington Street, and northbound high-capacity transit and two northbound vehicular travel lanes along Broadway Street.

Due to reduced traffic lane capacity, downtown streets generally south of Mill Plain Boulevard, east of Columbia Street and west of C Street would experience increased congestion compared to No-Build conditions. With light rail service, signal pre-emption for transit would cause additional congestion for traffic traveling on streets that cross the transit guideway.

**Two-Way Washington or Washington-Broadway Couplet: Parking and Access Impacts**

The two-way Washington Street option would remove all on-street parking (97 spaces) and five loading zones along Washington Street between Fifth Street and Mill Plain Boulevard. The existing 18 access points would remain, but drivers would be prohibited from making left turns across the high-capacity transit guideway, except at signalized intersections. This option would not require the removal of disabled parking. However, the removal of all on-street parking along Washington Street would impact the ease of auto accessibility to these properties. Potential mitigation could be required to improve auto access for the disabled.

The Washington-Broadway couplet option would remove 69 on-street parking spaces and one loading zone along Washington and Broadway Streets between Sixth Street and Mill Plain Boulevard. This option would also remove 20 (61 percent of the total) access points along these streets.

**Two-Way Washington or Washington-Broadway Couplet: Safety and Security**

Intersections are the point of interface between traffic, transit and pedestrian modes and so are the focus of much of the concern for safety. A couplet has generally twice as many intersections to go through as a two-way option and so is less safe from that standpoint. However, two-way transit operation on one street requires pedestrians and drivers to be more aware of transit. With two-way transit in the middle of the street on Washington, there would be no allowed left turns. It would be difficult to

adequately sign for this, so there is some concern that drivers might make unsafe, uncontrolled left turns across transit lanes.

#### **16TH STREET OR MCLOUGHLIN**

The transit alignment options for the Kiggins Bowl terminus or Clark College MOS in northern Vancouver would not substantially affect the transit performance metrics reported in this section (see Exhibit 3.1-45).

#### **16th Street or McLoughlin: Local Street Performance**

The Kiggins Bowl and Clark College MOS terminus options would turn east at the Mill Plain Transit Center and cross I-5. The high-capacity transit route could be aligned east along either McLoughlin Boulevard or 16th Street to the Clark College Park and Ride.

The McLoughlin Boulevard option would maintain two-way traffic, while the 16th Street option would require converting the street to one-way westbound traffic. Converting 16th Street would result in some minor re-routing of local traffic in the vicinity of 16th Street to account for limited movements along 16th Street. Running high-capacity transit along either street would generally degrade intersection operations and cause increased vehicle queuing in the subarea between 15th Street and 19th Street, and Main Street and I-5.

#### **16th Street or McLoughlin: Parking and Access Impacts**

As shown in Exhibit 3.1-44, the 16th Street option would remove 54 (50 percent) on-street parking spaces along 16th Street between Mill Plain Boulevard and G Street; two of these are disabled parking spaces, and none of them are loading zones. It would also eliminate 11 (39 percent) access points in this segment.

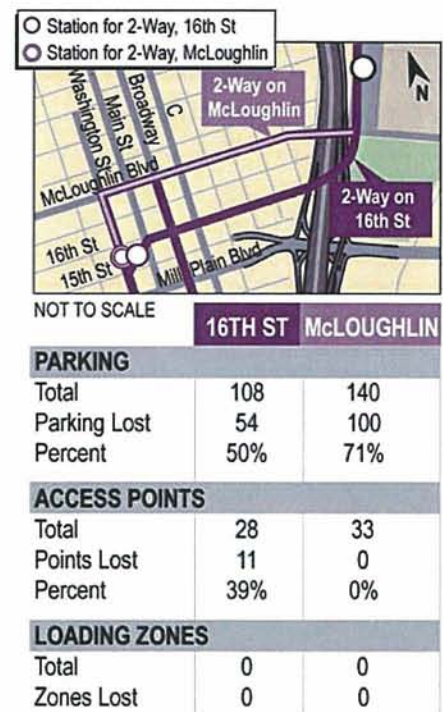
The McLoughlin Boulevard option would remove 100 (about 71 percent) on-street parking spaces along McLoughlin Boulevard between Mill Plain Boulevard and G Street; none of these are disabled parking spaces or loading zones. None of the mid-block driveways would be lost, but drivers would be prohibited from making left turns across the guideway, except at signalized intersections.

These options also assume the construction of an angled high-capacity transit station north of 15th Street (bound by 15th Street, 16th Street, Washington Street, and Main Street). Currently, this block is undeveloped and used by area employees for long-term off-street parking. These options would remove existing off-street parking without providing alternate facilities at this location.

#### **16th Street or McLoughlin: Safety and Security**

These alignment options apply to the Kiggins Bowl and Clark College MOS terminus options. There may be some safety difference between locating transit on the side of the street, as planned for 16th Street, and locating transit in the middle of the street, as planned for McLoughlin Boulevard. However, the difference would be small. Both options would include a transit crossing under I-5. Tunnel portals in a neighborhood can provide an unsafe environment for children or other pedestrians who might enter the tunnel.

Exhibit 3.1-44  
**Alignment Options in North Vancouver for the Kiggins Bowl Terminus**





**TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET**

Transit alignment options north of downtown for the Lincoln terminus—two-way on Broadway between 16th and 29th Streets, or a couplet on Main and Broadway between 16th and 29th Streets—would not substantially affect the transit performance metrics reported in this section (see Exhibit 3.1-45).

**Two-Way Broadway or Broadway-Main Couplet: Local Street Performance**

The Lincoln terminus would run either two-way along Broadway Street between McLoughlin Street and 29th Street and along Main Street north of 29th Street to the northern terminus at the Lincoln Park and Ride, or as a one-way couplet along Broadway and Main Streets to 29th Street, and two-way on Main Street from 29th Street to the northern terminus at the Lincoln Park and Ride.

**Two-Way Broadway or Broadway-Main Couplet: Parking and Access Impacts**

As shown in Exhibit 3.1-45, the two-way Broadway option would remove 83 (about 50 percent) on-street parking spaces along Broadway between Mill Plain Boulevard and 29th Street; none of these are disabled parking spaces or loading zones. North of 29th Street there is no on-street parking, so all impacts would be to access. This option, from Mill Plain Boulevard to 40th Street, would remove 13 (22 percent) access points.

The Broadway-Main Street couplet option would remove 206 (about 80 percent) on-street parking spaces along Broadway Street between Mill Plain Boulevard and 29th Street, but no loading zones. This option, from Mill Plain Boulevard to 40th Street, would remove 38 (46 percent) access points along these streets.

In north Vancouver, the City of Vancouver has found on-street parking to be underutilized. A recent study conducted in the north Vancouver area (bound by 15th Street, 28th Street, Columbia Street and D Street) found that on-street parking had a 44.5 percent utilization during the weekday peak hour at 11 a.m. This parking space utilization was even lower during the weekend peak hour at 1 p.m., with 28.7 percent of the spaces occupied.<sup>3</sup>

All options assume the construction of an angled high-capacity transit station north of 15th Street (bound by 15th Street, 16th Street, Washington Street and Main Street). Currently, this block is undeveloped and used by area employees for long-term off-street parking. This alignment would remove the existing off-street parking without providing alternate facilities at this location.

**Two-Way Broadway or Broadway-Main Couplet: Safety and Security**

These alignment options apply to the Lincoln terminus. The safety concerns are the same here as for the two-way Washington or Washington-Broadway couplet, discussed above.

Exhibit 3.1-45

**Parking and Access Impacts from Alignment Options in North Vancouver for the Lincoln Terminus**

NOT TO SCALE

	COUPLET	2-WAY
<b>PARKING</b>		
Total	256	163
Parking Lost	206	83
Percent	80%	51%
<b>ACCESS POINTS</b>		
Total	83	60
Points Lost	38	19
Percent	46%	32%
<b>LOADING ZONES</b>		
Total	0	0
Zones Lost	0	0

<sup>3</sup> City of Vancouver, 2007.



## Transit Operations

The two transit operation scenarios under evaluation—“Efficient” or “Increased”—differ in the frequency that rapid transit buses or light rail trains would operate, as described in Chapter 2. Increased transit operations would shorten the headways between transit vehicles and could lead to greater impacts on local traffic conditions than those caused by Efficient operations.

### TRANSIT OPERATIONS: LOCAL STREET PERFORMANCE

#### Vancouver Local Streets

Increasing the frequency of light rail trains would moderately increase delays for vehicles crossing the transit guideway caused by signal pre-emption. Increasing bus frequency could cause greater bus queuing, resulting in more congestion on streets in downtown Vancouver. Increased transit frequency would congest upper Main Street. Additionally, streets south of Mill Plain Boulevard would likely to experience congestion from Increased transit operations.

#### Portland Local Streets

Neither transit mode would cause local street traffic impacts in Portland north of the Expo Center station, as the guideway would be elevated. South of the Expo Center station, either transit mode would increase the number of peak trains operating along the existing MAX Yellow Line from 10 trains per hour to 16 trains per hour with Efficient operations, whereas Increased transit operations would increase the frequency to 20 trains per hour.

The traffic effects of an increased number of trains would be limited to local streets along the Interstate Avenue corridor. Because trains receive traffic signal priority at signalized intersections, pre-empting vehicular traffic on cross-streets, an increased number of trains would increase vehicle delays. Additional impacts would result under Increased transit operations. In the Rose Quarter/Steel Bridge area in Portland, adding light rail service may require modifications to signals, street geometry, or traffic and pedestrian movements to optimize transit and traffic performance.

### TRANSIT OPERATIONS: TRANSIT RIDERSHIP AND MODE SPLIT

Efficient operations would entail 2,700 to 2,800 weekday platform hours of transit service (including both revenue and non-revenue service) versus 3,900 to 4,400 weekday platform hours with Increased operations. Similarly, Efficient operations would entail 823,000 to 850,000 annual platform hours of transit service, versus 1,185,000 to 1,320,000 annual platform hours of transit service with Increased operations. The higher values represent service with BRT; the lower values represent light rail.

Adding transit capacity (Increased operations) would attract more transit ridership and correspondingly increase transit mode split. As shown in Exhibit 3.1-46, this difference would be more dramatic during peak periods when congestion makes transit more attractive, because the exclusive transit guideway would allow high-capacity transit to avoid congestion on I-5.

Exhibit 3.1-46

**Ridership and Mode Split for Efficient and Increased Transit Operations**

	Efficient Operations		Increased Operations	
	BRT	LRT	BRT	LRT
<b>Transit riders over the I-5 crossing</b>				
PM peak period	4,900	6,100	5,600	6,700
Daily	16,800	20,800	19,800	23,100
<b>Transit mode split over the I-5 crossing</b>				
PM peak period	19%	21%	33%	37%
Daily	13%	15%	15%	16%

Source: CRC Transit Technical Report 2008.

**TRANSIT OPERATIONS: TRANSIT TRAVEL TIMES**

Increased transit operations would slow buses but would not affect light rail travel speeds. BRT would require more vehicles than light rail to provide the same capacity. With Increased operations, the additional vehicles would cause congestion in the transit guideway during peak periods, slowing buses using the guideway (Exhibit 3.1-47). In contrast, light rail could use fewer vehicles in either operating scenario, and would not experience congestion or reduction in travel speed.

Exhibit 3.1-47

**Travel Speeds and Times<sup>a</sup> for Efficient and Increased Transit Operations**

	Efficient Operations		Increased Operations	
	BRT	LRT	BRT	LRT
Average travel speed through CRC area	14.5 mph	17.3 mph	13.1 mph	17.3 mph
Average travel speed through downtown Vancouver	9.6 mph	12.9 mph	7.5 mph	12.9 mph
Travel time from Expo Center to Northern Terminus <sup>b</sup>	13 min.	12 min.	19 min.	12 min.

Source: CRC Transit Technical Report 2008.

<sup>a</sup> These speeds and times are during the afternoon/evening peak period in the peak direction (northbound).

<sup>b</sup> The data in this table assumes a Lincoln terminus, so the northern terminus is the Lincoln station. Travel times would be similar for the Kiggins Bowl terminus.

**TRANSIT OPERATIONS: TRANSIT OPERATIONS AND MAINTENANCE COSTS**

Capital costs would be slightly higher for Increased transit operations in order to purchase additional new vehicles (Exhibit 3.1-48). However, Increased transit would cost substantially more for annual operating and maintenance costs. This substantial increase in annual operating and maintenance costs would reduce the cost-effectiveness of the transit system, even though Increased transit operations would attract higher ridership. Ultimately, Increased transit operations would have a larger effect on annual operating and maintenance costs than on ridership, producing a higher cost per transit passenger.

Exhibit 3.1-48

**Cost Comparison of Efficient and Increased Transit Operations**

	Efficient Operations		Increased Operations	
	BRT	LRT	BRT	LRT
Annual operating and maintenance costs	\$75 Million	\$73 Million	\$114 Million	\$106 Million
Cost per incremental new passenger <sup>a</sup>	\$15.09	\$11.55	\$23.67	\$16.58

Source: CRC Transit Technical Report 2008.

<sup>a</sup> Incremental capital and operational cost per incremental passenger over the No-Build Alternative.**TRANSIT OPERATIONS: SAFETY AND SECURITY**

The Increased transit operations scenario would place many more buses on the street, which would result in more interaction with pedestrians and other traffic. Efficient operations would have fewer transit vehicles than Increased operations, potentially reducing the likelihood of collisions involving transit vehicles.

**Bridge Toll**

This section compares how daily traffic levels would vary at the I-5 and I-205 crossings if no toll were collected, if only the I-5 crossing were tolled, or if both the I-5 and I-205 crossings were tolled using the same toll rate structure (see Exhibit 3.1-49). Tolls on the I-5 crossing are included in all build alternatives. Other scenarios were included to analyze how tolling would affect demand on the roadway.

**BRIDGE TOLL: I-5 AND I-205 TRAFFIC LEVELS**

The adjacent table summarizes 2030 average daily traffic volumes for the I-5 and I-205 crossings under non-tolling and two tolling scenarios (the No-Build Alternative would not be tolled). The comparative analysis was conducted for the replacement crossing (Alternatives 2 and 3); however, with these tolling scenarios similar trends would result for the supplemental crossing (Alternatives 4 and 5). Sensitivity tests conducted on supplemental bridge alternatives showed trends similar to the replacement bridge for No Toll, Toll I-5 only, and Toll I-5 and I-205 scenarios.

Highway performance results assume that tolls would be administered at the I-5 crossing. Under this scenario, the replacement crossing would result in 178,000 daily vehicle trips across the I-5 bridges and 213,000 vehicle trips across the I-205 bridges.

If no toll were collected in 2030, the I-5 crossing's daily traffic levels would increase by 32,000 vehicles (18 percent). The I-205 crossing's daily traffic would decrease by 13,000 vehicles (6 percent). Without tolling, an additional 19,000 (5 percent) cross-river vehicle trips would be made in 2030.

Without tolling, I-5's traffic performance would substantially degrade compared to the modeled project alternatives. Peak travel demand would be higher, as would the duration of congestion experienced at critical highway bottlenecks. I-5 travel speeds would be lower and travel times

Exhibit 3.1-49

**Average Daily Traffic per Tolling Scenario (Replacement Crossing)**

Tolling Scenario	I-5 Crossing	I-205 Crossing	Total
No Toll	210,000	200,000	410,000
Toll I-5 Only	178,000	213,000	391,000
Toll I-5 and I-205	196,000	170,000	366,000

Source: CRC Traffic Technical Report 2008.

Note: Comparative data for the supplemental river crossing show similar trends.



higher than under an I-5 only tolled scenario. In addition, traffic conditions along I-205 would not improve substantially, as traffic demand would continue to exceed the I-205 crossing's capacity.

If both I-5 and I-205 crossings were tolled, daily cross-river vehicle trips would decrease by 6 percent compared to the scenario with only I-5 tolled. Daily traffic levels would increase by 18,000 vehicles (10 percent) at the I-5 crossing, but would decrease by 33,000 vehicles (20 percent) at the I-205 crossing.

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Compared to No-Build conditions in 2030, without the provision of tolling, I-5's daily traffic would increase by 32,000 vehicles or 18 percent. I-205's daily traffic would decrease by 13,000 vehicles, or 6 percent.

With both crossings tolled, the I-5 crossing's traffic performance would degrade compared to a condition where only the I-5 crossing was tolled, resulting in increased traffic congestion. However, the I-205 crossing would experience substantially lower traffic demand, resulting in improved operations along this corridor.

#### BRIDGE TOLL: LOCAL STREET PERFORMANCE

Without a toll on the I-5 crossing, or with a toll on both the I-5 and I-205 crossings, traffic volumes to and from I-5 would be higher and local streets in the vicinity of I-5 interchanges would generally perform with decreased levels-of-service compared to the scenario with only the I-5 crossing tolled. Local streets in the vicinity of I-205 interchanges would benefit with improved service levels with both the I-5 and I-205 crossings tolled.

#### BRIDGE TOLL: TRAFFIC SAFETY AND SECURITY

Traffic models that analyze tolling (discussed in the Traffic section of this DEIS) indicate that tolling the I-5 crossing would reduce traffic demand and congestion over non-tolled levels, which is likely to reduce the collision rate on the highway and increase traffic safety. Local traffic tends to increase when the highway is congested as drivers seek alternate routes, so lowering congestion on the highway is likely to lower local street congestion as well, reducing the likelihood of collisions on local streets.

If both the I-5 and I-205 crossings were tolled, it would increase demand and congestion on I-5, although not to as great an extent as a no-toll projection. This would increase congestion and the likelihood of collisions on I-5, although it would reduce this risk on I-205 compared to tolling only the I-5 crossing.

#### BRIDGE TOLL: TRANSIT RIDERSHIP AND MODE SPLIT

Introducing a toll on the I-5 crossing (or, as ridership models show, on the I-205 crossing as well) would generally increase the attractiveness of transit. The No-Build Alternative is the only alternative that would not be tolled. Tolling would not affect most measures of transit performance, such as travel times or cost, but could increase ridership as some commuters might decide to take transit instead of driving to avoid paying the toll (Exhibit 3.1-50). A higher toll (\$0.50 more during peak travel periods) would further increase transit ridership, though only modestly. Tolling both I-5 and I-205 (at the standard rate) would increase transit ridership even more than a standard or higher rate toll on just the I-5 crossing.

Increases in transit ridership caused by tolling would produce a greater increase in transit mode split. In general, tolling would increase transit

ridership over the river, decrease auto usage over the river, and thus increase transit mode split.

Exhibit 3.1-50

**Daily Transit Trips across the I-5 River Crossing<sup>a</sup>**

	No Toll	I-5 Standard Toll	I-5 Higher Toll	I-5 and I-205 Standard Toll
Daily transit trips across the I-5 river crossing	19,300	20,800	21,400	21,700
Transit mode split across the I-5 river crossing	19%	21%	22%	23%

Source: CRC Transit Technical Report 2008.

<sup>a</sup> These data are for light rail, but the relationship would be the same for BRT.

**Transportation Demand and System Management Measures****TRANSPORTATION DEMAND AND SYSTEM MANAGEMENT MEASURES: I-5 AND I-205 TRAFFIC LEVELS**

This project includes substantial transportation demand management measures—chiefly, adding high-capacity transit through Vancouver and introducing a toll on the I-5 crossing. The effects of high-capacity transit and tolling are discussed in detail earlier in this chapter. There are also several other transportation demand and system management measures, such as commute trip reduction policies, which are part of all of the build alternatives; these are described in Chapter 2. These additional measures would increase the efficiency of the other improvements included in the build alternatives.

**TRANSPORTATION DEMAND AND SYSTEM MANAGEMENT MEASURES: TRAFFIC SAFETY AND SECURITY**

Transportation demand management (TDM) and transportation system management (TSM) measures will not have an impact on safety and security. However, TDM programs often include public education campaigns aimed at encouraging alternative modes of travel. Components of these campaigns (newsletters, promotions, web pages, etc.) can be used to address safety and security issues as well.

**Temporary Effects**

River crossing and highway construction impacts to transportation will come from a variety of sources—detours, construction activity, lane and ramp closures, narrow lanes and shoulders, construction traffic, commuter behavioral changes, dust, and others. As more definitive plans are developed, impacts will be further defined. All discussion of construction staging is conceptual at this phase of project development.

The main construction issue is having only one feasible alternative route for north-south travel across the river (I-205), which is also congested at peak hours. Pedestrian and bicycle traffic is always a safety concern in a construction zone, with rerouting and out of direction travel possibly required.

The detour alignments necessary during construction are generally not up to highway standards, and would contribute to increased congestion

With the provision of high-capacity transit and tolling, the build alternatives would reduce vehicle traffic volumes across the I-5 bridge by up to 10 percent compared to No-Build conditions.

during construction. The constraints of this narrow urban corridor do not permit high-speed detour connections. As such, sharper curves, narrower lanes, and adverse pavement slopes would be common. These conditions would require lowering the speed limit.

#### TEMPORARY EFFECTS: REGIONAL TRAFFIC

I-5 is one of only two highway crossings of the Columbia River in the Portland-Vancouver area. The I-205 crossing is about 6.5 miles upstream. The closest crossing downstream is some 40 miles away at Longview-Rainier. The closest upstream crossing outside this area is over 40 miles away at Cascade Locks, and is a tolled crossing.

The I-5 and I-205 crossings are approaching or at capacity during peak hours, leaving little opportunity for diversion of traffic if construction leads to an increase in congestion on I-5. Construction impacts would extend the hours of existing congestion and likely create failure at other times of day. The project would strive to accommodate peak hour traffic by keeping three lanes open for all weekday, daytime hours. Lane closures on I-5 would likely be restricted to night-time hours.

The interchanges near the river have interrelated movements that make it imperative to construct the crossing and new interchanges simultaneously. Interchanges north of SR 14 can be built independently; however, if they are not built at the same time because of funding or other issues, overall construction would be extended by several years.

During evening and weekend closures, motorists would have to use I-205 to avoid congestion in the I-5 corridor. It is estimated that half the peak weekend I-5 trips would need to divert to I-205 to keep an acceptable level of service on I-5. Advanced warning systems and real-time motorist information signing would be used to redirect motorists.

Staging area and casting yard activities would need to be managed to keep movement to and from the construction sites to a minimum during peak hours. The main effect of movement between these sites would be on local road networks, for deliveries not using the highway system.

#### TEMPORARY EFFECTS: LOCAL TRAFFIC

Local systems would experience direct and indirect effects—backups from ramps due to highway congestion, closures of highway overcrossings while new structures are constructed, loss of access to or from the highway at some interchanges, use of local systems for material delivery and haul routes, and partial closure of city blocks during transit construction. Motorists would need to change routes or travel modes to avoid some of these impacts.

#### Marine Drive Interchange

Two construction features could create problems at Marine Drive, under all build alternatives. Constructing an overpass to carry Marine Drive across the highway would be a priority. After the main pier of this crossing is constructed, the short distance between the North Portland Harbor bridge and the new pier would require the most adverse alignment of the mainline detours. A speed reduction to 40 miles per hour or lower might be necessary, which could result in expanding congestion hours and further lowering the level of service during other high volume periods. These conditions could last from 1.5 to 2 years.



Regional traffic uses this interchange to reach the state highways leading east and west. Peak hours are already gridlocked north-south, and this would increase congestion. The total number of lanes would remain the same. Backups would still occur from highway-related merging conditions northbound. Backups do not currently halt east-west travel through the interchange area. The current slow-downs would continue, and could possibly worsen during construction. Staging areas are possible here, most likely to the west. Material deliveries should for the most part be scheduled outside peak hours.

#### Columbia River Bridges

Retrofitting the existing bridges for the supplemental crossing (Alternatives 4 and 5) would create additional congestion. Substructure work can likely be performed with traffic on the structures. Superstructure work would require traffic to switch to the other structure. Motorists would generally adapt, however the on and off connections at each end would change between stages and would be more difficult to navigate than under current conditions, especially for the I-5 northbound to SR 14 eastbound movement. This ramp's curve is already very substandard and would be made much more so when the traffic has to come from over 80 feet further away. Backups occur now and would be further aggravated during construction, leading to additional congestion on the bridge.

#### Hayden Island Interchange

During construction of the replacement crossing, staging the construction of the North Portland Harbor structure would be the main issue at the Hayden Island interchange. Traffic lanes would be restricted to 11 feet with 1-foot shoulders during several construction stages, and traffic entering I-5 southbound from Hayden Island would lose an existing auxiliary lane that now exits at Marine Drive. This would likely expand the hours of southbound congestion and lower the level of service during other heavily traveled times of day. With the supplemental crossing, Hayden Island may experience more backups from the highway with the elimination of both auxiliary lanes between Marine Drive and the island.

For the supplemental crossing, Hayden Island construction would have the most adverse effects to traffic. The construction of the North Portland Harbor bridge would eliminate both auxiliary lanes, versus just the southbound in the replacement. This configuration could last up to three years and would reduce capacity. The only remedy for congestion in this area is reducing vehicle travel demand at peak hours through transit, rideshare and other measures; no temporary roadway configurations could remedy congestion here.

Congestion would extend the peak hours and affect other high volume hours at the crossing. I-5 northbound traffic would split into two 2-lane movements just north of Marine Drive. This is an unexpected movement and would require additional signing to safely direct motorists. Traffic in the two left lanes would not be able to exit at Hayden Island or SR 14. Traffic entering I-5 northbound would merge into through traffic. At times this movement would be an add lane, and other than speed differential, should not have an adverse effect on traffic. However, in a latter phase all traffic would use the existing southbound bridge and this movement would have to merge into the fast lane. The geometry to move

northbound traffic from a temporary detour on the southbound bridge to the existing southbound lanes/bridge may require a reduction in speed to 40 miles per hour or less, adding to congestion.

The on and off movements to Hayden Island are already substandard, so detours needed during construction would probably have minimal effect. Short term closures are not anticipated if traffic can switch over in the evening with the help of flaggers and signing.

The main effect on local traffic would be additional backups from traffic trying to access the highway. These afternoon/evening peak problems occur daily now, and would likely increase, causing congestion for local trips. Detours should accommodate the current lanes but the lack of an auxiliary highway lane southbound, along with revised and shortened merges in both directions, would add to current backups and affect the local traffic movement. Construction staging areas could be located on the island, and haul routes would have to use the local system.

Remediation efforts for the southbound auxiliary lane closure are likely limited to information and outreach. Physical limitations prohibit additional lanes. A moveable barrier system to create an additional lane in the peak directional period could be considered, although this would sacrifice a lane in the opposing direction. Alternating lane assignments would be difficult, and could make congestion worse if motorist confusion or unnecessary weaving should develop.

#### SR 14 Interchange

SR 14 is one of the few areas where traffic movements would be eliminated for an extended period of time. For the replacement crossing, Washington Street to SR 14 eastbound, I-5 northbound to C Street, and SR 14 westbound to C Street movements would all be closed for a majority of the construction timeline, which could last three to four years. Traffic to or from SR 14 and downtown have a small number of alternate routes: Mill Plain interchange to access the highway, then SR 14; Columbia Way and the Columbia House interchange on SR 14; or Mill Plain or Evergreen Boulevard to Grand Boulevard, then south to SR 14.

For the supplemental crossing, construction would require closing the same three ramps into and out of Vancouver, but the durations would be much less. The Washington Street to SR 14 eastbound closure could be as short as 2.5 years. The I-5 northbound to C Street and SR 14 westbound to C Street could be closed for as little as 9 months.

Detour geometry for the highway would be less severe for the supplemental crossing, and the I-5 northbound weave between SR 14 and Mill Plain would be less affected. The I-5 southbound weave between Mill Plain and SR 14, however, would become shorter and more difficult, as the touchdown for the supplemental bridge would be several hundred feet farther north than the replacement bridge and would restrict the room needed to design adequate geometry for this temporary weave. It would have a few staging iterations and possibly add to motorists' confusion.

The effect to I-5 traffic would be mainly to northbound traffic. Traffic normally leaving I-5 to enter downtown Vancouver at SR 14 would have

to merge with traffic westbound from SR 14 and exit at the Mill Plain interchange. This movement would combine with the already heavy weaving movement used by traffic exiting at Mill Plain and traffic coming from SR 14 to proceed north on I-5. Local traffic would soon adjust to the options for east-west travel. At SR 14 some access closures would be shorter for the supplemental crossing, so effects to downtown Vancouver and east-west detour routes would not last as long.

While the I-5 southbound to SR 14 eastbound movement would not close during peak hours, the current weave between this and the Mill Plain to I-5 southbound movement would be relocated during various stages, and the weaving distance could be shorter than currently exists. This weave area is already a major source of conflict with mainline traffic, and would extend congestion and lower the level of service at other heavy traffic volume hours.

Construction staging activities in Vancouver would generate construction traffic for material delivery and removal. Construction activities could occur at any time of the day or night. To the west, a staging area in lower downtown could access the construction site via city streets. Other sites would use Mill Plain Boulevard and city streets to gain access to SR 14 construction areas on the west side. Problems most likely would occur at construction access points from city streets, especially if the areas cannot accommodate more than one vehicle at a time or if the size of the load requires special maneuvering. Flaggers would facilitate local traffic movement where such conflicts occur.

Crossing I-5 from west to east may result in larger local traffic issues. Evergreen Boulevard would close for 9 to 12 months while the new crossing is constructed. Construction on Evergreen should be completed before closing the SR 14 over-crossing into Vancouver. When SR 14 closes, Evergreen and Columbia Way would become the relief routes. Columbia Way may not be able to handle some oversized loads, which would need to use Evergreen or move up to Mill Plain. Few streets on the east side of the highway would be impacted.

Remediation would consist of extensive public information and outreach to encourage motorists and employers to reduce commute trips, especially during peak hours. Real-time information needs to be readily available through message boards and broadcast media. Incident response would be enhanced. Signed detours to I-205 would be required during I-5 closures.

#### Mill Plain, Fourth Plain and SR 500/39th Street Interchanges

During highway construction of all build alternatives, the northbound Mill Plain highway off-ramp could have intersection failure during peak hours, which could result in traffic backing up into the weaving section from SR 14. Construction traffic hauling materials on Mill Plain, Fourth Plain, and SR 500/39th Street would add to local congestion during peak hours.

For the most part through-flow would not be adversely affected at these interchanges. Detour alignments may require speed reductions, and some areas would require construction under traffic, but would not have traffic impacts above what is normal in a construction zone. SR 500 would be narrowed to one southbound lane before it crosses I-5, whereas it



currently has two lanes. However, it effectively becomes one-lane as it enters I-5, and the exit at Fourth Plain from SR 500 would be eliminated, so the overall effects to congestion should be manageable.

The replacement of highway crossings at Mill Plain and construction on McLoughlin would not close the movements to east-west traffic. Fourth Plain and 39th Street would have temporary structures in place before the old ones are dismantled. Fourth Plain's temporary crossing would likely be three lanes, versus the current five, which could lead to congestion at peak times.

The 29th and 33rd Street over-crossings would close during construction of their replacement structures. However, they would not be closed at the same time, to shorten the detour. These are relatively low volume and low speed roadways, and the detours should not pose a problem to motorists.

#### TEMPORARY EFFECTS: FREIGHT

Truck traffic would be influenced by construction, with effects comparable to regional and local traffic. Trucks generally avoid peak hour traffic, when possible. With peak hours extended by construction detours and other factors, the choice of travel times would become slimmer. The nearest alternate route is also affected by peak hour traffic. Other options create a longer trip (with some of the trip subject to Oregon's weight-mile fee), and the trucks must still pass through the Portland Metro area. The Bridge of the Gods, a toll bridge located 43 miles upstream in Cascade Locks, cannot accommodate over-height or over-weight loads. The Longview-Rainier Bridge 40 miles downstream has weight restrictions and requires flagging for loads over 12 feet wide. Therefore, trucks would probably be more highly represented in peak hours and would add to the congestion with their lower performance. Trucks are not prone to making discretionary trips, so there is little mitigation available. Some loads may shift to rail, but more than likely no in appreciable amounts.

#### TEMPORARY EFFECTS: PEDESTRIANS AND BICYCLISTS

Effects to pedestrians and cyclists would be similar to those described for vehicles. One main difference, however, would be the need to maintain access to businesses and residences through the construction area. This could be accomplished with temporary walkways and short bridges over and through the construction zone, with appropriate safety fencing and signing.

Construction of the river crossings would require closing the sidewalk on the southbound bridge, and all bicycle and pedestrian traffic would move to the northbound bridge, which is slightly narrower and slightly less convenient for accessing downtown Vancouver. This configuration would remain until the new high-capacity transit bridge is constructed and bicycles and pedestrians can move to it.

On Hayden Island, once construction of the North Portland Harbor Bridge begins, it would be necessary to eliminate the current bike path. The transit crossing of the harbor to accommodate non-motorized travel would ideally be finished before this closure. Construction of the interchange and crossing could be delayed approximately 13 months and not delay the overall completion of the interchange, which would allow

for this sequencing. If this is not feasible then a shuttle or construction of a temporary structure may be possible, but could present access issues.

The Marine Drive interchange has paths that connect to the crossing on the east side of I-5. These paths would be eliminated once construction of the new interchange begins. As with Hayden Island, the construction start could be delayed to allow the transit crossing to be constructed first. If not, then a temporary path would have to be designed and constructed. East/west travel through these two interchanges would be maintained on separated or adjoining temporary paths associated with the detours.

The recently opened Confluence Land Bridge pedestrian overcrossing of SR 14 gives a northbound alternate route close to the east side of I-5. Traffic going to lower Vancouver would have to circle around and use Columbia Way. East-west movements at Mill Plain, Fourth Plain, and 39th Street would be maintained. Fourth Plain and 39th Street would be on temporary structures, along with the local traffic; 29th Street and 33rd Street would be closed at different times, and bicycle and pedestrian traffic normally using the structure would detour.

Constructing a wider path on the existing northbound bridge for bicycle and pedestrian traffic (as part of the supplemental crossing) would require some additional staging for this traffic. The southbound bridge would be closed to bicycle and pedestrian traffic during construction of the new river crossing. The widened path would most likely be constructed while the northbound bridge is undergoing seismic upgrades. Bicycle and pedestrian traffic would then move back to the southbound bridge, with temporary connections to access current paths or connections outside the right-of-way. Scenarios similar to those described in the replacement option apply to the remaining interchanges. The North Portland Harbor crossing presents the biggest challenge and is similar in effects to the replacement crossing.

#### TEMPORARY EFFECTS: CONSTRUCTION SAFETY

Safety in a construction zone decreases when traffic patterns change, lane and shoulder widths narrow, merging and weaving distances shorten, or turns become sharper. Increased congestion and substandard geometry leads to more collisions. Scenarios that close more interchanges, reduce the number or width of lanes, or present longer construction times would pose higher safety risks. Temporary connections would be designed to the highest standards possible within the constraints of the physical environment. An effective awareness campaign would be the key to safety.

Several stages of construction for the supplemental crossing would require unusual merge or diverge movements and would place traffic entering the highway into the left lane. These measures would likely decrease safety compared to the construction effects of the replacement crossing. However, the SR 14 interchange closures would likely not last as long with the supplemental crossing, decreasing detours and increasing safety near that interchange compared to the replacement crossing.

Construction areas that eliminate sidewalks, shoulders, or multi-use paths can increase the danger to pedestrians and cyclists who may utilize

traffic lanes rather than make out-of-direction travel around construction areas.

Effects to bicycle and pedestrian traffic would be similar to that for motor vehicles. Access to businesses and residences through the construction areas would be accomplished with temporary walkways and short bridges with appropriate safety fencing and signing.

#### TEMPORARY EFFECTS: TRANSIT MODE

The choice of light rail or BRT would have similar effects on local traffic; construction of either mode would have minimal effects on regional highway traffic. Construction of either a bus or light rail guideway would have a substantial impact on local streets in Vancouver around the transit guideway. In general, both modes would require reconstructing the roadbed. Besides closing sections of streets to traffic, associated utility impacts would add to the duration and conflicts. Traffic could be totally excluded from blocks during active construction, resulting in detours to adjacent streets. Cross-traffic would also be precluded in some areas and restricted in others to one lane each direction or one lane total. Transit construction impacts in Oregon should be minimal.

#### TEMPORARY EFFECTS: TRANSIT TERMINUS AND ALIGNMENT OPTIONS

The largest temporary effect of construction of the transit guideway would be at the Kiggins Bowl terminus, which will require shifting the I-5 roadway approximately 25 feet west. This shift would require constructing new piers for I-5 overpasses, and could entail additional detours. For the Kiggins Bowl terminus, the transit guideway would cross I-5 north of SR 500, potentially narrowing some highway lanes or creating rolling traffic stops to erect girders. These effects are typical for construction activities in the corridor, but could cause some additional congestion.

Construction of the Lincoln terminus on Main Street north of 29th Street may have the most impacts. Downtown Vancouver has adjacent blocks that can accommodate detour traffic. However, Main Street is the primary north-south arterial for northern Vancouver west of I-5, so construction activity on Main Street may be more disruptive for north-south travelers. Construction north of 29th Street would take all but two lanes of traffic, and would require establishing some alternate routes with out of direction travel, especially north of 39th Street. High-capacity transit construction would disturb parking along Main and Broadway Streets for the duration of construction. Parking might be reestablished on sections of these streets during some phases of construction.

#### TEMPORARY EFFECTS: TRANSIT PERFORMANCE

During construction, expanded hours of peak congestion and lower traffic levels-of-service during heavy demand periods on I-5 would be the norm. Express buses would experience similar effects to those experienced by regional and local traffic. Bus priority or special purpose lanes would not be available in the narrow construction corridor. Routes would be adjusted to reflect the potential longer travel times outside normal peak hours.



Bus service through downtown Vancouver and Delta Park would be affected by interchange closures at SR 14. One bus line that uses SR 14 into the city would have to use Columbia Way. Schedule adjustments would be required for these routes.

High-capacity transit construction may have the greatest impact on current service. Construction of the Lincoln terminus may disrupt some primary bus routes in northern Vancouver. Disruption of these routes would affect transit service, and routes or times may have to be adjusted.

### **Potential Mitigation Measures**

#### **POTENTIAL MITIGATION MEASURES: MULTI-MODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS**

Exhibit 3.1-51 summarizes the local street impacts that would result under the build alternatives and show potential measures to mitigate impacts to less-than-substantial levels.

Many of the impacts that would occur with Alternatives 4 and 5 could not be mitigated without changing the supplemental crossing's fundamental design. Many of the traffic impacts from the supplemental crossing occur at on- and off-ramps as traffic is funneled into the two right-hand lanes that are separated from the interior northbound lanes. Essentially, the only mitigation possible for these traffic impacts would be to add an additional auxiliary lane on the outside northbound bridge; however, this is not reasonable because it would remove the safety shoulders on this bridge that are necessary to improve safety conditions and to address this project's Purpose and Need.

Bus routes would need to be rerouted during construction. To minimize disruptions to passengers, substantial rerouting could be minimized.

To help citizens and business owners become aware of how to navigate within the construction area, public meetings could be held, booths could be set up at public events, public notices could be posted, and information could be distributed by local newspapers and during local television new casts. In addition, the project sponsors could assist business owners in making the public aware that they are open during construction through additional signage and way-finding descriptions to available public parking.

Exhibit 3.1-51

**Potential Impacts and Mitigation Measures for River Crossing and Highway Effects on Local Street Performance**

Subarea and Crossing	Potential Impact	Potential Mitigation Measure
<b>Marine Drive Area</b>		
Replacement river crossing	Union Court/Vancouver Way (PM LOS, AM Queuing)	Signalize intersection and optimize for critical turning movements
	Circuitous pedestrian and bicycle route	Add pedestrian only sidewalk on east side of N Portland Harbor Bridge and add sidewalk to east side of northbound bridge
Supplemental river crossing	Union Court/Vancouver Way (PM LOS, AM/PM Queuing)	Extend northbound right turn storage lane 50 feet, signalize intersection and optimize for critical turning movements
	Vancouver Way/MLK on- and off-ramps (PM Queuing)	No reasonable mitigation recommended
	Circuitous pedestrian and bicycle route	Add pedestrian only sidewalk on east side of N Portland Harbor Bridge and cantilevered pathway on west side of current southbound bridge
Stacked Transit/Highway Bridge	Circuitous pedestrian and bicycle route	Add suspended pathway on west side of current southbound bridge and/or sidewalk to fix below roadway deck for east side of northbound bridge

Source: CRC Traffic Technical Report 2008.

**POTENTIAL MITIGATION MEASURES: TRANSIT MODE**

Exhibit 3.1-52 summarizes local street impacts that would result for transit options and provides potential measures to mitigate impacts to non-substantial levels.

Exhibit 3.1-52

**Potential Impacts and Mitigation Measures for Transit Mode Effects on Local Street Performance**

Potential Impact	Potential Mitigation Measure
Increased vehicle delays at some intersections with LRT service due to pre-emptive traffic signals for transit	<ul style="list-style-type: none"> <li>Optimize traffic signal coordination.</li> <li>Minimize or eliminate transit pre-emption at key downtown traffic signals with the heaviest cross-traffic demand.</li> </ul>

**POTENTIAL MITIGATION MEASURES: TRANSIT TERMINUS AND ALIGNMENT OPTIONS**

Exhibit 3.1-53 provides potential measures for impacts from the transit terminus and alignment options.

Exhibit 3.1-53

**Potential Vancouver Local Street Intersection Impacts and Mitigation Measures for Long-Term Impacts from Minimum Operable Segments**

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**Potential Mitigation Measures**

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*City of Vancouver, C-TRAN and WSDOT could monitor traffic operations and pursue mitigating measures such as:*

- Monitor traffic volumes and signalize intersections as warranted.
  - Extend/add turn lanes at key intersections.
  - Prohibit on-street parking during peak periods (e.g., 8th Street, 15th Street, Mill Plain Boulevard).
  - Monitor northbound left-turns on Main Street at 15th Street and on Columbia Street at 15th Street and prohibit when appropriate to provide southbound left and left/thru lanes to Mill Plain Boulevard.
  - Monitor and adjust Interstate ramp meter rates at Mill Plain Boulevard on-ramps.
  - Convert two-way streets to one-way couplets.
  - Reduce number of parking spaces at park and ride stations.
  - Provide multiple driveways to/from park and ride stations.
  - Increase shuttle bus service to park and ride station to decrease automobile traffic generation.
  - Current underutilized off-street facilities may be able to mitigate the loss of on-street parking.
  - Provide drop-off facilities for disabled patrons.
  - Reduce number of parking spaces at park and ride stations.
  - Reconfigure Fourth Plain Blvd. over-crossing to provide two through lanes in the westbound direction.
  - Grade separate HCT crossing at 39th Street and Main Street.
  - Designate Columbia Street as an arterial roadway.
- 

Source: CRC Transit Technical Report 2008.

**POTENTIAL MITIGATION MEASURES: TRANSIT SAFETY AND SECURITY**

Safety mitigation measures are generally proposed for transit projects after an alignment is chosen, since mitigation is very site-specific, but often include improvements for pedestrian crossing by adding signalized intersections or other types protected crossings. Intersections and access points to transit are analyzed individually to enhance safety. Pedestrian and traffic crossings will be limited to controlled areas and will be discouraged in other places.

Intersections with transit crossings will be controlled by traffic signals to direct safe pedestrian, bicycle and auto movements. Signage should increase the awareness of the new guideway by clearly delineating the guideway and adjacent streets and by warning pedestrians when trains are approaching. One possible measure could be inclusion of audible warnings and textured ramps to alert hearing and visually impaired persons to crossings.

During construction, additional public involvement and education programs should provide information to residents, travelers, shoppers, cyclists, and others. The project could assist a transportation management association with public education for downtown Vancouver.



Local transit agency employees and the public should be involved in a public campaign to address security issues, incorporating security into design and construction practices, and enhancing emergency preparedness. Crime prevention should be integrated into station environmental design by including good lighting, clear sight lines, clearly defined public travel routes, reduced station clutter, and security cameras. For the Stacked Transit/Highway Bridge design, TriMet's experience with safety and security management of the Westside MAX tunnel offers guidance for effective measures to limit access to the inside of the bridge structure.

## 3.2 Aviation and Navigation

When proposing changes to the river crossing, project staff considered the beneficial or adverse effects of the project on aviation and navigation. Two goals of the CRC project are to minimize hazards to Columbia River navigation and to minimize hazards to air navigation from Pearson Field. However, these goals conflict, as recommended clear heights for river navigation intrude on recommended clear airspace for Pearson Field. Some obstruction of both river and air traffic is inevitable, but the project has worked to balance these two interests fairly.

The information presented in this section is based on analyses found in the Aviation and River Navigation Technical Reports.

### 3.2.1 Existing River Navigation and Aviation Conditions

#### Existing River Navigation Safety

The I-5 bridges cross both the main channel of the Columbia River and a channel on the south side of Hayden Island known as North Portland Harbor. Because both channels are designated Federal Navigable Waterways, the U.S. Coast Guard must approve construction or alteration of bridges across either of them. Currently, navigation is limited for both waterways by the I-5 crossing and by a BNSF railroad bridge located about one mile downstream to the west of the I-5 crossing (Exhibit 3.2-1).

Exhibit 3.2-1  
I-5 and BNSF Railroad Bridges



Near the CRC area, North Portland Harbor supports marinas of floating homes and primarily non-commercial boats, as shown on the south side of Hayden Island in Exhibit 3.2-1. West of the I-5 crossing, large ocean-

going cargo ships use North Portland Harbor to reach Port of Portland Terminal 6 (not shown). This channel has a navigation width of 215 feet and a clearance height under the existing bridges of 35 to 40 feet, which limits the use of the channel to primarily recreational boats and smaller boats and barges.

In the main Columbia River channel, large vessels must pass the railroad bridge at its opening span near the Washington shore, (shown open in Exhibits 3.2-1 and 3.2-2). The lift spans of the I-5 crossing are also located in the primary channel near the Washington shore. During hours of lift-span operation, vessels can pass the two bridges without steering a complex, weaving maneuver, course.

Exhibit 3.2-2

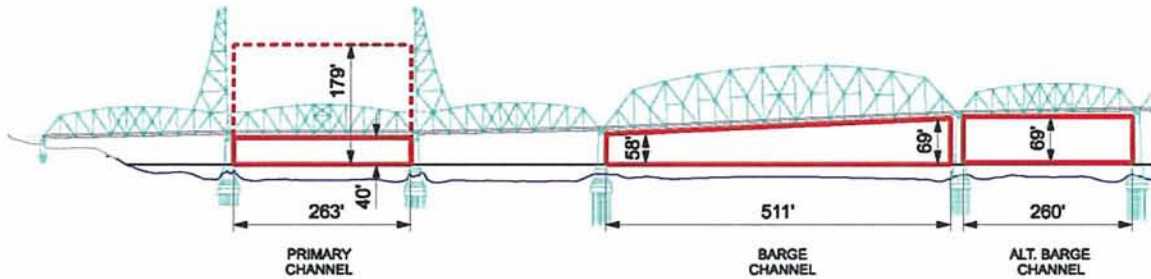
**I-5 and BNSF Railroad Bridge Shipping Routes**

However, during restricted hours (weekdays, between 6:30 and 9:00 a.m. and between 2:30 and 6:00 p.m.), many medium-sized vessels use one of the alternate channels under the I-5 crossing rather than wait several hours for the lift-spans to open. This results in more complex navigation for vessels, which must make relatively sharp turns in a short stretch of river and use channels that may have lower height clearance, narrower width, or shallower depths than the primary channel. This represents a potential safety hazard for marine traffic.

Exhibit 3.2-3 illustrates the navigation constraints posed by the existing I-5 crossing. The primary channel lies between piers set 263 feet apart, and has a vertical clearance of 40 feet when the lift spans are down. When fully raised, the vertical clearance is 179 feet. The barge channel lies under the wide spans of the bridge, and has a horizontal clearance of 511 feet and a vertical clearance ranging from 58 to 69 feet. The alternate barge channel occupies the span directly to the south of the wide span, and has a horizontal clearance of 260 feet and a vertical clearance of 69 feet.



Exhibit 3.2-3

**Existing I-5 Columbia River Crossing Navigation Clearances**

Source: CRC Navigation Technical Report 2008. Drawing not to scale.

With the exception of some specialized vessels that use the river infrequently, commercial, cruise and recreational vessels require vertical clearances of less than 90 feet from the surface of the water to the bottom of the bridge deck. The project team, in consultation with the Coast Guard, established a vertical minimum of 95 feet clearance, so that new structures could be built without a lift-span. Higher vertical clearances would have violated restricted airspace for flight navigation.

Exhibit 3.2-4

**Summary of Vertical Clearance Requirements and Frequency of Use**

Vessel Type	Clearance Requirement	Approximate Annual Frequency
Tugs and Tows	49 feet to 58 feet	> 500 trips
Sailboats/Recreation	76 feet to 88 feet	24 trips
Marine Contractors	100 feet to 110 feet	Infrequent
Marine Industrial	65 feet	6 trips
Cruise/Passenger	50 feet to 60 feet	25 trips

Source: Parsons Brinckerhoff Inc., 2004.

The Coast Guard, which approves construction or alteration of the bridges, has stated that navigation conditions cannot become worse than existing conditions, if the CRC project designs are to receive permitting. They have requested at least a 300-foot navigation clearance between bridge piers, which would require bridge spans of between 400 and 500 feet. For Alternatives 4 and 5, because of seismic retrofits required to the piers of the existing bridges, the primary channel would have an available clearance of only 200 feet. The Coast Guard, as the permitting agency, has stated that piers for all adjacent new structures must align with the piers on the existing I-5 bridges. This would most directly apply to the Supplemental crossing (Alternatives 4 and 5).

**Existing Aviation Safety**

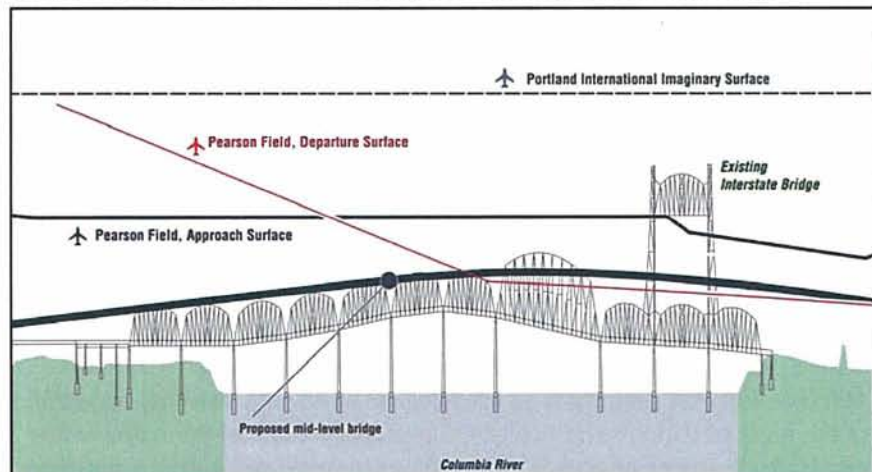
Two airports are located near the CRC area. Portland International Airport is located about three miles southeast of the project on the Oregon side of the Columbia River. It is the major regional airport and serves large commercial passenger and freight service, private craft, and Air National Guard fleets. Planned expansions include both potential runway extensions and the addition of a new runway.

Pearson Field is located directly east of the project on the Washington side of the Columbia River. It serves primarily small piston engine aircraft weighing 10,000 pounds or less. Because it is surrounded by developed urban uses and the Vancouver National Historic Reserve, there are no plans to expand facilities or operations at this airfield in the future.

The lift towers of the existing bridge currently intrude into the recommended clear airspace for Pearson Field and are an aviation hazard. To avoid the towers, aircraft must use a departure gradient of 650 feet elevation per nautical mile (ft/NM). If the lift towers were removed, then electrical transmission towers on Hayden Island would be the tallest structures in the airport flight path. These require a gradient of only 269 ft/NM, making it much safer for aircraft to arrive and depart without steep changes in altitude.

An important goal of the CRC project is to minimize effects of the crossing to both Columbia River navigation and air navigation from Pearson Field. However, the area between allowable airspace clearances overlaps with necessary navigational heights. The Federal Aviation Administration uses a 20:1 horizontal to vertical clearance ratio to identify obstructions (obstacle clearance surface) to aviation for the runway classification of Pearson Field. The existing lift span towers penetrate 98 feet into this airspace. Exhibit 3.2-5 shows the design constraints posed by both Portland International imaginary surface and Pearson Field approach and departure clearance surfaces.

Exhibit 3.2-5  
**Pearson Field and Portland International Airport Aviation Constraints**



Source: CRC Aviation Technical Report 2008. Drawing not to scale.

In order design a bridge with minimal negative height, portions of both the maritime and aviation envelopes were used for the proposed bridge and roadway design.

### 3.2.2 Long-term Effects from Full Alternatives

This section summarizes the safety-related impacts on navigation and aviation associated with the project alternatives.

### Alternative 1: No-Build

In the No-Build Alternative, the current lift span towers would continue to represent an aviation hazard for Pearson Field. The lift span restrictions would continue to cause delays to river traffic, while the continuing need to navigate around the lift-span and the relatively narrow width between existing bridge piers would continue to represent potential hazards to navigation. In addition, without the seismic upgrades included in the build alternatives, a major earthquake could collapse or seriously damage the bridge, creating an adverse impact to navigation.

### Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.2-6

#### Summary of Safety Performance for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
<b>River Navigation Safety and Security</b>	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.
<b>Aviation Safety and Security</b>	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 2 would improve both aviation and navigation safety and efficiency. Likely bridge designs would not include lift towers. The bridge would be located slightly farther from the airfield, and so would intrude less into Pearson Field airspace.

The crossing would require fewer piers, creating less of an obstacle to river navigation than either the existing crossing or the supplemental crossing. Taller ships would not be restricted by the hours of lift-span operation, and would not have to navigate a difficult path around the lift-span channel. A replacement crossing would be slightly closer to the downstream railroad bridge, which could potentially make navigation past the two bridges more difficult. However, the new primary channel under the I-5 crossing would have a better alignment with the channel through the railroad bridge than currently exists, which should improve navigation even with the two crossings slightly closer together.



### Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.2-7

#### Summary of Safety Performance for Alternative 3

Alternative 3: Replacement Crossing with Light Rail				
Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
<b>River Navigation Safety and Security</b>	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.
<b>Aviation Safety and Security</b>	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 3 would have aviation and river navigation improvements similar to those described for Alternative 2.

### Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.2-8

#### Summary of Safety Performance for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
<b>River Navigation Safety and Security</b>	Adverse. S-curve maneuver more difficult. More piers and narrower channels.	Adverse. S-curve maneuver more difficult. More piers and narrower channels.	Adverse. S-curve maneuver more difficult. More piers and narrower channels.	Adverse. S-curve maneuver more difficult. More piers and narrower channels.
<b>Aviation Safety and Security</b>	Existing lift-span would remain a hazard to aviation at Pearson Field.	Existing lift-span would remain a hazard to aviation at Pearson Field.	Existing lift-span would remain a hazard to aviation at Pearson Field.	Existing lift-span would remain a hazard to aviation at Pearson Field.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.

Alternative 4 would have adverse effects to aviation and navigation. The supplemental crossing would retain the existing lift span towers and would remain a hazard to aviation at Pearson Field. The height difference between the deck of the existing and supplemental structures would further restrict an area already congested for aviation.

Lift-span restrictions of the existing crossing would continue to cause delays to river traffic. The continuing need to navigate around the lift-span and the relatively narrow width between existing bridge piers would continue to represent a potential hazard to navigation. This width would decrease by 40 to 60 feet because of the seismic reinforcement planned for the existing bridge piers.

In addition, the supplemental crossing would require placing a new structure between the existing I-5 crossing and the downstream railroad bridge. This would increase the potential hazard to navigation, particularly if vessels should attempt to navigate around the I-5 lift-span, by providing less distance to navigate between the BNSF and I-5 crossings. The existing piers would be retained and new piers added for the new bridge, increasing the number of obstacles to navigation in the river.

### Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.2-9

#### Summary of Safety Performance for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail				
Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
<b>River Navigation Safety and Security</b>	Adverse. S-curve maneuver more difficult. More piers & narrower channels.	Adverse. S-curve maneuver more difficult. More piers & narrower channels.	Adverse. S-curve maneuver more difficult. More piers & narrower channels.	Adverse. S-curve maneuver more difficult. More piers & narrower channels.
<b>Aviation Safety and Security</b>	Lift-span remains a hazard to aviation at Pearson Field.	Lift-span remains a hazard to aviation at Pearson Field.	Lift-span remains a hazard to aviation at Pearson Field.	Lift-span remains a hazard to aviation at Pearson Field.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.

Alternative 5 would have aviation and river navigation improvements similar to those described for Alternative 4.

### 3.2.3 Long-term Effects from Project Components

#### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

##### RIVER CROSSING AND HIGHWAY IMPROVEMENTS: NAVIGATION AND AVIATION

The replacement crossing would improve both aviation and navigation safety and efficiency over existing conditions and the supplemental alternatives. Likely designs would not include lift towers and so would intrude less into Pearson Field airspace. The supplemental crossing would retain the existing lift span towers and would remain a hazard to aviation at Pearson Field. The height difference between the deck of the existing and supplemental structures would further encroach on restricted airspace for aviation.

With either crossing, ramps connecting SR 14 and I-5 would intrude into Pearson Field airspace, in part because they must pass over a BNSF railroad berm between the bridge and surface grade. This would require a flight gradient of 275 ft/NM, which is a substantial improvement over current conditions but which would still represent the controlling gradient for the airfield.

A replacement crossing would be slightly closer to the downstream railroad bridge, which could potentially make navigation past the two bridges more difficult. However, the new primary shipping channel under the I-5 crossing would have a better alignment with the channel through the railroad bridge than currently exists, which should improve navigation even with the two crossings slightly closer together.

The replacement crossing would require fewer piers, therefore fewer obstacles to river navigation than either the existing bridge or the supplemental crossing. Taller ships would not be restricted by the hours of lift-span operation, and would not have to navigate a difficult path around the lift-span. For the supplemental crossing, lift-span restrictions of the existing bridges would continue to cause delays to river traffic. The continuing need to navigate around the lift-span and the relatively narrow width between existing bridge piers would continue to represent a potential hazard to navigation. This width may decrease by 40 to 60 feet because of the seismic reinforcement planned for the existing bridge piers.

In addition the supplemental crossing would require placing a new structure between the existing I-5 crossing and the downstream railroad bridge. This would increase the potential navigation hazard, particularly if vessels should attempt to navigate around the I-5 lift-span, by providing less distance to between the crossings. The existing piers would be retained and new piers added for the new bridge, increasing the number of obstacles to navigation in the river.

#### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

The choice of transit mode would not substantially influence how this project affects aviation or river navigation.

#### **Transit Terminus Options (with all Alternatives)**

The choice of transit terminus option would not substantially influence how this project affects aviation or river navigation.

#### **Transit Alignment Options (with all Alternatives)**

The choice of transit alignment option would not substantially influence how this project affects aviation or river navigation.

#### **Transit Operations**

Transit operations would not substantially influence how this project affects aviation or river navigation.

#### **I-5 Bridge Toll**

Tolling would not substantially influence how this project affects aviation or river navigation.

#### **Transportation Demand and System Management**

Transportation demand and system management would not substantially influence how this project affects aviation or river navigation.



### 3.2.4 Temporary Effects

#### Temporary Effects: River Navigation

The actual construction methods selected would determine the type and extent of temporary effects on navigation. The North Portland Harbor structure is expected to match or exceed the height of the existing structure. Construction methods would be chosen to eliminate the need for extensive construction supports in the navigation channel. However, there may be some temporary restrictions due to blockages from barges and cranes used to construct piers and lift bridge segments into place. Most vessels that currently use the navigation channel would likely be able to continue to use the channel throughout most of the construction period.

During construction of a replacement crossing, bridge piers in the Columbia River are not likely to line up with the existing bridge piers. While the new crossing is under construction and the existing crossing is still operational, this would result in more obstacles in the river and more difficulty in navigation during construction.

During construction of a supplemental crossing, vertical clearance may be reduced from 95 feet to approximately 70 feet. This would result from the seismic retrofits planned for the existing lift-span towers, which would periodically prohibit their operation.

Construction staging would be planned to minimize adverse effects to river navigation. In-water work would likely occupy only part of the river at one time, maintaining a minimum channel for navigation. Closures or restrictions on river traffic would be communicated in advance, enabling river users to accommodate their schedules without undue interruption. Additional tugs may be needed to assist vessels through areas of reduced clearances, especially during times of high water. The Coast Guard would review construction plans to determine potential effects.

#### Temporary Effects: Aviation

Tall cranes used during construction may be a hazard to aviation. Equipment used to either remove or retrofit the existing lift-span towers would likely be the tallest construction equipment and therefore the most likely to present a hazard to aviation. Cranes used to remove or retrofit the existing lift towers would need to be taller than the existing structures, and would temporarily affect Pearson Field airspace more than under existing conditions. Construction activities are not anticipated to affect Portland International Airport. The FAA would review construction plans to determine potential effects.

Construction dust or emissions from construction equipment could pose a short-term hazard to aviation by reducing visibility. Dust could result when wind disturbs uncovered fill or open excavations. Trucks and equipment traveling on unimproved construction roads could also stir up dust, impairing visibility.

Temporary stormwater ponds that fall within the limits of the hazardous wildlife exclusion zone, especially near the SR 14 interchange, may provide a place for birds to land and congregate, increasing the potential for aircraft bird strikes.

### 3.2.5 Potential Mitigation Measures

#### Potential Mitigation Measures: Navigation and Aviation

The FAA would require obstruction marking and lighting to make the river crossing structures and any construction equipment visible to aircraft. Proposed roadway or accent lighting on the bridge and surrounding interchanges should be designed to limit light or glare that could affect air navigation.

The FAA has established a 5,000-foot zone around runways where features attractive to birds, such as open water ponds, should not be created. For Pearson Field, this zone extends across the CRC area. Stormwater ponds constructed by the project in this area may require features to discourage birds from utilizing the ponds. To improve safety at Pearson Field, structures in this zone should be designed to minimize locations for birds to roost or nest.

Because it would not include a lift-span, a replacement crossing would reduce the maximum available vertical clearance under the bridge from 179 feet to approximately 102 feet. The CRC project team collected information on vessels traveling this river section to assess the vertical and horizontal clearance needs of river users.<sup>4</sup> Results were discussed and verified with vessel operators and the Coast Guard. Exhibit 3.2-4 summarizes the vertical clearances needed by river users and the frequency of their use.

As shown, specialized marine contractors, which utilize this portion of the river at less than annual frequency, could not pass under the fixed-span bridge without partial disassembly of their loads. This limitation would be offset by substantially improved navigational safety and the elimination of river traffic delays caused by restrictions on the lift-span.

A supplemental crossing would increase the difficulty in navigating around the lift-span and could prompt a repeal of the current lift-span restrictions in order to improve navigation safety. The Coast Guard may require the bridges to have navigational aids such as vertical clearance gauges and lighting.

During construction, additional public involvement and education programs should be used to provide information to tug operators, pilots, and the general public. Additional tugs may be needed to aid in temporary navigational challenges. Construction materials and activities should be managed so as to minimize dust, glare, and smoke.

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<sup>4</sup> Parsons Brinckerhoff Inc., 2004.

### 3.3 Property Acquisitions and Displacements

All build alternatives would need to acquire property to allow for the new river crossing and highway improvements, transit guideway and stations, bicycle and pedestrian improvements, improved local intersections, maintenance facilities, and park and rides. In many areas, the project would require only a narrow strip of property next to the existing road for highway or transit construction, allowing businesses and homes to remain. In some cases, entire parcels would be affected, displacing the existing residents, businesses, or other uses.

This section describes potential property acquisitions (the amount of new land each alternative or option would require) and potential displacements (the number of residences, businesses, or other uses that would need to relocate). Appendix D includes a list of all the properties that could potentially be affected by the river crossing, highway, and transit components of this project. The location of potential staging sites will be identified and potential environmental impacts analyzed in the Final EIS (FEIS). This section also discusses possible steps to potentially mitigate for these acquisitions and help relocate displaced residents and businesses, which would be done in compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended).

The information presented in this section is based on the analysis done in the Acquisitions Technical Report, included as an electronic appendix to this DEIS.

#### 3.3.1 Existing Conditions

##### Vacancy Rates

Vacancy and rental rates of residential, commercial and industrial properties are an indication of the potential for finding viable sites for relocating displaced residents and businesses. Higher vacancy rates generally indicate greater potential for relocating a displaced use to a location that is desirable to the property owner or tenants. The average length of time that single family homes are on the market prior to sale and median single family home sale price also indicate the potential for finding viable sites for relocating residents of single family homes.

In November 2007, the Portland-Vancouver metropolitan area had an 8.3 month supply of homes for sale and a median home sale price of \$285,000. Median annual home prices, but not supply of homes, are also available for smaller geographic areas for 2007, up to and including the month of November 2007. For the seven subareas relevant to the CRC project, median annual sale prices and approximate locations are summarized in Exhibit 3.3-1.



Exhibit 3.3-1  
Median Home Prices

Subarea	Median Annual Sale Price	Northern Boundary	Western Boundary	Southern Boundary	Eastern Boundary
Downtown Vancouver	\$215,500	39th Street	Vancouver Lake	Columbia River	I-5
Lincoln – SW Hazel Dell	\$230,000	78th Street	Vancouver Lake	39th Street	I-5
SW Heights	\$284,300	Mill Plain Blvd.	I-5	Columbia River	Andresen Blvd.
NW Heights	\$170,000	SR 500	I-5	Mill Plain Blvd.	Andresen Blvd.
E Hazel Dell/Minnehaha	\$235,000	78th Street	I-5	SR 500	Andresen Blvd.
North Portland	\$235,500	Columbia River	Willamette River	Willamette River	Williams Ave.
NE Portland <sup>a</sup>	\$283,000	Columbia River	Williams Ave.	East Burnside	182nd Ave.

Source: Regional Multiple Listing Services 2007.

<sup>a</sup> The "NE Portland" subarea includes Hayden Island east of I-5 and the Bridgeton Neighborhood on the south shore of the North Portland Harbor and east of I-5.

In February of 2008, industry reports showed that West Vancouver, which includes the Vancouver portion of the project area, has a higher vacancy rate, but higher costs per square foot for multi-family residential units than the North Portland/St Johns area.<sup>5</sup> These rates are listed in the Exhibit 3.3-2.

Exhibit 3.3-2  
Multi-family Vacancy and Rental Rates

Subarea	Vacancy Rates	Monthly Rental Rate per sq ft	Monthly Rental Rate for 1-Bedroom Apt <sup>a</sup>	Northern Boundary	Western Boundary	Southern Boundary	Eastern Boundary
West Vancouver <sup>b</sup>	4.65%	\$0.88	\$572.00	159th Street	Columbia River	Columbia River	117th Avenue
N Portland/St. Johns <sup>c</sup>	2.61%	\$0.81	\$526.50	Columbia River	Willamette River	I-84	Williams Ave

Source: Metro Multifamily Housing Association 2007.

<sup>a</sup> Typical apartment defined as 650 square feet.

<sup>b</sup> Corresponds to zip codes 98660-98666, 98685, 98656, and 98668.

<sup>c</sup> Corresponds to zip codes 97203, 97217, 97227, and 97283.

All build alternatives would require the displacement of floating homes in the North Portland Harbor. Most marinas currently operate at capacity, and there are therefore very few floating home slips available in the

<sup>5</sup> Metro Multifamily Housing Association, 2007.

metropolitan area. As there is no known planned growth in the number or size of marinas, there are limited opportunities to relocate floating homes in the region. Additionally, displaced floating homes may not have the structural integrity to be moved or may not meet with architectural design standards at other marinas.

All build alternatives will likely require commercial and industrial property. Office space is more available than either retail or industrial space in the CRC project area, as illustrated in Exhibit 3.3-3.

Exhibit 3.3-3  
Office, Retail and Industrial Vacancy Rates<sup>a</sup>

Subarea	Vacancy Rates	Monthly rental rate for Class A office space per sq foot	Monthly rental rate for Class B office space per sq foot	Northern Boundary	Western Boundary	Southern Boundary	Eastern Boundary
<b>Office Space</b>							
Portland-Vancouver	11.5%	\$25.01	\$19.51	Both Metropolitan areas			
Vancouver Central Business District/West Vancouver <sup>a</sup> .	11.5%	\$24.32	\$18.08	Burnt Bridge Creek Greenway	Columbia River	Columbia River	I-5
<b>Retail Space<sup>b</sup></b>							
Hayden Island	5.74%	N/A	N/A	Columbia River	Oregon Slough	North Portland Harbor	Oregon Slough
West Vancouver	8.83%	N/A	N/A	159th Street	Columbia River	Columbia River	117th Avenue
<b>Industrial Space<sup>c</sup></b>							
Portland-Vancouver	5.7%	N/A	N/A	Both Metropolitan areas			
Columbia Corridor <sup>c</sup>	6.9%	N/A	N/A	South shore of the Columbia River from its confluence with Sandy River to the Willamette River			
Rivergate	7.4%	N/A	N/A	At confluence of Willamette and Columbia Rivers			

<sup>a</sup> All vacancy rates based on the fourth quarter of 2007.

<sup>b</sup> Grubb & Ellis Company, 2007.

<sup>c</sup> CB Richard Ellis, 2007.

<sup>d</sup> Grubb & Ellis Company, 2007.

Industry research reports that new industrial development will slow in 2008, though vacancy rates are still expected to increase modestly east of the Willamette River in Oregon.<sup>6</sup>

<sup>6</sup> Grubb & Ellis Company, 2007.

### 3.3.2 Long-term Effects from Project Alternatives

The build alternatives, as described in the Description of Alternatives (Chapter 2), comprise different combinations of river crossing, high-capacity transit mode, and transit terminus and alignment options. Despite these different combinations of components, there is relatively little difference in the total acquisitions and displacements among the build alternatives. The following tables and associated discussions summarize the acquisitions (in acres), residential displacements (including floating homes), and business displacements that could occur as a result of the project alternatives.

#### Alternative 1: No-Build

The No-Build Alternative would not require any direct property acquisitions in the project area. Both the C-TRAN bus maintenance facility and TriMet Ruby Junction light rail maintenance facility may be expanded with the No-Build alternative, though the exact size of the expansions is not known.

#### Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.3-4 summarizes the potential property acquisitions, and residential and business displacements, that could occur as a result of Alternative 2.

Exhibit 3.3-4  
Acquisition Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit <sup>a</sup>				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Total area of Acquisitions (acres)	41-43	43-45	36-38	38-40
Residential Displacements	29-36	29-36	21-28	21-28
Business Displacements <sup>b</sup>	43-52	58-68	41-50	44-46

Source: CRC Acquisitions Technical Report and Economics Technical Report.

a Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

b Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Note: The impacts with the STHB option for the river crossing would be the same as shown in the table above for the replacement crossing.

Alternative 2 would require 36 to 45 acres of property for the river crossing, highway improvements, and transit terminus and alignment options. Alternative 2, as paired with the Lincoln terminus option requires more acreage because it travels along dense, predominately commercial streets with little right-of-way, while the Kiggins Bowl terminus can take advantage of existing right of way along I-5. Although shorter in length, the Mill Plain MOS would require two to four more acres in property acquisitions than the Clark College MOS, because it is associated with additional park and rides in downtown Vancouver.

Alternative 2 would require 21 to 36 residential displacements predominately in the floating home community in North Portland Harbor and along I-5 north of Fourth Plain Boulevard. Alternative 2, when



paired with either the Kiggins Bowl or Lincoln terminus options would both result in the same number of residential displacements, although in northern Vancouver these would not be the same residences. Alternative 2, when paired with either MOS, results in the same 21 to 28 residential displacements in the floating home community and along I-5 in Vancouver.

Alternative 2 would require 41 to 68 business displacements predominately on Hayden Island, and for alternative 2B, along Main Street north of Fourth Plain. The Lincoln transit terminus travels along dense commercial streets, while the Kiggins Bowl transit terminus travels through largely residential areas and can take advantage of existing right of way. As both MOSs, have a shorter transit component, they avoid some of the business acquisitions, resulting in fewer displacements as compared to the full-length terminus options.

Alternative 2 would displace the ODOT permit center on Hayden Island, and possibly the WSDOT maintenance facility at 39th and Main when paired with the Lincoln (B) and Mill Plain MOS (D) terminus options.<sup>7</sup>

Alternative 2 would require the expansion of the existing C-TRAN bus maintenance facility. This expansion would acquire five parcels zoned for light industrial use and would displace one business and two residences directly south of the existing facility.

### Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.3-5 summarizes the potential property acquisitions, and residential and business displacements, that could occur as a result of Alternative 3.

Exhibit 3.3-5

#### Acquisition Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail <sup>a</sup>				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
<b>Total area of Acquisitions (acres)</b>	41-43	43-45	36-39	38-39
<b>Residential Displacements</b>	29-36	29-36	21-28	21-28
<b>Business Displacements<sup>b</sup></b>	43-52	58-68	41-50	44-46

Source: CRC Acquisitions Technical Report and Economics Technical Report.

<sup>a</sup> Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

<sup>b</sup> Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Note: The impacts with the STHB option for the river crossing would be the same as shown in the table above for the replacement crossing.

Alternative 3 would result in the same number of residential and business displacements as Alternative 2.

<sup>7</sup> See discussion of this impact in Transit Alignments section.

The light rail transit mode associated with Alternative 3 requires slightly less area around Expo Center than bus rapid transit, but potentially more near the proposed Mill Plain Transit Center, making the difference very minor. Due to rounding this difference is not evident in for Alternative 3, when comparing the Lincoln and Kiggins Bowl terminus options, which have the same range of acreage required as in Alternative 2. A difference is evident in the MOS options. Alternative three, when paired with the Clark College MOS and Mill Plain MOS would result in 36 to 39 acres and 38 to 39 acres of property acquisitions, respectively.

Alternative 3 would displace the ODOT permit center on Hayden Island, and possibly the WSDOT maintenance facility at 39th and Main when paired with the Lincoln and Mill Plain MOS terminus options.

Alternative 3 would require the expansion of the existing TriMet Ruby Junction light rail maintenance facility. This expansion would fully acquire 14 parcels zoned for heavy industrial use, and displace up to seven potentially inhabited residences and up to seven businesses, including a mix of service and light industrial uses.

#### **Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Exhibit 3.3-6 summarizes the potential property acquisitions and residential and business displacements that could occur as a result of Alternative 4.

Exhibit 3.3-6

#### **Acquisition Summary for Alternative 4**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit<sup>a</sup></b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Total area of Acquisitions (acres)</b>	36-37	39-40	32-33	34-35
<b>Residential Displacements</b>	26-27	32-33	24-25	24-25
<b>Business Displacements<sup>b</sup></b>	40-48	56-64	34-43	37-39

Source: CRC Acquisitions Technical Report and Economics Technical Report.

<sup>a</sup> Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

<sup>b</sup> Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Alternative 4 would acquire a total of 32 to 40 acres of property for the river crossing, highway improvements, and transit terminus and alignment options. The Lincoln terminus requires more acreage because it travels along dense, predominately commercial streets with little right-of-way, while the Kiggins Bowl terminus can take advantage of existing right of way along I-5. Although shorter in length, the Mill Plain MOS would require two to three more acres in property acquisitions than the Clark College MOS, because it is associated with additional park and rides in downtown Vancouver.

Alternative 4 would require 24 to 33 residential displacements predominately in the floating home community in North Portland Harbor and along I-5 north of Fourth Plain Boulevard. The narrower highway

associated with the supplemental river crossing reduces the need to the Kiggins Bowl terminus to shift the highway west, which would result in residential displacements, while the Lincoln terminus is still associated with the residential displacements at the Lincoln Park and Ride. When paired with the two MOSs, Alternative 2 results in the same 21 to 28 residential displacements in the floating home community and along I-5 in Vancouver.

Alternative 4 would require 34 to 64 business displacements predominately on Hayden Island, and for the Lincoln terminus option, along Main Street north of Fourth Plain. The Lincoln transit terminus travels along dense commercial streets, while the Kiggins Bowl transit terminus travels through largely residential areas and can take advantage of existing right of way. The Clark College MOS and Mill Plain MOS have shorter transit components, and would avoid some of the business acquisitions.

Alternative 4 would displace the ODOT permit center on Hayden Island and possibly the WSDOT maintenance facility at 39th and Main with Alternatives 4B and 4D.

Alternative 4 would require the expansion of the existing C-TRAN bus maintenance facility as described for Alternative 2.

#### **Alternative 5: Supplemental Crossing with Light Rail**

Exhibit 3.3-7 summarizes the potential property acquisitions and residential and business displacements, that could occur as a result of Alternative 5

Exhibit 3.3-7

#### **Acquisition Summary for Alternative 5**

<b>Alternative 5: Supplemental Crossing with Light Rail<sup>a</sup></b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Total area of Acquisitions (acres)</b>	35-37	38-40	32-34	34
<b>Residential Displacements</b>	26-27	32-33	24-25	24-25
<b>Business Displacements<sup>b</sup></b>	40-48	56-64	34-43	37-39

Source: CRC Acquisitions Technical Report and Economics Technical Report.

<sup>a</sup> Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

<sup>b</sup> Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Alternative 5 would result in the same number of residential and business displacements as Alternative 4. Alternative 5 would require the acquisition of between 32 and 40 acres.

Alternative 5 would displace the ODOT permit center on Hayden Island and possibly the WSDOT maintenance facility at 39th and Main with the Lincoln terminus option and Mill Plain MOS.

Alternative 5 would require the expansion of the existing TriMet Ruby Junction light rail maintenance facility, as described for Alternative 3.



## Acquisition of DOT Land

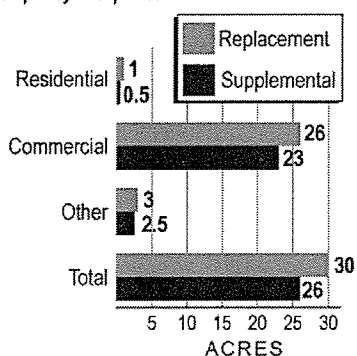
Both river crossings, and associated highway improvements would need to expand into existing DOT right-of-way adjacent to I-5. The river crossings would also require the acquisition of the ODOT permit center on Hayden Island and possibly the WSDOT maintenance facility on 39th in Vancouver. As this land is already owned by the DOTs, its acquisition is not counted in the total acreage requirements, although the displacement of these public owned facilities are included and disclosed in this document.

Exhibit 3.3-8

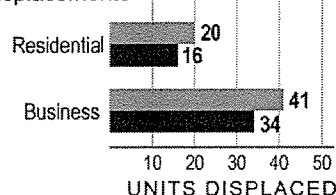
### River Crossing and Highway Improvements

#### Total acquisitions and displacements

##### Property Acquisitions\*



##### Displacements



\*Assumes Kiggins Bowl Terminus in North Vancouver.

Source: CRC Acquisitions Technical Report and Economics Technical Report.

### 3.3.3 Long-term Effects from Project Components

This section describes the impacts of the project components and various options that are part of the project alternatives. Operational components (I-5 bridge tolling, transit operations, and transportation system and demand management options) do not influence acquisitions and are therefore not discussed below.

#### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The multimodal river crossings and associated highway improvements would require between 26 and 30 acres of new right-of-way, and would displace residences, businesses, and publicly-owned facilities mostly on Hayden Island. This section discusses the acquisition impacts resulting from the river crossing and highway improvements in more detail. Transit related acquisitions are discussed in the Transit Terminus and Alignment Options sections below.

The replacement river crossing would acquire about 30 acres of new right-of-way, not including land already owned by the state Departments of Transportation (DOTs, see sidebar), and would displace up to 20 residences (including 13 floating homes) and up to 41 businesses. Up to eight additional displacements could occur as a result of pairing the replacement river crossing with the Kiggins Bowl terminus option. The Kiggins Bowl terminus option requires the shifting of the highway west to accommodate transit on the east side of I-5. These impacts are attributed to transit and discussed in the Transit Terminus Options section. The supplemental river crossing would acquire about 26 acres of new acquisitions, and would displace up to 16 residences (including 15 floating homes) and up to 34 businesses for highway construction. Exhibit 3.3-8 compares the acquisitions caused by the two river crossings, and Exhibits 3.3-9 and 3.3-10 show the approximate locations of these property acquisitions. Exhibits 3.3-11 and 3.3-12 highlight the entire parcel where these property acquisitions result in the displacement of a residence, business, or public service. These impacts are discussed by geographical area in the following paragraphs.

The stacked transit/highway bridge (STHB) option for the replacement river crossing does not result in new and unique acquisitions from those described for the replacement river crossing, and is therefore not addressed in this section.

Most, if not all, of the acquisitions required for bicycle and pedestrian facilities are disclosed as a part of the river crossing. The project may acquire a portion of a block on Fifth and Washington in Vancouver or possibly additional area immediately adjacent to the transit crossing on Hayden Island for pathways, stairs, or elevators to transport users up to and down from the elevated pathway. Every effort will be made to employ land already acquired for the purpose of the river crossing. These features of the bicycle and pedestrian facilities have yet to be fully designed, and will be largely influenced by the recommendations of the Bicycle and Pedestrian advisory committee.

**OREGON**

Near the Marine Drive interchange both river crossings would require approximately three acres of new right-of-way, which would displace up to five businesses. On Hayden Island, highway and interchange realignments would require 20 acres for the replacement crossing, and displace up to 29 businesses. The supplemental crossing would acquire 21 acres and displace up to 24 businesses in this area. These businesses include a mix of retail/service, professional office, and lodging, as well as one publicly-owned facility; the ODOT permit center. The only grocery store on Hayden Island, Safeway, would be displaced by the supplemental river crossing. The replacement river crossing could likely avoid this displacement. For specific uses see Appendix D.

The Southern and Diagonal Marine Drive interchange options could require additional acquisitions. The Southern realignment of Marine Drive could require the acquisition of two buildings that are used by a warehouse distributing business on the corner of Marine Drive and Force Avenue. The Diagonal realignment of Marine Drive would divide the Expo Center Complex by removing about 3 acres of land on the north side of the complex. The northern building of the Expo Center would be removed to provide right-of-way for Marine Drive. See Chapter 2, Description of Alternatives for more detailed design information regarding these two interchange options.

Both river crossings would displace floating homes in North Portland Harbor. The replacement crossing would result in 13 floating home displacements, while the supplemental would displace 15. These displacements are included in Exhibit 3.3-8.

**WASHINGTON**

In Washington, the highway improvements would require fewer property acquisitions and displacements compared to impacts in Oregon. The replacement crossing would require 7.9 to 8.3 acres of right-of-way in Washington, displacing up to seven residences, seven businesses, and possibly a portion of one publicly-owned facility, the FHWA Western Federal Lands building in the Vancouver National Historic Reserve.<sup>8</sup> The supplemental crossing would require 3.9 acres of right-of-way in Washington, displacing up to one residence and five businesses. The supplemental crossing would avoid impacting the Western Federal Lands building.

The impacted businesses include a mix of retail/service and professional office businesses. Most of the acquisitions and displacements in Washington would be due to the high-capacity transit alignments and park and rides, discussed on the following pages.

Appendix D includes a list of all the properties that could potentially be affected by any of the river crossing or highway improvements.

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<sup>8</sup> The impacted portion of the FHWA Western Federal Lands building is an annex that could potentially be removed without displacing the entire building. Design refinements of the replacement crossing may avoid this impact, though access through that area (from Anderson Road) would still be eliminated.

Exhibit 3.3-9

# Replacement River Crossing and Highway Improvements Acquisitions



DIMENSIONS ARE APPROXIMATE.

Marine Drive



Hayden Island



■ Replacement River Crossing  
 ■ Property Acquisition

River to Mill Plain Blvd



Mill Plain to Fourth Plain



North of Fourth Plain Blvd





Exhibit 3.3-10

# Supplemental River Crossing and Highway Improvements Acquisitions

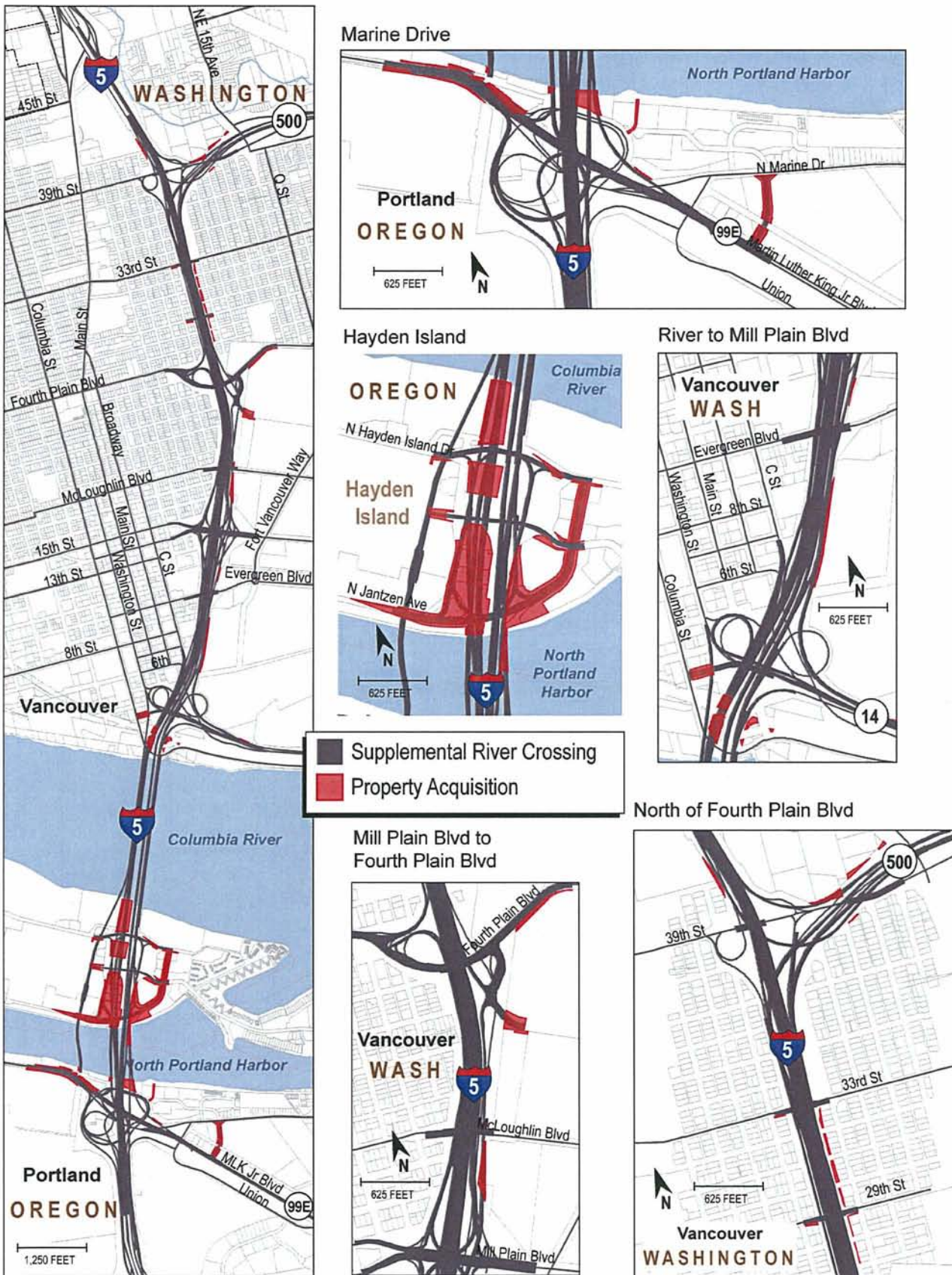
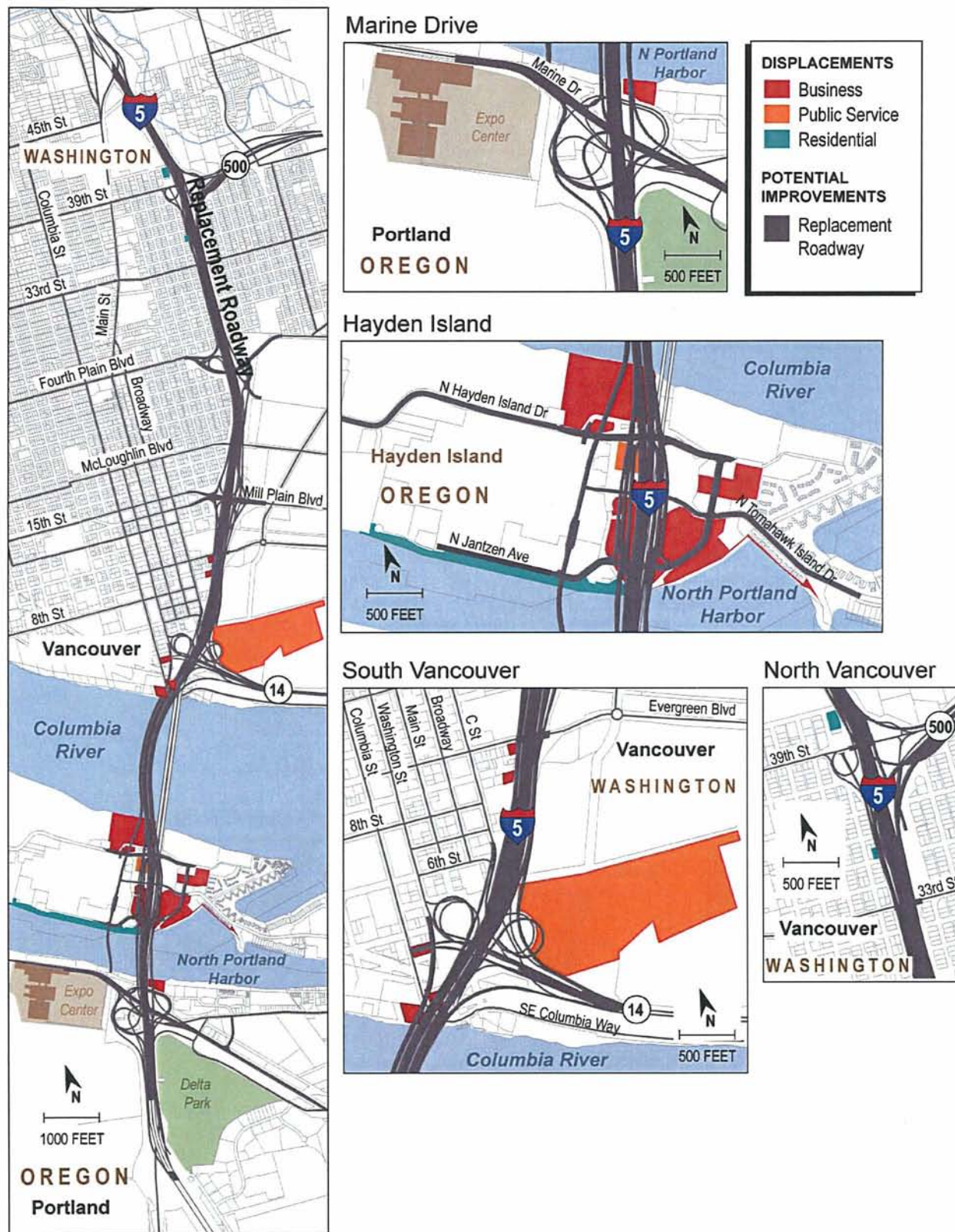




Exhibit 3.3-11

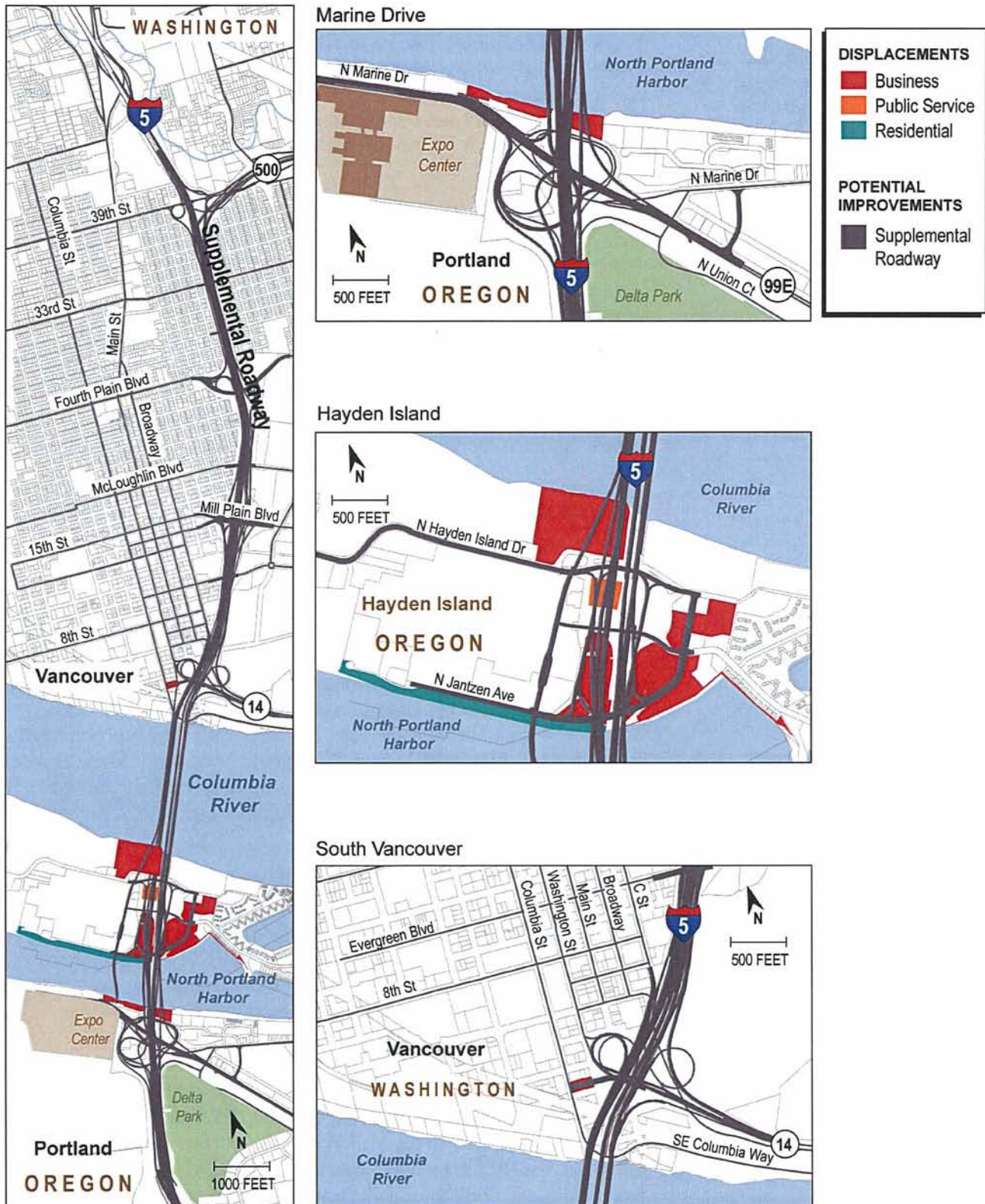
**Displacements\* Caused by Replacement Roadway**

DIMENSIONS ARE APPROXIMATE.

\*Entire parcels where displacements occur are highlighted.



Exhibit 3.3-12

**Displacements\* Caused by Supplemental Roadway**

DIMENSIONS ARE APPROXIMATE.

\*Entire parcels where displacements occur are highlighted.



## Acquisition of TriMet land

All transit terminus options and both modes would require the acquisition of land already owned by TriMet at the Expo Center. These 0.4 to 1.1 acres of land are disclosed here, but not counted in total acreage requirements in this Draft EIS.

### Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

There are slight differences in property acquisitions from bus rapid transit versus light rail. At the Expo Center transit station, bus rapid transit would require 1.1 acres, as compared to 0.4 acre for light rail of TriMet owned property (see sidebar). Buses would require a turnaround area and passenger facility so riders could transfer between buses and light rail. Light rail would not require this additional transfer and turnaround area as fewer buses would be transferring passengers to this station.

Additionally, light rail would require greater acquisitions near the Mill Plain transit center than bus rapid transit, as it would cut diagonally through one, possibly two blocks. Bus rapid transit can largely stay within the existing right-of-way, and would avoid some of these impacts. With the Washington/Broadway couplet to two-way Broadway, light rail may result in the displacement of the US Bank Building at 16th and Main Streets. Bus rapid transit would avoid this impact, but would displace the Wells Fargo Bank building at McLoughlin Blvd and Main Street with all transit alignments, with the exception of the 16th Street transit alignment option.

Bus rapid transit would require expanding the C-TRAN bus maintenance facility in east Vancouver at 65th Avenue. This expansion would acquire five parcels and would displace one business and two residences on NE 18th Street directly south of the existing facility.

Likewise, light rail would require expansion of the existing TriMet Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. This expansion would fully acquire 14 parcels, and displacing up to seven potentially inhabited residences, and one vacant residence used for storage. The expansion would also displace up to seven businesses, including a mix of service and light industrial uses, and one potentially vacant factory. One partial acquisition would be acquired from a parcel for the construction of a cul-de-sac, but would not displace the use. Please see the TriMet Ruby Junction Maintenance Facility Technical Addendum for more information.

Either maintenance base expansion would also support other planned transit service improvements in the region. According to TriMet's maintenance facility expansion plans, the CRC project would account for approximately half of the Ruby Junction expansion. Though the entire footprint is necessary to develop the track connections for even a smaller expansion and to make the required changes in the roadway.

### Transit Terminus Options (with all Alternatives)

The Kiggins Bowl (A), Lincoln (B), Clark College MOS (C), and Mill Plain MOS (D) terminus options could have the same alignment options from the Expo Center to the Mill Plain transit center in Vancouver. At this point, the Mill Plain MOS would terminate, while terminus option B would continue north through Uptown Vancouver and onto upper Main Street, and terminus options A and C would travel east across I-5. The Clark College MOS (C) would terminate immediately after crossing I-5 near Clark College, while the Kiggins Bowl terminus (A) would travel

## Acquisition of DOT Land

All transit terminus options would require portions of the parcel that houses the ODOT permit center, and the Lincoln terminus option and Mill Plain MOS would fully acquire the 3 acres WSDOT parking lot north of Kiggins Bowl. These acreage requirements are disclosed here, but not included in any acquisition totals, as the land is already owned by the Departments of Transportation.

north along the eastern side of the highway. For more information regarding the details of the terminus options, please see Chapter 2, Description of Alternatives. Exhibit 3.3-13 compares the right-of-way requirements for all four terminus options. In order to graphically display this comparison, the same alignment options were assumed for each transit terminus.

The Lincoln terminus (B) would acquire approximately 2 to 3 more total acres than the Kiggins Bowl terminus (A), and would displace more residences and businesses. While terminus option B would require widening a relatively narrow street in a dense commercial area, terminus option A could take advantage of existing right-of-way near the interstate in a low-density residential area. Seven of the residential displacements associated with terminus option B are the result of the Lincoln Park and Ride, while the residential displacements associated with terminus option A all occur along the alignment. These acquisitions are graphically displayed on Exhibits 3.3-16 and 3.3-17. Exhibit 3.3-18 shows the locations of these impacts when they result in the displacement of a residence, business, or public service.

Compared to the full-length terminus options, both of the MOS options (C and D) would require 3 to 9 fewer acres of property acquisitions, as well as fewer residential and business displacements. The Mill Plain MOS (D) would still require property acquisitions and displacements associated with the Lincoln, Kiggins, and Clark College Park and Rides, as well as park and ride space near SR 14 and the Mill Plain transit center. The Clark College MOS (C), would still require acquisitions along 16th Street or McLoughlin Boulevard, as well as those for the Kiggins and Clark College Park and Rides. Due to the greater number of park and rides associated with the Mill Plain MOS (D), it would require two to three more acres than the slightly longer Clark College (C) terminus option.

#### PERMANENT AIRSPACE OR SUBSURFACE EASEMENTS

In addition to the acquisition of specific properties, the transit terminus options may require airspace or aerial guideway easements from properties being passed over, and subsurface or tunnel easements from properties being passed under. Permanent airspace rights from WSDOT may be required for the flyover associated with Kiggins Bowl terminus option. An aerial guideway easement would include the area immediately surrounding and beneath the elevated structure, while a tunnel easement would include the area immediately over and surrounding the tunnel. Depending on the depth of potential guideway tunnels, allowable land uses above the tunnel will vary.

#### Transit Alignment Options (with all Alternatives)

The transit-related acquisitions and displacements discussed on the following pages are graphically displayed in Exhibits 3.3-16, 3.3-17, and 3.3-18.

#### OFFSET OR ADJACENT

Starting from the Expo Center in Portland and continuing north to where the transit bridge touches down in Vancouver, the transit guideway could be placed either adjacent to the roadway or offset from it toward the

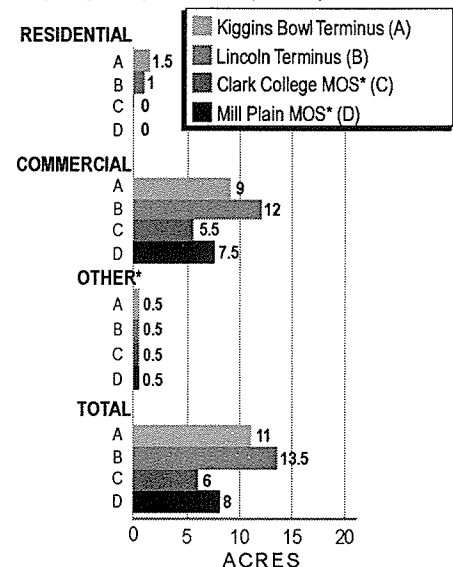
#### Exhibit 3.3-13 High-Capacity Transit Acquisitions and Displacements

Values are based on light rail transit with the following alignments:

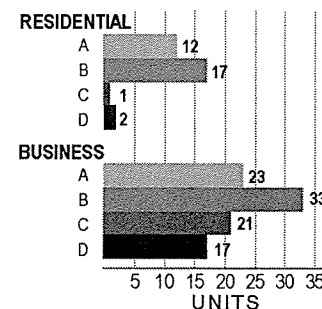
- Adjacent for Delta Park to South Vancouver,
- Two-way on Washington to the Mill Plain District, and
- Two-way on either McLoughlin or Broadway.

The Lincoln Terminus values assume a supplemental roadway. The Kiggins Bowl Terminus values assume a replacement roadway.

#### Property Acquisitions (Acres)



#### Displacements (Units)



MOS=Minimum Operable Segment

Source: CRC Acquisitions Technical Report and Economics Technical Report.

Note: Includes industrial and open space.

west. Exhibit 3.3-14 summarizes the acquisition impacts associated with the offset and adjacent alignment options.

Exhibit 3.3-14

**Offset versus Adjacent: Summary of Transit Related Acquisitions**

River crossing Transit alignment option	Replacement		Supplemental	
	Offset	Adjacent	Offset	Adjacent
Acres of Acquisition	3.7 to 4.2	2.5 to 3.0	2.9 to 3.7	2.2 to 3.0
Residential Displacements <sup>a</sup>	8	1	8	9
Business Displacements	4 to 5	13 to 14	4 to 5	4 to 5

Source: CRC Acquisitions Technical Report and Economics Technical Report.

<sup>a</sup> Includes displacement of floating homes.

Note: ranges reflect differences between BRT and LRT.

Most of the transit-related acquisitions from the offset or adjacent alignment options would occur on Hayden Island. South of Hayden Island, both of these alignment options would require less than 1 acre and could displace up to one single-family home around the Marine Drive interchange. North of Hayden Island, where transit touches down in Vancouver, approximately 0.2 to 0.5 acre and one business could be displaced.

Most, if not all of the businesses, displaced by the offset or adjacent transit alignments as shown in Exhibit 3.3-14, would also be displaced by the river crossings, as shown in Exhibit 3.3-15.

Exhibit 3.3-15

**Business Displacements on Hayden Island from both the River Crossing and Transit Alignment Options**

River crossing Transit alignment option	Replacement		Supplemental	
	Offset	Adjacent	Offset	Adjacent
Businesses displaced by transit	4	13	4	4
Those businesses also displaced by roadway	4	12	4	3
Displacements unique to transit	0	1	0	1

Source: CRC Acquisitions Technical Report and Economics Technical Report.

In addition to business displacements, floating homes in North Portland Harbor would also be displaced. The adjacent alignment would displace no additional floating homes when paired with the replacement crossing, but would add eight displacements when paired with the supplemental crossing. The offset alignment would displace seven floating homes when paired with either river crossing.



**TWO-WAY WASHINGTON OR BROADWAY-WASHINGTON COUPLET**

Neither the two-way Washington nor the Washington-Broadway couplet alignment option would require property in addition to the existing right-of-way through most of downtown Vancouver. North of Mill Plain Boulevard, three to seven parcels used for parking could be acquired where the guideway transitions to new streets. Additionally, one business may potentially be displaced in this area, depending on transit mode and guideway transition.

**16TH STREET OR MCLOUGHLIN**

These two alignment options apply to the Kiggins Bowl (A) and Clark College MOS (C) terminus options. The 16th Street alignment would result in the partial acquisition of the parcel on which the Clark County Historical Museum is located on 16th, but would not displace the use. The McLoughlin alignment could require partial acquisitions from approximately 33 parcels along McLoughlin, resulting in the displacement of two commercial buildings. Most of these acquisitions would be relatively minor; a narrow strip of property would be required from front yards to accommodate the widening of McLoughlin Boulevard.

**TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET**

These two alignment options apply only to the Lincoln terminus option (B). The two-way Broadway alignment could result in the partial acquisition of four parcels that contain businesses between McLoughlin Boulevard and 29th, resulting in one displacement. This alignment option would require the full acquisition of two parcels on Broadway that contain businesses. The Broadway-Main couplet could result in partial acquisitions to approximately four parcels along Broadway Street that contain businesses, but would not result in any displacements. There would be no property acquisitions on Main Street associated with this alignment option.

Additionally, both of these alignment options could result in access impacts to businesses, although none has been identified as severe enough to require the full acquisition of the property. Those properties that have an access to parking or a driveway from Broadway or Main that could be eliminated or limited by alignment options have alternate access from alleys or side streets. For more detail regarding parking and access impacts see Section 3.1, Transportation.

# TRANSIT ACQUISITIONS: Expo Center to Downtown Vancouver

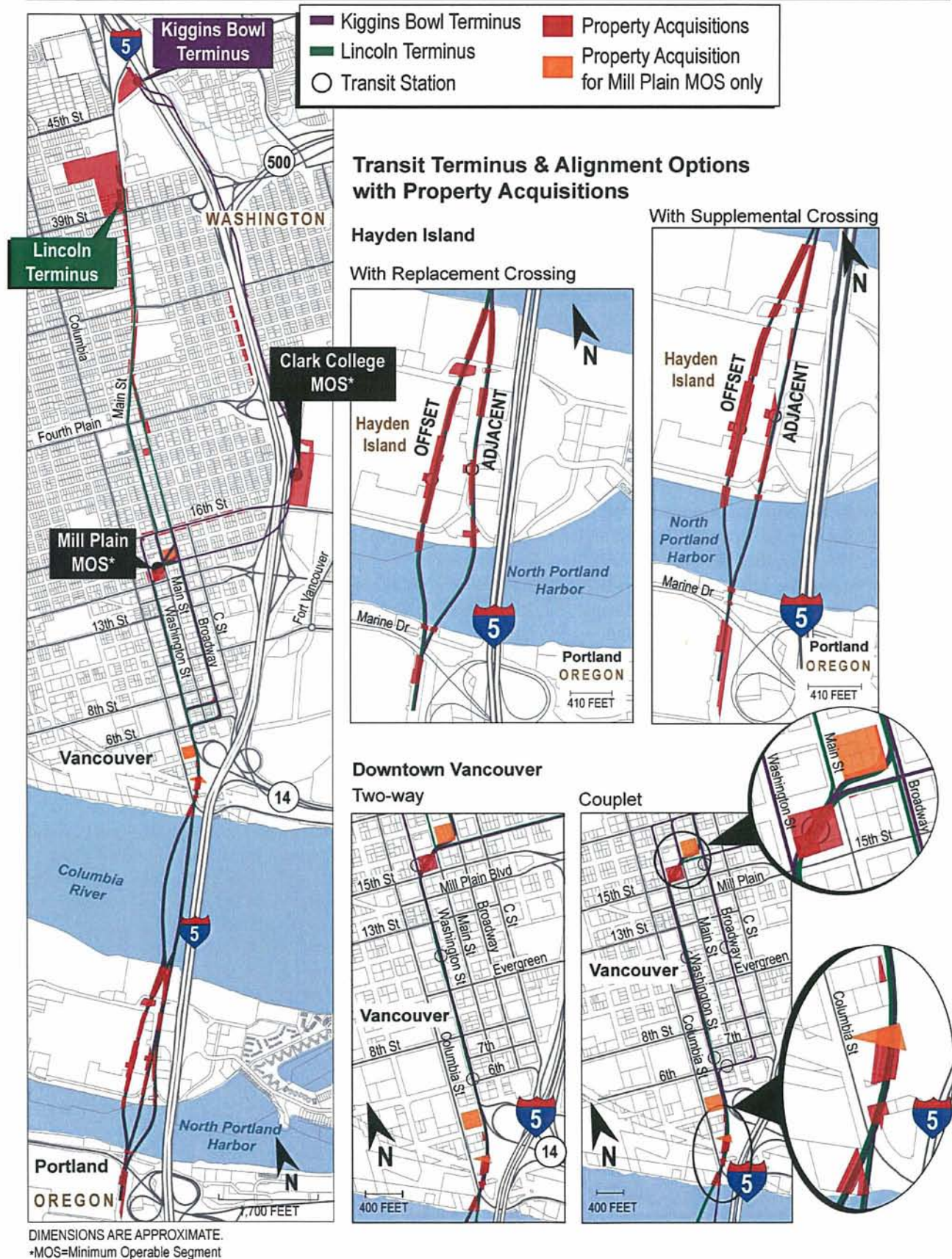




Exhibit 3.3-17

## TRANSIT ACQUISITIONS: North Vancouver Connections



DIMENSIONS ARE APPROXIMATE.

\* Minimum Operable Segment

### Transit Terminus & Alignment Options with Property Acquisitions

- |                         |                                                |
|-------------------------|------------------------------------------------|
| ■ Kiggins Bowl Terminus | ■ Property Acquisitions                        |
| ■ Lincoln Terminus      | ■ Property Acquisition for Mill Plain MOS only |
| ○ Transit Station       |                                                |

North Vancouver Connection  
(for Lincoln Terminus) ➔

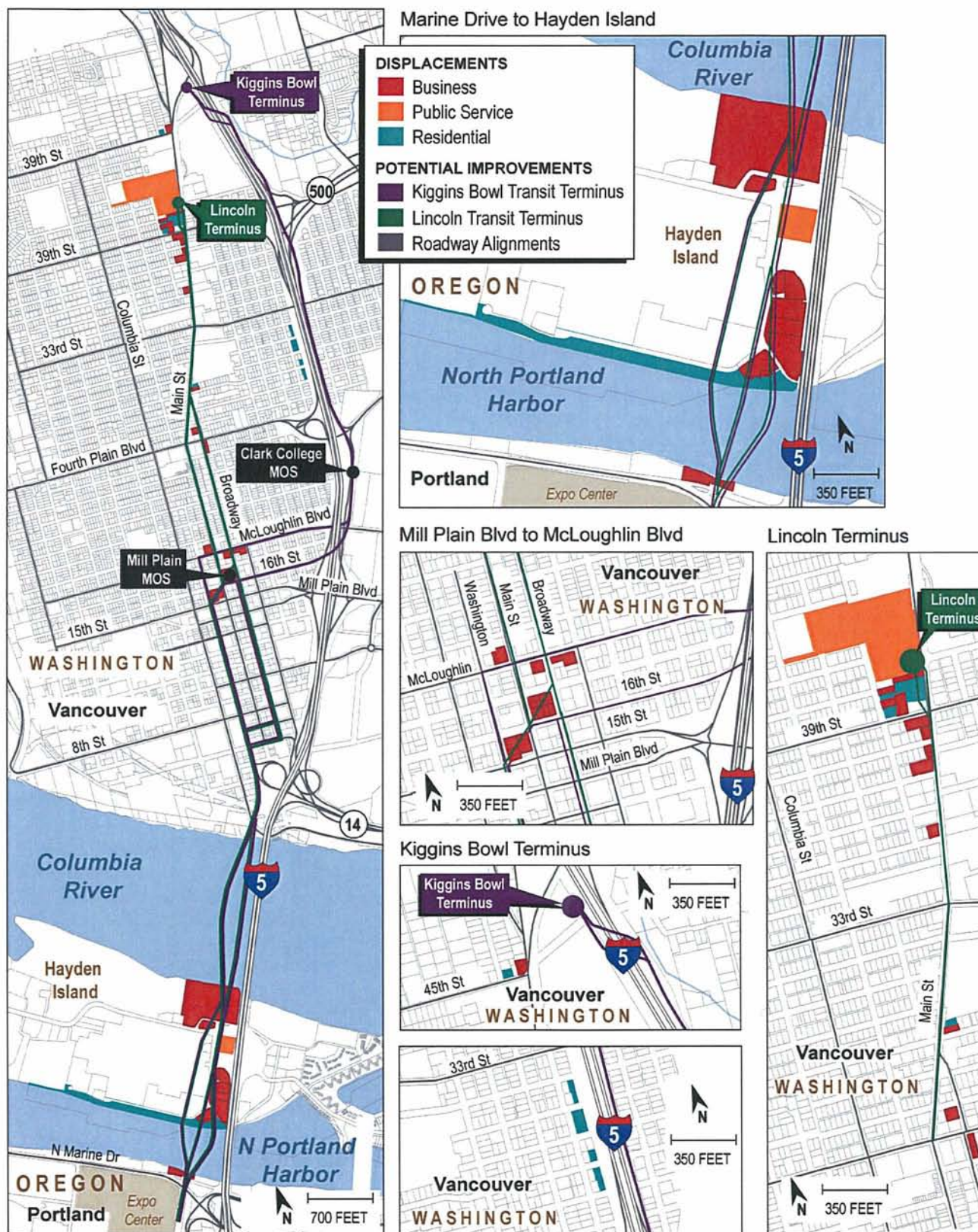
North Vancouver Connection  
(for Kiggins Bowl Terminus) ▼





Exhibit 3.3-18

## Displacements\* Caused by Transit Terminus Options



DIMENSIONS ARE APPROXIMATE.

\*Entire parcels where displacements occur are highlighted.

### 3.3.4 Temporary Effects

#### Temporary Property Easements

Construction easements would be required for the temporary staging of equipment and materials during construction. These easements are separate from the acquisitions and displacements reported elsewhere in this section because they are temporary uses. Property used during construction could be returned to its owner once construction is complete, or alternatively, if the site is accessible to transit, the land might instead be purchased at a fair market value and then developed with transit-oriented uses, such as retail, residential, or mixed use.

Staging or construction activity can often be accommodated in existing right-of-way, but an estimated 1.5 to 3 acres of temporary easements could be required near the proposed transportation improvements. Additional land may be permanently acquired for staging for transit construction and then later developed as described above. Preference would be given to locations that are vacant or could be obtained or leased from willing owners.

Along the transit alignment, it may be necessary to seek temporary construction easements or small permanent easements on adjacent properties to allow construction workers to enter the first several feet of a property while rebuilding the sidewalk in front of the property or to place specific elements such as an overhead catenary pole behind the sidewalk.

It is too early in the design process to know whether a large casting yard and staging site will be needed for the construction of the river crossing. However, if the pre-casting construction technique is used, desirable site characteristics are likely to include:

- A large (at least 15 acres) open site suitable for heavy machinery and casting of bridge segments,
- Waterfront property with access for barges to convey material to the construction zone, and
- Roadway or rail access for landside transportation of materials by truck or train.

The acquisition of a large casting yard and staging site could result in additional displacements, which would be appropriately mitigated at described in the Potential Mitigation discussion below.

Activities occurring on any of the potential casting and staging sites would be in accordance with federal, state, and local environmental regulation and land use code. Depending on the construction requirements of the project, the project may need to obtain variances for some or all of these local codes.

#### AIRSPACE RIGHTS AND SUBSURFACE EASEMENTS

As the construction plan is developed, the project will need to identify all locations where temporary airspace rights or easements or subsurface easements would be required. A temporary easement conveys certain property rights, but not ownership, to a parcel of real estate for a defined period of time. The temporary easement provides its holder with specified rights to use the easement area. Temporary airspace easements

may be acquired for construction over locally-owned roads, the interstate, or the railroad, while subsurface easements may be required for utility relocation.

The project may need to obtain a temporary airspace easement from the Burlington Northern Santa Fe Railway (BNSF) for the construction of the project over the mainline. BNSF has requirements for access to and construction over its property. Project staff would need to work with BNSF to determine specific construction and safety requirements and access permits needed as the construction plan is developed.

Additionally, an agreement between BNSF and the project may be developed before the FEIS that will identify any terms and conditions for construction.

Project staff would work with the cities of Portland and Vancouver land use, transportation, and development staff to determine specific permitting and easement requirements. These requirements are typically determined during the development review process in each city.

Memoranda of understanding may be used by city, county, or state project participants to determine how issues related to easements, access, etc. would be handled.

### 3.3.5 Potential Mitigation Measures

During the design process to date, the CRC project has minimized the amount of new property required for the proposed improvements. Once a locally preferred alternative is chosen, the project would further refine designs and solicit public input in order to further avoid or minimize property acquisitions, where possible.

Most aspects of mitigation for property acquisition are addressed by federal and state statutes, which require that property be purchased at fair market value and that all residential displacements be provided with replacement housing or relocation assistance and business displacements be provided relocation assistance. Federal and state statutes, such as the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended) (see sidebar), determine the standards and procedures for providing such replacement housing and business relocation assistance. A Real Estate Management Plan, or a similar document, will be developed to provide consistent policy, direction, and guidance for management of real estate activities that need to occur as a result of any of the build alternatives.

Residential relocation benefit packages are based on the characteristics of individual households and usually include replacement housing for owners and renters, moving costs, and assistance in locating replacement housing. Relocation benefits for businesses can include moving costs, site search expenses, and business reestablishment expenses. As with residential displacements, relocation packages are determined on an individual basis based on ownership or tenant status. In general, an attempt would be made to minimize relocation impacts to residences, businesses, and public facilities. Eligibility and terms of relocation assistance would be determined during future project planning.

## Providing Relocation Assistance

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended) provides important protections and assistance for people affected by federally funded projects. It was enacted by Congress to ensure that people whose real property is acquired, or who have to move as a result of projects receiving federal funds, are treated fairly and equitably and receive assistance in moving from the property they occupy. The CRC project and all project partners will follow the requirements of this Act.



The relocation of displaced residents, businesses, and public services could be encouraged to occur within the same neighborhood when possible. This could mitigate the impact to the residents and avoid the loss of resources to their communities.

The displacement of floating homes in the North Portland Harbor could be mitigated through relocation of displaced homes and residents in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended). Ideally, relocations would be near their original location, although this may not be possible. These relocations could potentially occur in the following ways:

- Purchase or build a marina and build new slips, although this would likely be difficult because of the potential impacts to ESA-protected fish species from a new facility or additional slips.
- Work with a marina/moorage to add slips, although this could run into the same difficulties as above.
- Purchase low-value floating homes and replace them with newer homes that are comparable to ones displaced.
- Purchase and remodel floating homes to bring them up to standards for relocating displaced home owners.
- Find comparable “upland” housing, which would often provide displaced floating home owners with a relocation option that results in additional property value.
- Begin search for relocation opportunities early, so as to maximize the possibility of finding suitable relocation options. This would require early permission to purchase property, and the allocation of funds to do so.

All of these relocation ideas are preliminary. ODOT is currently investigating new ways to perform the relocation of displaced floating homes, with the first step being the identification of new marina locations.

The US General Services Administration may be involved in any property acquisition related to the acquisition of federally-owned property, such as the property owned by FHWA Western Federal Lands. Additionally, the acquisition of property owned by the US Army, such as that near the SR-14 interchange, would require consultation with the Defense Base Closure and Realignment Commission (BRAC).

The displacement of publicly owned facilities, such as the ODOT permit center, FHWA Western Federal Lands building, or WSDOT maintenance facility could be mitigated by functionally replacing the property acquired with another facility that would provide equivalent utility.

This project would pay the fair market-value equivalent of rent for easements needed for the temporary use of land during construction. The project would strive to maintain reasonable access to all uses during construction, although temporary access impacts will likely be inevitable.

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### 3.4 Land Use and Economic Activity

This section evaluates the CRC project's potential effects on the region's ability to meet land use planning goals and to influence existing and future economic activity. The evaluation includes a detailed assessment of changes to land uses as well as consistency of these changes with adopted policies and regulations. Information in this section is based on data in the CRC Land Use Technical Report and Economics Technical Report.

Jurisdictions in the Portland-Vancouver metropolitan region traditionally integrate transportation and land use planning to encourage economic and community development around designated urban centers and transportation corridors. I-5 is the region's primary north-south traffic corridor, and there is substantial adjacent development, including the downtowns of both Portland and Vancouver. The CRC project segment of I-5 is expected to accommodate travel resulting from the region's anticipated growth and economic development. Any acceptable project alternative must directly accommodate trips arising from additional residents and jobs near this project, and must indirectly improve the ability of trucks that rely on I-5 to more efficiently deliver freight to and from the area's ports and industrial centers.

#### 3.4.1 Existing Conditions

Transportation and land use plans have helped define how this region has grown. Oregon's Statewide Planning Goals and Washington's Growth Management Act agree on general principles of compact urban form, preservation of rural areas, use of urban growth boundaries, and multimodal transportation systems. Regional plans help local and regional governments to tailor these goals for the Portland-Vancouver area. Local plans provide further refinement of these goals and help governments to establish policies, such as zoning and other development regulations, to implement them.

The Portland-Vancouver region is located at the confluence of two navigable rivers, the Columbia and the Willamette, and is served by the Burlington Northern Santa Fe (BNSF) and Union Pacific transcontinental rail lines, Portland International Airport, and marine terminals at the ports of Portland and Vancouver. The region's economic competitiveness largely depends on its role as a gateway and distribution center for domestic and international markets. Freight moving through the two ports is expected to double from approximately 300 million tons in 2000 to almost 600 million tons in 2035.<sup>9</sup> Access to port facilities is crucial because many of this region's industries depend on the movement of freight.

#### Existing Land Uses

The area in north Portland between Columbia Boulevard and the Columbia River consists mostly of commercial uses along with a few industrial uses. There are also parks and open space near the existing I-5 corridor. Some regionally important properties in this area include

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<sup>9</sup> Metro, 2006.



Portland International Raceway, Portland Meadows, the Exposition (Expo) Center, and large wetlands. Currently the TriMet MAX light rail line ends at the Expo Center just south of the Columbia River and north of the Columbia Slough.

Exhibit 3.4-1

**Existing Land Use on Hayden Island**

Hayden Island, shown in Exhibit 3.4-1, has two distinct land use types. Much of the developed part of the island west of I-5 is devoted to the Jantzen Beach commercial district. East of I-5 and along the waterfront west of I-5 are residential uses that include condominiums, manufactured homes, and floating homes. Several restaurants, two gas stations, and the Red Lion Hotel surround the I-5 interchange. There is a large vacant parcel at the former Thunderbird Motel, immediately west of I-5.

Downtown Vancouver includes a central business district, residential areas, and the large Central Park neighborhood, which includes the Vancouver National Historic Reserve, a nationally important park. Land uses in the area are typical of an urban core, with retail, offices, industrial, governmental, and residential uses. The downtown Vancouver area serves as the governmental and cultural center of Clark County.

Community facilities include a train station, the Vancouver National Historic Reserve, and various government offices. The I-5 corridor separates the west side—including the downtown area, commercial, residential, and office centers—from the eastside, which includes the Historic Reserve, Fort Vancouver, a large Veterans Administration complex, the Clark County Center for Community Health, and Clark College. This separation can be seen in Exhibit 3.4-2.

Exhibit 3.4-2

**Existing Land Use in Vancouver (facing south)**

The Uptown commercial district (between Mill Plain and Fourth Plain Boulevards on Main Street) is a small-scale commercial and residential area between downtown and the lower-density neighborhoods to the north. Primary uses are residential, with major transportation corridors such as Fourth Plain Boulevard and Main Street supporting vibrant

commercial districts. South of Fourth Plain Boulevard, there are older neighborhoods with many vintage homes and a tight street grid. The east side of I-5 includes public facilities and institutions, multi-family housing, and some commercial uses. Further to the east and south of Fourth Plain Boulevard there is a traditional street grid with historic neighborhoods and small lots, single-family homes, and duplexes. North of Fourth Plain Boulevard in the Rose Village neighborhood there is a traditional street grid with small lots, single-family homes, and duplexes. North of SR 500, development becomes progressively more suburban, with larger lots, off-street parking lots, and few structures over one story in height.

### Adopted Plans

State, regional, and local plans provide guidance on economic development, transportation systems, and urban form. These plans and their implementing regulations provide both general policy and specific standards for community and transportation planning and for transportation projects. The list below shows many of the laws, regulations, and plans that were reviewed for this analysis:

#### FEDERAL

- U.S. Department of Transportation, Federal Transit Administration (FTA). 2004. "New Starts Guidelines and Standards for Assessment of Transit Supportive Land Use." Washington, D.C.
- Uniform Relocation Assistance and Real Property Acquisition Act. 42 USC 4601 et. seq., 49 CFR 24.
- Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. EO 12898; 59 CFR 7629, 62 CFR 18377, 60 CFR 33896.

#### STATE – WASHINGTON

- Revised Code of Washington (RCW). Growth Management Act (GMA), Chapter 36.70A.
- RCW. 1971. "Shoreline Management Act (SMA) of 1971." RCW 90.58, Olympia, Washington.
- Washington State Transportation Commission, Washington State Department of Transportation. 2002. Washington Transportation Plan (WTP), 2005-2022. Olympia, Washington.
- Washington Administrative Code (WAC). 1998. State Environmental Policy Act (SEPA) WAC 197-11. Olympia, Washington.

#### STATE – OREGON

- Oregon Revised Statutes (ORS). 1973. ORS 660-15-0000 (1-15), Salem, Oregon.
- The Oregon Department of Transportation (ODOT), Transportation Development Division, Planning Section. 1999. Oregon Highway Plan (OHP). Salem, Oregon.

- Land Conservation and Development Commission (LCDC). Transportation Planning Rule (TPR). OAR Chapter 660, Division 12. As amended 2005.

## LOCAL – WASHINGTON

- Southwest Washington Regional Transportation Council (RTC). 2003. Metropolitan Transportation Plan for Clark County. Vancouver, Washington.
- Clark County, Long Range Planning Division of the Community Development Department. 2004. Comprehensive Growth Management Plan. Vancouver, Washington.
- Clark County, Long Range Planning Division of the Community Development Department. 2004. Highway 99, Focused Public Investment Area Action Plan. Vancouver, Washington.
- City of Vancouver, Community Development Department. 2004. City of Vancouver Comprehensive Plan. Vancouver, Washington.
- City of Vancouver, Economic Development Department. 2004. Vancouver City Center Vision (VCCV) Plan. Vancouver, Washington.
- City of Vancouver, Transportation Services. 2004. City of Vancouver Transportation Plan. Vancouver, Washington.
- The Columbia Renaissance Trail Plan, as represented in The Clark County Trails and Bikeway System Plan. 1992.
- City of Vancouver, Community Planning. 2007. The Central Park Plan. Vancouver, Washington.
- City of Vancouver. Vancouver Municipal Code.

## LOCAL – OREGON

- Metro. 1995. 2040 Growth Concept. Portland, Oregon.
- Metro. 2005. Regional Framework Plan. Portland, Oregon.
- Metro. 2004. Regional Transportation Plan (RTP). Portland, Oregon.
- Metro. 2005. Nature in Neighborhoods. Ordinance No. 05-1077C. Portland, Oregon.
- City of Portland, Bureau of Planning. 2004. Comprehensive Plan Goals and Policies. Portland, Oregon.
- City of Portland, Bureau of Planning. 2000. Central City Plan. Portland, Oregon.
- Albina Community Plan.
- Kenton Downtown Plan.
- Interstate Corridor Urban Renewal Area Plan.
- Natural Resource Management Plans (NRMPs) for the Portland International Raceway, East Columbia, Columbia Corridor, and Peninsula.
- City of Portland Code (CPC), Title 33 Planning and Zoning.



Site-specific master plans were reviewed for the Bonneville Power Administration, Vancouver Campus; Clark College; Columbia Gateway Subarea; Vancouver National Historic Reserve; and other locations.

### **Applicable Policies and Regulations**

In 1973, the Oregon Legislature passed legislation requiring all cities and counties to adopt and implement comprehensive land use plans that comply with 19 Statewide Planning Goals. These goals range from the protection of natural resources to promotion of economic development to land use and transportation planning.

The State of Washington adopted the Growth Management Act in 1990. This act requires most local jurisdictions to define and implement a land use policy framework that emphasizes reducing inappropriate conversion of rural land to urban development. This law also requires designation of urban growth areas around cities and identification of areas for future urban expansion to help preserve rural land.

The Southwest Washington Regional Transportation Council (RTC) is the metropolitan planning organization for southwest Washington, and has regional authority over transportation only. Clark County determines population and employment growth forecasts, and sets urban growth areas.

#### **LOCAL PLANNING**

In Oregon, Metro is an elected regional government that serves as a Metropolitan Planning Organization with jurisdiction over both transportation and land use. The Metro 2040 Growth Concept outlines a vision for regional growth and development in the Portland metropolitan region. Policies in the 2040 Growth Concept encourage efficient use of land and protection of farmland and natural resources by focusing growth along transportation corridors and in urban centers.

Comprehensive plan designations in Portland are similar to existing land uses. North Portland neighborhoods adjacent to I-5 are a mix of residential zones, with higher densities and a few commercial areas along arterial roads. Most land between Columbia Boulevard and north Portland Harbor is either industrial or open space.

The City of Portland is currently developing a plan for Hayden Island that may include comprehensive plan and zoning designations, and a street plan. The planning process will influence specific elements of the CRC project, such as transit station design.

#### **LOCAL PLANNING**

The Vancouver comprehensive plan designations are similar to existing land uses. The waterfront immediately west of I-5 is designated City Center to accommodate planned development here. This designation extends north to 15th Street.

Commercial zoning along Broadway and Main Streets extends north past Fourth Plain Boulevard. East and west of these streets are primarily low-density residential land uses. East of I-5 is designated public facility and open space in recognition of the Vancouver National Historic Reserve, Pearson Airfield, and Clark College. North of Fourth Plain Boulevard to

### **Plan Consistency**

The CRC project has been designed to address and support adopted land use and transportation plans. A few key plans are summarized here in the DEIS. The CRC Land Use Technical Report provides a comprehensive discussion of adopted local and regional plans that are relevant to the CRC alternatives.

SR 500, the east side of I-5 has low-density residential development, with duplexes and commercial uses along arterial corridors.

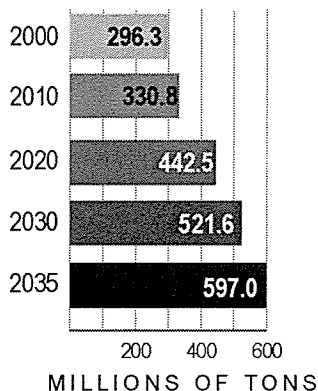
The Vancouver City Center Vision includes a list of goals and guiding principles for downtown Vancouver. Land use goals include focusing waterfront redevelopment on residential uses, with public access, recreation, cultural, hospitality, entertainment, and limited commercial uses. Specific goals include:

- Strengthen the primary street connections to the waterfront.
- Support a secondary connection to the waterfront.
- Connect downtown with the Vancouver National Historic Reserve via a Seventh Street pedestrian bridge.
- Ensure that expansion of I-5 and CRC improvements improve access to the city center and minimize potentially negative effects.
- Reduce the disruption between downtown and the waterfront created by the physical barrier of the BNSF railroad berm.
- Provide improved access into the southern and western areas of the city center.

Vancouver has adopted the Downtown Vancouver Transportation System Plan, which addresses transportation conditions and plans between Fourth Plain Boulevard and the Columbia River. This plan states: “The extension of MAX service into Vancouver is a key ingredient to the region’s growth management strategy and the overall I-5 corridor plan. Light rail in Vancouver would directly benefit the downtown area by improving access to downtown Vancouver, particularly during the peak commuter hours.”

Exhibit 3.4-3

**Ports of Portland/Vancouver  
projected commodity growth**  
(millions of tons)



Source: Metro, 2006.

### Economic Conditions

The ports of Portland and Vancouver are critical to the economic growth and prosperity of this region. For these ports to remain competitive with other West Coast ports, efficient and cost-effective multimodal transportation systems must be available. Reducing freight travel times by investing in transportation infrastructure improvements that increase access and decrease congestion will help maintain the region’s competitiveness. The total annual tonnage moving through these two ports is expected to double between 2000 to 2035 (see Exhibit 3.4-3). Furthermore, trucks are predicted to play an increasingly large role in transporting freight. Increased demand for truck-hauled freight will create a corresponding growth in demand on the Interstate system, as shown in Exhibit 3.4-4.

The Portland-Vancouver region is more susceptible to long-term economic losses from congestion than other areas because its economy is relatively dependent on manufacturing, transportation/port distribution, and services that serve broader regional, national and global markets. Transportation-related firms bring new money into the region by selling their products and services nationally and internationally. These firms could locate elsewhere, but choose the Portland-Vancouver region for its attractiveness and competitiveness for their operations. An inadequate transportation system could negatively impact this region's economic competitiveness.

Both the City of Portland and the City of Vancouver rely heavily on tax revenues to fund general services. Property taxes are the largest single source of revenue for both cities, accounting for 36 percent of Portland's annual tax revenue and 31 percent of Vancouver's. Total tax revenue accounts for 40 percent of Portland's overall revenue and 78 percent of Vancouver's. This dramatic difference in percentage is largely because Vancouver receives sales tax revenues, while Oregon does not have a sales tax. The Economics Technical Report provides a detailed breakdown of revenue sources for each city.

### 3.4.2 Long-Term Effects from Project Alternatives

The CRC project team analyzed land use and economic effects in five broad categories:

- Direct land use effects from property acquisitions
- Direct economic effects from displacing businesses, parking, or access points to these businesses, and the resulting loss of employment and revenue generation, and loss of tax revenue to local jurisdictions
- Regional economic impacts resulting from changes in transportation performance and access to businesses and freight movement
- Consistency with land use plans and implementing regulations
- Potential for induced growth and development that could arise from two separate elements of this project—induced development pressure at the urban periphery (sprawl) resulting from added highway capacity, and growth from economic investment around high-capacity transit stations (transit-oriented development).

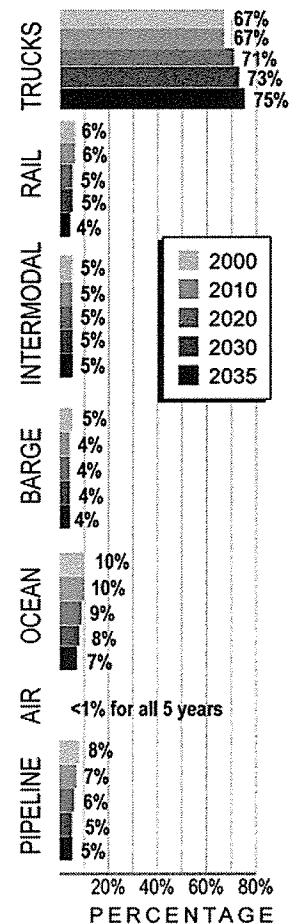
The impacts of each alternative are summarized in Exhibits 3.4-5 through 3.4-8 and in the following discussions. This is followed by a discussion of the impacts from the individual components and options that make up the alternatives.

#### Alternative 1: No-Build

The No-Build Alternative would not have direct impacts to land use or commercial property, but would increase existing transportation problems that inhibit economic growth. This alternative would impact regional freight movement because it would allow transportation on I-5 to deteriorate well beyond current conditions. For example, daily congestion at the I-5 river crossing would grow from 6 hours per day to 15 hours per day by 2030. This congestion would greatly reduce travel time reliability and spread into the middle of the day when trucks most

Exhibit 3.4-4

#### Ports of Portland-Vancouver commodity flow forecast by mode



Source: Metro, 2006.



often travel. Furthermore, this congestion could hinder access to businesses for employees and even retail trips in some areas. These transportation effects of the No-Build Alternative would indirectly limit economic development, urban development in downtown Vancouver and the planned development on Hayden Island

### Alternative 2: Replacement Crossing with Bus Rapid Transit

Replacing the existing bridges with a safer, larger capacity river crossing and adding bus rapid transit (BRT) would provide substantial benefits for the local and regional economy and assist jurisdictions in reaching land use goals. However, these improvements would also require property acquisitions that could have localized effects on the economy and, to a lesser extent, land use goals.

Exhibit 3.4-5

#### Land Use and Economic Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Direct Land Use Impacts (related to acquisitions)	Minor	Moderate	Minor	Minor
Direct Commercial Impacts (related to acquisitions)	Moderate	High	Moderate	Moderate
Regional Economy	Highly beneficial	Highly beneficial	Highly beneficial	Highly beneficial
Plan Consistency	Moderate consistency	Moderate consistency	Moderate consistency	Moderate consistency
Increased TOD Potential	Low	Moderate	Low	Low

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

This alternative would require property acquisition for additional right-of-way, but this would have little effect on the broader scale of local or regional land use planning. Business displacements would have a moderate to high impact on Hayden Island and potentially on North Main Street in Vancouver. However, there is likely to be only a minor effect on local or regional economic conditions, such as property tax revenue generation for the Cities of Portland and Vancouver.

A replacement river crossing would result in improved economic development conditions for businesses in Portland and Vancouver by reducing congestion (to about 5 hours per day, versus 15 hours with the No-Build Alternative) and improving access and safety. This would support economic growth by improving travel times and travel reliability for freight, commuters, and other vehicles traveling between Portland and Vancouver.

Adding high-capacity bus rapid transit through Vancouver would help concentrate growth along the transit corridor and advance local and regional land use goals. This growth would in turn stimulate economic investment around transit stations.

### Alternative 3: Replacement Crossing with Light Rail

This alternative would long-term effects similar to those under Alternative 2, except that light rail (LRT) could attract more

redevelopment around transit stations. This could result in greater advancement of local and regional land use goals to concentrate growth along transit corridors, and potentially greater economic investment around station areas.

Exhibit 3.4-6

**Land Use and Economic Effects Summary for Alternative 3**

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Direct Land Use Impacts (related to acquisitions)	Minor	Moderate	Minor	Minor
Direct Commercial Impacts (related to acquisitions)	Moderate	High	Moderate	Moderate
Regional Economy	Highly beneficial	Highly beneficial	Highly beneficial	Highly beneficial
Plan Consistency	High consistency	High consistency	High consistency	High consistency
Increased TOD Potential	Moderate	High	Moderate	Moderate

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

This alternative would provide benefits similar to those provided under Alternative 2 by introducing bus rapid transit through Vancouver; however, it would provide less overall highway improvement and congestion relief.

A supplemental crossing would offer better I-5 traffic performance than the No-Build Alternative, but less improvement than the replacement river crossing (nearly 11 hours of congestion by 2030, versus 5 hours for a replacement crossing). This congestion relief would benefit businesses, employers, and industrial centers that rely on the I-5 corridor.

Exhibit 3.4-7

**Land Use and Economic Effects Summary for Alternative 4**

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Direct Land Use Impacts (related to acquisitions)	Minor	Moderate	Minor	Minor
Direct Commercial Impacts (related to acquisitions)	Moderate	High	Moderate	Moderate
Regional Economy	Moderately beneficial	Moderately beneficial	Moderately beneficial	Moderately beneficial
Plan Consistency	Low consistency	Low consistency	Low consistency	Low consistency
Increased TOD Potential	Low	Moderate	Low	Low

A supplemental crossing would require displacement of fewer businesses than a replacement crossing, as described in Section 3.3 of this DEIS,

Property Acquisitions. This would result in slightly lower loss of property tax revenue for the Cities of Portland and Vancouver.

With Alternative 4 there is less emphasis on highway improvements and more emphasis on transit improvements. However, this alternative would result in minimal increase in transit ridership over Alternatives 2 or 3, as discussed in Section 3.1, Transportation. This alternative would also have BRT-related land use benefits through Vancouver similar to those described above for Alternative 2.

#### **Alternative 5: Supplemental Crossing with Light Rail**

This alternative would have long-term effects similar to those under Alternative 4, except that light rail could attract more redevelopment around stations. This could result in greater advancement of local and regional land use goals for concentrating growth around transit, and potentially greater economic investment in these station areas.

Exhibit 3.4-8

**Land Use and Economic Effects Summary for Alternative 5**

<b>Alternative 5: Supplemental Crossing with Light Rail Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Direct Land Use Impacts (related to acquisitions)</b>	Minor	Moderate	Minor	Minor
<b>Direct Commercial Impacts (related to acquisitions)</b>	Moderate	High	Moderate	Moderate
<b>Regional Economy</b>	Moderately beneficial	Moderately beneficial	Moderately beneficial	Moderately beneficial
<b>Plan Consistency</b>	Moderate consistency	Moderate consistency	Moderate consistency	Moderate consistency
<b>Increased TOD Potential</b>	Moderate	High	Moderate	Moderate

#### **3.4.3 Long-Term Effects from Project Components**

This section describes the effects of the project components that make up the alternatives described above. Some components, such as transit operations, the stacked transit/highway bridge design, and TDM/TSM measures, would have few impacts on land use or economics effects, and are therefore not discussed in this section.

#### **Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)**

##### **DIRECT EFFECTS ON LAND USE AND COMMERCIAL PROPERTY**

Both the supplemental and replacement river crossings would require property acquisition for additional right-of-way. The supplemental crossing would require acquisition of less property because it has a narrower footprint. The replacement crossing would incur a slightly greater loss of property tax revenue for the Cities of Portland and Vancouver. Exhibit 3.4-9 summarizes the business impacts of the replacement and supplemental crossings.



Exhibit 3.4-9

**Potential River Crossing and Highway Business Impacts**

	<b>Replacement Crossing</b>	<b>Supplemental Crossing</b>
Businesses displaced or relocated	Up to 41	Up to 34
Employees in businesses displaced or relocated	Up to 565	Up to 481
Annual sales of displaced/relocated businesses	Up to \$112 million	Up to \$68 million
Direct property tax impact <sup>a</sup>	\$240,000	\$215,000
Parking spaces removed	40-80 spaces	40-80 spaces

Source: CRC Economics Technical Report.

<sup>a</sup> Annual loss in tax revenues (based in 2006 dollars) from displaced business.

Hayden Island is the only area where property acquisitions could potentially result in a change in planned land uses. A privately initiated redevelopment plan for the Jantzen Beach shopping center envisions a “Main Street” feel and a greater mix of uses. Changes in the highway alignment and addition of a transit guideway could potentially alter development trends on the island. The City of Portland is currently in the process of drafting a plan for how Hayden Island should develop in the future; this planning process recognizes the CRC project as an integral part of future development on Hayden Island.

**TRANSPORTATION EFFECTS ON THE ECONOMY**

Both replacement and supplemental river crossings would result in improvements to economic development conditions for businesses in Portland and Vancouver by reducing congestion and improving access, safety, and travel time reliability. These improvements would support economic growth by increasing the efficiency of truck-hauled freight in the region and improving access for commuters and other travelers traveling between Portland and Vancouver.

A replacement crossing would offer superior traffic performance on I-5 compared to a supplemental river crossing and No-Build Alternative, as summarized in Exhibit 3.4-10 and described in detail in Section 3.1, Transportation. This congestion relief would substantially benefit businesses, employers, and industrial centers that rely on the I-5 corridor.

Exhibit 3.4-10

**Highway Transportation Performance**

	<b>Existing</b>	<b>No-Build</b>	<b>Replacement</b>	<b>Supplemental</b>
Peak-period person trips	49,000	55,000	75,000	66,000
Duration of congestion	6 hours	15 hours	3.5–5.5 hours	11 hours

Source: CRC Traffic Technical Report.

The following discussions highlight the long-term economic effects of the transportation improvements included in the replacement and supplemental river crossings on key areas of concern.

## How would highway capacity affect job distribution?

Modeling conducted in 2002 as part of the I-5 Strategic Plan evaluated I-5 capacity improvements similar to those proposed by CRC. That analysis projected that, compared to No-Build, increased I-5 crossing capacity would shift about one percent of the region's employment to the I-5 corridor by the year 2020.

**Downtown Portland and downtown Vancouver:** The replacement crossing offers modest travel time improvements and greatly improved travel reliability between downtown areas, due to the elimination of bridge lifts and the reduced potential for traffic accidents that cause unexpected congestion. Improved access to these central business districts would reinforce the economic growth and development that is already occurring in both districts. Under the replacement crossing, vehicles traveling northbound along I-5 from I-84 to 179th Street during the afternoon/evening peak would experience a travel time decrease of 18 minutes, or 40 percent, compared to No-Build conditions. Under the supplemental crossing, northbound travel times would improve for motorists using the through lanes (western bridge) by about 15 minutes, or 34 percent, compared to No-Build conditions. However, due to the seven hours of congestion expected to occur due to over-capacity conditions on the eastern bridge, northbound vehicles using the eastern bridge (those entering the highway from Marine Drive or Hayden Island, and those exiting the highway to SR 14, City Center, Mill Plain Boulevard, and Fourth Plain Boulevard) would experience substantial delays.

**Regional economy:** The I-5 corridor is the backbone of a network of roads that provide access to the greater Vancouver and Portland region. The Oregon Commodity Flow Forecast<sup>10</sup> projects an 81 percent increase in tonnage moving to, from, and through the state by 2030. Trade capacity studies further concluded that while all modes are important, the roadway system links all of the others and links land uses critical to business. Roadway congestion increases the cost of doing business for those activities that are transportation-dependent.

Five industries in the Portland-Vancouver region are particularly sensitive to road congestion: lumber/wood/paper, distribution/wholesale trade, transportation equipment/steel, farm and food products, and high-tech. These industries account for approximately 70 percent of the commodity tonnage crossing the I-5 and I-205 bridges and for 31 percent of Oregon and Washington's gross regional output in 2000. These industries would benefit greatly from the improvements offered by the build alternatives. Both crossing alternatives would reduce future southbound congestion to less than four hours each day. The replacement crossing would reduce northbound congestion to less than two hours per day. Reconfiguration of the existing bridges under the supplemental crossing, requiring a split in northbound I-5, would result in seven hours of daily congestion, one hour less than under No-Build conditions.

**Ports:** Maintaining and enhancing the efficiency of the highway system would allow the ports of Portland and Vancouver to stay competitive with other West Coast ports. This is especially true because of anticipated growth in the movement of truck-hauled freight to and from marine and aviation ports. The replacement crossing would require fewer piers, creating less of an obstacle to river navigation than either the existing or the supplemental crossing. Taller ships would not be restricted by the hours of lift-span operation, and would not have to navigate a difficult path around the lift-span. A replacement crossing

<sup>10</sup> Global Insight et al., 2006.

would be slightly closer to the downstream railroad bridge, which could potentially make navigation past the two bridges more difficult. However, the new primary channel under the replacement crossing would be better aligned with the channel through the railroad bridge than currently. This should improve navigation, even with the two bridges slightly closer together.

The supplemental crossing would result in more adverse effects to navigation than either the No-Build Alternative or the replacement crossing. Lift-span restrictions from the existing bridges would continue to cause delays to river traffic. The continuing need to navigate around the lift span, and the relatively narrow width between existing bridge piers, would continue to represent a potential hazard to navigation. Moreover, this width could potentially be decreased even more because of the seismic reinforcement planned for the existing bridge piers. In addition to the effects from retaining the existing structures, a supplemental crossing would require a new structure between the existing I-5 bridges and the downstream railroad bridge. By providing a shorter distance to navigate between the two bridges, this has the potential to increase the hazard to navigation, particularly when vessels have to navigate around the I-5 lift-span.

The river crossing component also affects river navigation and the movement of marine-hauled freight. Nearly 10 million tons of freight in over 9,500 shipments passed under the I-5 crossing in 2005.<sup>11</sup> River navigation between the I-5 crossing and the BNSF railroad bridge would be improved by a replacement crossing, but worsened by a supplemental crossing, as discussed in Section 3.2 of this DEIS.

**Regional competitiveness:** Transportation infrastructure is one of many factors that affect the relative attractiveness of doing business in this region. The build alternatives would improve transportation and increase the competitiveness of the region. The amount of this improvement depends on the extent to which this region adopts policies to capitalize on the benefits of this project.

**Trucking industry:** Congestion at the I-5 crossing is predicted to increase the cost of delay to trucks by 140 percent, from \$14 million in 2000 to \$34 million in 2020.<sup>12</sup> By reducing congestion, the build alternatives would benefit the trucking industry by reducing labor and fuel costs, improving safety, and reducing scheduling uncertainty.

#### PLAN CONSISTENCY

The CRC project would generally support Oregon's Statewide Planning Goals and Washington's Growth Management Act policies pertaining to transportation and infrastructure improvements. The project would be integrated with a variety of planned transportation facilities. Both the replacement and supplemental river crossings would be consistent with goals for providing infrastructure to urban areas. Improving infrastructure in the urban core would also support regional plans adopted by the Southwest Washington RTC, Clark County, and Metro.

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<sup>11</sup> U.S. Army Corps of Engineers, 2005.

<sup>12</sup> Cambridge Systematics et al., 2003.



Overall, the CRC project would comply with the direction of the Vancouver Comprehensive Plan to provide City Center infrastructure and a range of transportation facilities that would accommodate transit, bicycles, and pedestrians. The project would meet the Comprehensive Plan goals for improved access to I-5 and for improved connections to the Vancouver National Historic Reserve and waterfront areas.

Both Oregon and Washington highway plans state objectives for mobility, congestion relief, and freight movement. Both river crossings would support these objectives, although the replacement crossing would be more supportive as it would result in greater congestion improvements.

The higher clearance of the replacement crossing would open more space along the waterfront for the park that currently passes under the relatively low clearance of the existing I-5 crossing (Exhibit 3.4-11). A replacement crossing would also allow Vancouver to extend Main Street to Columbia Way, which supports the City's vision of providing greater connectivity to the waterfront. A supplemental crossing would not allow this, and the lack of this connectivity could hinder planned development in lower downtown Vancouver. This connectivity under the replacement option would also be beneficial for the waterfront Renaissance project, which is required to integrate with the downtown. The City of Vancouver considers the Main Street connection to be critical to achieving Vancouver City Center Vision goals.

Exhibit 3.4-11  
**Existing Low Clearance at Waterfront Park**



### How is potentially induced growth managed?

State and local plans and regulations manage growth in the Portland/Vancouver area. Local decision making regarding growth rates, zoning, and development intensities are developed to direct growth, even that which may be partially "induced" as a project specific effect.

The supplemental crossing would result in closure of the intersection of Sixth and Washington Streets. This closure could negatively affect the economic vitality of several businesses by reducing east-west circulation in lower downtown Vancouver.

The supplemental river crossing could make it more difficult for the City of Vancouver to provide a planned physical connection, such as a pedestrian pathway, between downtown and the Vancouver National Historic Reserve. The supplemental crossing calls for increasing the height of the southbound portion of I-5 through downtown Vancouver, thus requiring any physical connection to be elevated approximately 15 feet higher than under existing conditions or with a replacement river crossing. This additional height would increase the cost, complexity, and size of a connection between downtown Vancouver and the Vancouver National Historic Reserve.

### INDUCED GROWTH

Highway improvements could induce development by improving travel times and making areas at the urban periphery more attractive to developers. Additional highway capacity could increase pressure on local jurisdictions to allow higher intensity land uses outside urban centers, encouraging employment and residential development to locate further from the urban core. This induced growth is typically not desirable, as it often conflicts with local and regional planning goals and can lead to deterioration of existing economic and cultural centers such as downtown areas.

There is concern that increased capacity and decreased travel times on I-5 could result in housing and commercial development pressure to expand urban growth boundaries in Clark County. Some indirect effects

on job and population distribution are likely with the CRC project, but these are likely quite small. A comprehensive literature review and comparative analysis of case studies indicate that adding highway capacity within a well-planned urban area with a full range of infrastructure and urban services is unlikely to have substantial indirect effects on land use patterns. Previous modeling of I-5 highway and high-capacity transit improvements similar to those included in the CRC build alternatives suggests that induced effects on jobs and housing distribution would not be substantial and would generally be consistent with local and regional land use plans.<sup>13</sup>

While adding highway capacity at the river crossing would reduce congestion and increase potential throughput, other aspects of the project—such as tolling the crossing and adding a new high-capacity transit connection between urban centers—would reduce auto trips. Overall, the CRC improvements are expected to support local and regional goals for providing efficient transportation, encouraging alternative transportation, supporting urban centers, and concentrating growth in the urban core. Jurisdictions would be able to continue to effectively manage growth through adopted plans and implementing regulations. Prior to completion of the Final EIS, the project team will review access and land use controls near proposed interchanges to ensure that the transportation investments would be adequately protected from unintended or unplanned development.

#### **MARINE DRIVE INTERCHANGE DESIGNS**

In addition to the standard design assessed with the full alternatives, there are two interchange options for Marine Drive, called the Southern and the Diagonal Marine Drive Realignments. Both realignments would directly impact buildings to the north and west of the Expo Center, and could indirectly impact freight movement through traffic changes.

Realigning Marine Drive south of the Expo Center would require acquisition of two existing buildings, located at the SW corner of Marine Drive and Force Avenue. Exhibit 3.4-12 shows the property tax, gross sales, and number of employees impacts that would result from these potential acquisitions.

Realigning Marine Drive south of the Expo Center would also greatly reduce sight and stopping distances, requiring trucks to slow to below the existing 45 mph speed limit. However, this southern realignment of Marine Drive would push the interchange farther south, increasing the spacing between the Hayden Island interchange and allowing space for vehicles to merge onto and leave the highway. This extra distance is particularly important for trucks. The southern realignment would also displace parking for the Expo Center.

The diagonal realignment of Marine Drive would divide the Expo Center Complex by removing about 3 acres of land on the north side of the complex. The northern building of the Expo Center would be removed to provide right-of-way for Marine Drive. The diagonal realignment of Marine Drive would slightly decrease sight and spotting distances, but

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<sup>13</sup> Regional Land Use Assessment Committee, 2001.

much less so than the southern realignment. The diagonal realignment would also require displacement of parking for the Expo Center.

Exhibit 3.4-12

**Potential Acquisitions Associated with Marine Drive Interchange Designs**

	Southern Design	Diagonal Design
Businesses displaced or relocated	1	1
Employees in businesses displaced or relocated	Up to 5	Up to 80
Annual sales of displaced/relocated businesses	Up to 2.4 million	Up to \$12.4 million
Direct property tax impact <sup>a</sup>	\$322,000	0 <sup>b</sup>

Source: CRC Economics Technical Report.

<sup>a</sup> Annual loss in tax revenues (in 2006 dollars) from displaced business.

<sup>b</sup> This design impacts the corner of an Expo Center building. It would not require a full displacement. While there is no property tax paid by the Expo Center, The City of Portland Assessor's data shows a market value of nearly \$50 million, and \$769,000 in annual taxes on its sales.

**TRANSIT MODE (BRT WITH ALTERNATIVES 2 AND 4; LRT WITH ALTERNATIVES 3 AND 5)****Direct Effects on Land Use and Commercial Property**

The direct impacts of the proposed transit systems are discussed more fully in following sections. The difference in long-term impacts between these transit modes is their required maintenance facilities.

Choosing the light rail transit option would require an expansion of the existing Ruby Junction light rail maintenance facility expansion, including full acquisition of 14 parcels in the vicinity of NW Eleven Mile Lane in Gresham. These parcels are zoned for heavy industrial, but currently support residential, commercial, and light industrial uses. In many cases there seem to be multiple uses occurring on a single lot. Expansion of the Ruby Junction facility would be more consistent with Heavy Industrial zoning than with the current mix of single-family residence (SFR), small service business, and industrial uses. This expansion would displace six businesses that, together, employ an estimated 60 people and have estimated annual sales of approximately \$17.4 million (see Exhibit 3.4-13).

In contrast, choosing bus rapid transit would require expansion of only one maintenance facility, the AOM facility at 18th Street and 65th Avenue in Vancouver. The area now includes a business, and two residences. One business would be displaced; this business has 5 employees and just over \$1 million in annual sales.



Exhibit 3.4-13

**Maintenance Base Business Displacements**

	No. Businesses Impacted	No. Employees Impacted	Affected Sales (Millions)
<b>Maintenance Base Option</b>			
LRT Maintenance Base Option (Expansion of Ruby Junction Facility)	6	60	\$17.4
BRT Maintenance Base Option (Expansion of AOM Facility)	1	5	\$1.2

Source: InfoUSA, 2007, CRC Right-of-Way Acquisitions Dataset.

**TRANSIT EFFECTS ON THE ECONOMY**

Bus rapid transit or light rail would improve transit accessibility and travel time reliability, and would potentially broaden the pool of labor available to firms within the region. The following would be economically improved by either transit mode.

**Downtown Portland and downtown Vancouver:** Both high-capacity transit modes would offer improved access between these two downtown areas. Light rail would be especially beneficial because it would allow for no-transfer transit trips between downtown Vancouver and downtown Portland; bus rapid transit would require a transfer at the Expo Center station. Improved access to these downtown areas would reinforce the economic growth and development that is already occurring in both.

**Regional economy:** Transportation system improvements could reduce household out of pocket costs for personal travel, thereby increasing disposable personal income. The result would be an increase in living standards and consumer spending, which could then support additional retail and consumer business activity. High capacity transit could also increase the employment and incomes of local residents by increasing their access to outside business locations.

**Regional competitiveness:** Transportation infrastructure is one of many factors that affect the relative attractiveness of doing business in this region. The amount of improvement to regional competitiveness depends on the extent to which this region adopts policies to capitalize on the benefits of this project, including access management, congestion pricing, and others. Currently, this region has many policies and existing infrastructure in place to encourage transit usage. Adding bus rapid transit or light rail to the CRC project area would capitalize on this.

**Local Businesses:** High Capacity Transit service and its accompanying transit stations have the potential to significantly benefit nearby businesses. The increase in access for both customers and employees is a direct benefit. Factors related thereto are discussed in the following sections on induced growth and transit oriented development. The improved access, especially near transit stations, will bring many more potential customers within walking distance of commercial nodes serving to offset losses in customer parking. This will provide a benefit to existing businesses as well as increase opportunities for new business.

Furthermore, the investments in transit stations, which often include public art, high quality design, and new landscaping, will represent an investment in a specific area. These public investments typically lead to higher levels of private investment and subsequently increased vitality in commercial nodes.

#### PLAN CONSISTENCY

Either transit mode would generally support Oregon Statewide Planning Goals and Washington Growth Management Act policies pertaining to transportation and infrastructure improvements. Both modes would be consistent with goals for providing infrastructure to urban areas and for directing high-density growth to urbanized locations. Improving infrastructure in the urban core and extending high-capacity transit would also support regional plans adopted by the Southwest Washington RTC, Clark County, and Metro.

Adding bus rapid transit or light rail through Vancouver would comply with the direction of the Vancouver Comprehensive Plan to provide city center infrastructure and a range of transportation facilities that would accommodate transit, bicycles, and pedestrians. Comprehensive Plan goals include the introduction of high-capacity transit to Vancouver.

The Portland Comprehensive Plan, the Vancouver City Center Vision, and Vancouver Downtown Transportation System Plan call for expanding the existing light rail system to serve Hayden Island and Vancouver, making bus rapid transit potentially inconsistent with these plans.

#### INDUCED GROWTH

Transit, particularly high-capacity transit, can be a catalyst for development around transit stations. Often referred to as transit-oriented development (TOD), this is generally pedestrian-oriented and higher-density development that further supports the nearby transit service. This type of development is sought after by jurisdictions because it reduces demand for additional roadway capacity and advances local and regional planning goals by focusing development along transportation corridors.

The likelihood and magnitude of economic investment in transit-oriented development depends on many factors beyond the existence of transit stations. These factors include the characteristics of the transit infrastructure, local land use and development policies, and the strength of residential and commercial markets. The long-term nature of the analysis of this project (through 2030) makes assessing market conditions problematic. Local development policies are generally highly supportive of transit-oriented development. Therefore, the primary variable of this project that could influence potential for transit-oriented development is the high-capacity transit mode. The choice of transit terminus would influence TOD potential, as described in the Transit Terminus Options discussion below.

Academic research, case studies, and public outreach suggest that both light rail and bus rapid transit can attract economic investment, but that light rail can attract more investment than bus rapid transit. Rail lines

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More information on the methodology for assessing transit-oriented development potential is provided in the CRC Land Use Technical Report.

have greater visibility and appeal than buses,<sup>14</sup> and studies have correlated this with a rider preference for trains.<sup>15</sup> These factors, in addition to the perception that rail infrastructure is a more permanent and fixed public investment,<sup>16</sup> indicate that developers are more likely to invest around light rail stations than around bus rapid transit stations.

The following points are important to understanding the indirect land use and economic impacts of transit:

- Economic development and land use intensification opportunities arise from investment in high-capacity transit. There has been documented development at both light rail and bus rapid transit stations.<sup>17</sup>
- There is limited documentation about the expected level of economic development around stations, or whether one mode of transit will consistently induce more economic development than the other. Local zoning, market forces, developer incentives, choice of origin and destination points, and public preferences will all greatly affect the levels of economic development at transit stations.<sup>18</sup>
- TOD potential is directly correlated with ridership.

### **Transit Terminus Options (with all Alternatives)**

#### **DIRECT EFFECTS ON LAND USE AND COMMERCIAL PROPERTY**

The transit terminus options would require property acquisition for additional right-of-way to accommodate the exclusive transit guideway. However, these property acquisitions would generally have little effect on land use. The Kiggins Bowl terminus (A) would require less property acquisition and fewer business displacements than the Lincoln terminus (B), as illustrated in Exhibit 3.4-14. The Kiggins Bowl terminus would displace some commercial properties along 16th Street or McLoughlin Boulevard. The Lincoln terminus would displace some of the businesses along Broadway and Main Streets. The Lincoln terminus would also remove more on-street parking, although the Kiggins Bowl terminus with the McLoughlin alignment option would remove all on-street parking from McLoughlin Boulevard.

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<sup>14</sup> Dittmar and Ohland, 2004.

<sup>15</sup> Kenworthy, 2000.

<sup>16</sup> WMATA, 2005.

<sup>17</sup> APTA 2007, Cura 2003, Levinson et al. 2003, Light Rail Now 2006, MaryPIRG Foundation 2003, Weinstein 1999.

<sup>18</sup> Cervero 2004, 1993, ECONorthwest et al. 1998, Seskin 1996, Thomas 2004.



Exhibit 3.4-14

**Potential Business Impacts from Transit in Northern Vancouver<sup>a</sup>**

	Lincoln terminus (B)	Kiggins Bowl terminus(A)
Businesses Displaced or Relocated	17 to 26	2 to 9
Employees in Businesses Displaced or Relocated	50 - 129	10 to 45
Annual Sales of Businesses Displaced or Relocated (millions)	\$7 to \$15	\$<1 to \$3
Direct Property Tax Impact (thousands)	\$5 to \$7	\$1 to \$2
Parking Spaces Removed	85 to 131	43 to 82

Source: CRC Economics Technical Report.

<sup>a</sup> North of Mill Plain Boulevard.

Two alignment options on Hayden Island have been analyzed. The adjacent option would locate the transit guideway immediately next to the west side of I-5. The offset option would separate the guideway approximately 450 to 650 feet west of I-5. Exhibit 3.4-15 summarizes impacts from property acquisitions that would result from each of the alignment options. Few business displacements were uniquely associated with the transit alignments in this area—most would already be affected by the highway improvements.

Exhibit 3.4-15

**Potential Business Impacts from Transit in Oregon**

	Adjacent Replacement (Alts 2 or 3)	Adjacent Supplemental (Alts 4 or 5)	Offset Replacement (Alts 2 or 3)	Offset Supplemental (Alts 4 or 5)
Businesses Displaced or Relocated	17	7	5	5
Employees in Businesses Displaced or Relocated	215	165	25	50
Annual Sales of Businesses Displaced or Relocated (millions)	\$ 15	\$ 17	\$ 3	\$ 7
Direct Property Tax Impact (thousands)	\$ 15	\$ 65	\$ 140	\$ 130-135
Parking Spaces Removed	15	15	15	15

Source: CRC Economics Technical Report.

There are two alignment options for downtown Vancouver—a two-way guideway on Washington Street and a couplet on Washington and Broadway Streets. Near Mill Plain, transit vehicles would transition from the core of downtown to their uptown Vancouver or highway alignments. There are four options north of 15th Street—a two-way Broadway alignment or a Broadway-Main couplet (both for the Lincoln terminus), and a 16th Street or McLoughlin Boulevard alignment (for the Kiggins Bowl and Clark College MOS terminus options). Each of these options would result in slightly different impacts, as summarized in the Exhibit 3.4-16.

Exhibit 3.4-16

**Potential Business Impacts from Transit in Downtown Vancouver**

	Two-Way Washington				Washington-Broadway Couplet			
	Two-way Broadway	Broadway- Main Couplet	16th Street	McLoughlin Blvd	Two-way Broadway	Broadway- Main Couplet	16th Street	McLoughlin Blvd
Businesses Displaced or Relocated	1	0	0	1	1	0	0	1
Employee in Businesses Displaced or Relocated	5	0	0	5	30	0	0	30
Annual Sales of Businesses Displaced or Relocated (millions)	<\$1	\$0	\$0	< \$1	< \$1	0	0	<\$1
Direct Property Tax Impact (thousands)	0.8 -1	0.9	1	0.1-0.6	0.33	0.2	0	0.33
Parking Spaces Removed	97	97	151	197	69	69	123	169

Source: CRC Economics and Acquisition Technical Reports.

There would be no business displacements between Sixth and 15th Streets in the core of downtown Vancouver. The two-way Washington alignments would impact both on-street and off-street parking. Under either transit mode option, parking along Washington Street would not be allowed on either side of the street. This would result in a loss of all of the 106 on-street parking spaces along Washington Street between Sixth and 15th Streets.

Under all options, one block between 15th Street and 16th Street and Washington and Main would be acquired, where the future Mill Plain transit station would bisect the block. Currently this area is used as a paid surface parking lot with capacity for about 150 (unstriped) parking stalls. According to the operator of the lot, about 90 percent of spaces are rented monthly. Many monthly pass holders work in the downtown area.

The two-way Broadway and the Broadway-Main alignment options would impact the parking lot of a bank near Broadway and McLoughlin Boulevard. Both options are expected to remove approximately 10 parking spaces. The two-way Broadway and the McLoughlin Boulevard connections would also require the acquisition of an area bank, as described above. For light rail, the Broadway-Main connection would impact the parking lot of this bank, removing approximately 30 parking stalls, and would eliminate a small number of parking stalls (approximately five) of an auto parts store.

Exhibit 3.4-17 below shows the direct economic impacts associated with the McLoughlin Boulevard and 16th Street alignment options for the Kiggins Bowl terminus. The 16th Street alignment would result in fewer business displacements and parking impacts.

Exhibit 3.4-17

**Potential Business Impacts from Alignment Options in Northern Vancouver for Kiggins Bowl and Clark College MOS Terminus<sup>a</sup>**

	McLoughlin Blvd Alignment Option		16th Street Alignment Option
	with Two-way Washington	with Washington-Broadway Couplet	
Businesses Displaced or Relocated	9	8	2
Employee in Businesses Displaced or Relocated	45	31	10
Annual Sales of Businesses Displaced or Relocated (millions)	\$3	\$3	< \$1
Direct Property Tax Impact (thousands)	\$2 - \$8 (Replacement - Supplemental)	\$2	\$1
Parking Spaces Removed	82	82	43

Source: CRC Economics Technical Report.

<sup>a</sup> North of Mill Plain Boulevard.

Exhibit 3.4-18 below shows the direct economic impacts associated with the Lincoln terminus. All the options for this terminus result in comparable impacts to businesses. The Broadway-Main alignment has the greatest impact to parking spaces. The two-way Broadway alignment when combined with the two-way Washington alignment has the highest number of business displacements.

Exhibit 3.4-18

**Potential Business Impacts from Lincoln Terminus Alignment Options in Northern Vancouver<sup>a</sup>**

	Two-Way Broadway Alignment Option		Broadway-Main Couplet Alignment Option
	With Two-Way Washington	With Washington-Broadway Couplet	
Businesses Displaced or Relocated	32	26	25
Employee in Businesses Displaced or Relocated	285	215	209
Annual Sales of Businesses Displaced or Relocated (millions)	\$ 15	\$8	\$ 7
Direct Property Tax Impact (thousands)	\$ 5	\$ 5	\$ 7
Parking Spaces Removed	83	83	206

Source: CRC Economics Technical Report.

<sup>a</sup> North of Mill Plain Boulevard.**INDUCED GROWTH**

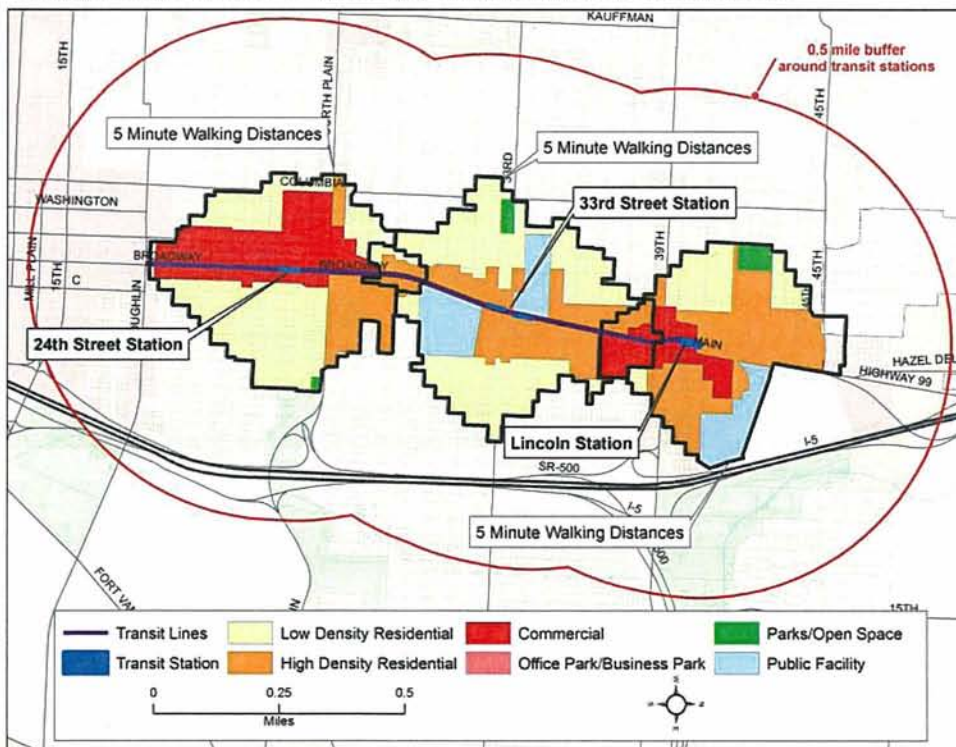
North of Mill Plain Boulevard the Lincoln terminus is surrounded by land uses and zoning more conducive to transit-oriented development, especially south of Fourth Plain Boulevard. The Kiggins Bowl terminus



(A) is bounded by the highway to the west and surrounded by a neighborhood of single-family homes. The adjacent highway creates a barrier at the western edge of the Kiggins Bowl terminus, restricting pedestrian access to transit stations. In addition, low-density residential zoning, such as that near the Kiggins Bowl terminus, is not conducive to higher-density TOD. In contrast, the Lincoln terminus is generally surrounded by medium- and high-density residential and commercial zoning that could allow for redevelopment around transit stations. A half-mile radius around transit stations (Exhibits 3.4-19 and 3.4-20) is generally considered to be the area in which transit is likely to influence development and redevelopment. These maps also indicate the land uses within a 5-minute walking distance of transit stations in northern Vancouver.

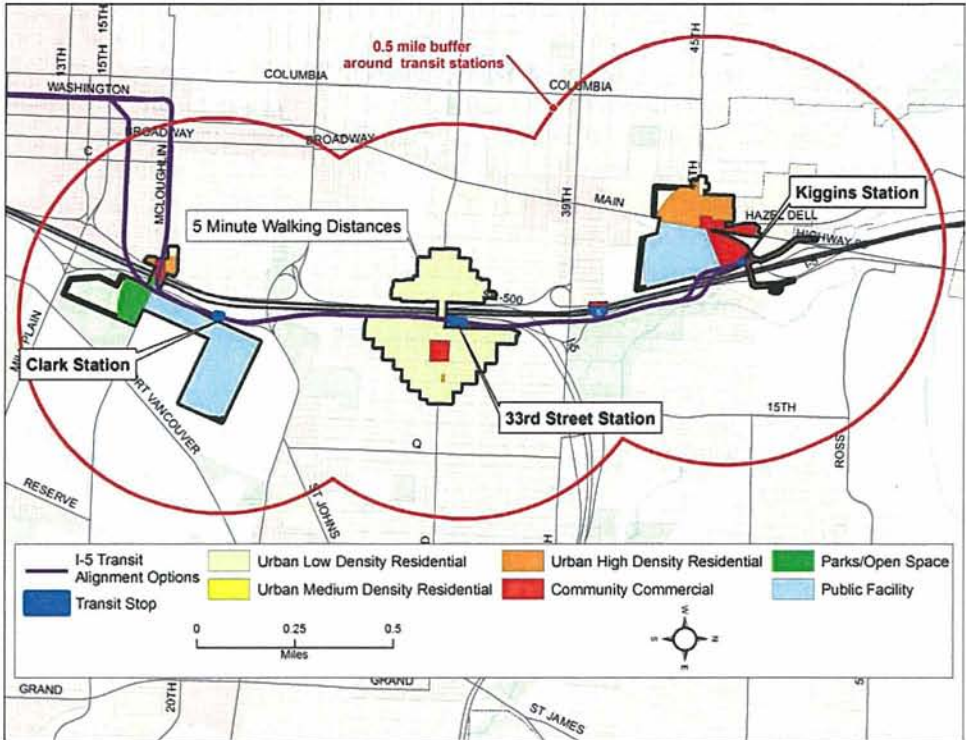
The potential for transit-oriented development can be estimated by analyzing existing land uses and the zoning around each transit station. The ratings shown in Exhibit 3.4-21 indicate the extent to which the high-capacity transit system is likely to attract transit oriented development around each station.

Exhibit 3.4-19

**Zoning Around Lincoln Terminus (B) Stations in Northern Vancouver**

Source: CRC Transit Technical Report.

Exhibit 3.4-20  
Zoning Around Kiggins Bowl Terminus (A) Stations in Northern Vancouver



Source: CRC Transit Technical Report.

Exhibit 3.4-21  
Transit-Oriented Development Potential for Transit Stations

Station	TOD Potential Rating
Hayden Island Station	Moderate to High
7th Street Station	Moderate
12th Street Station	Moderate to High
Mill Plain Station	High
<b>Lincoln terminus (B)</b>	
24th Street Station	Moderate
33rd Street Station	Low
Lincoln Park and Ride	Low to Moderate
<b>Kiggins Bowl terminus (A)</b>	
Clark College Station	Low
33rd Street Station	Low
Kiggins Bowl Park and Ride	Low

Source: CRC Land Use Technical Report.

The Clark College and Mill Plain minimum operable segment (MOS) terminus options would avoid some property acquisitions and business displacements in northern Vancouver. However the potential benefits of transit oriented development would go unrealized in these areas.

## **Transit Alignment Options (with all Alternatives)**

### **OFFSET OR ADJACENT**

There is little difference between these alignment options in terms of their impacts on land use and economics, and both would require displacement of some floating homes and businesses on Hayden Island. These impacts are summarized in Section 3.3, Property Acquisitions and Displacements.

### **TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET**

Neither transit alignment option in downtown Vancouver would displace any businesses, but both would reduce on-street parking. The two-way Washington Street alignment would require removal of all on-street parking spaces along Washington Street between Sixth and 15th Streets. The Washington-Broadway couplet would require removal of 34 percent of existing parking spaces on these streets. These parking losses could result in economic impacts to some businesses in this area, although parking would be available on side streets and parallel streets. A plan for replacing these lost parking spaces may be required if this parking is heavily utilized. There are parking-related mitigations proposed in this DEIS. See Section 3.1 for a discussion of transit-related parking impacts.

### **TWO-WAY MAIN OR MAIN-BROADWAY**

There is no substantial difference between these two alignment options in terms of their impacts on land use or economics. The impacts of these alignments are summarized in the range of impacts presented for the Lincoln terminus.

### **16TH STREET OR MCLOUGHLIN BOULEVARD**

There is no substantial difference between these alignment options in terms of their impacts on land use or economics. The impacts of these alignment options are summarized in the range of impacts presented for the Kiggins Bowl terminus.

## **Tolling Scenarios**

Tolling the I-5 crossing would generally benefit the regional economy by reducing congestion and improving travel time reliability, but some retail business could be adversely impacted. Some travelers may choose to avoid the toll and do business elsewhere; retail oriented trips would likely be most affected. Analysis of both the standard and higher rate tolling scenarios reveals similar vehicle throughput on I-205 (see Chapter 4 of this DEIS for more detail on tolling). This indicates that little traffic would divert to I-205 as a result of tolling, but instead drivers may avoid making trips or switch to another mode such as transit or carpool. Under a no toll scenario, the river crossing would be heavily congested, thereby diverting more trips to I-205 to avoid the congestion. This diversion would fail to provide many of the projects benefits to freight mobility.

For many travelers, the value of time saved from reduced congestion would be greater than the out-of-pocket cost of the toll, which would translate into greater efficiency and increased business productivity.<sup>19</sup>

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<sup>19</sup> Clower and Weinstein, 2005.

Increased business productivity can make locations more attractive for development and improve opportunities for trade.

The proposed toll scenarios would employ a variable toll structure, charging different rates during peak and non-peak times. This would help regulate traffic flows and increase traffic reliability throughout the day. Freight-dependent businesses and businesses that rely on just-in-time deliveries are especially likely to benefit from the improved travel predictability.

#### **3.4.4 Temporary Effects**

Construction activity for any of the build alternatives could temporarily disrupt land uses on Hayden Island, but would not likely have a major effect elsewhere in the project area. I-5 provides the only way on and off Hayden Island, and the existing businesses on the island are predominantly auto-oriented, big-box retail. Construction could temporarily reduce the attraction of the shopping center. Attracting new tenants, and possibly new residents, could be temporarily impeded by construction activities. Other parts of the project area are not as reliant on I-5 for access, and are thus less likely to experience any substantial effects on local land uses from temporary disruption.

Construction activities associated with all of the transit and highway improvements have the potential to cause economic impacts by temporarily blocking visibility and access to businesses, causing traffic delays, and rerouting traffic to detours. Access restrictions or other difficulties could divert customers and clients and hamper deliveries. However, most traffic movements would remain open throughout the construction stages.

Traffic congestion is already common within the I-5 corridor during peak travel periods. Adjacent construction activities and temporary detours would extend periods of congestion, negatively impacting businesses and other land uses. Movement of freight, goods, and services would also be negatively affected. If construction activities make travel times more difficult to determine, many freight shippers and businesses that rely on just-in-time delivery would be negatively affected. Through effective communication strategies and advanced signing, motorists would be warned about delays. As a result, some might avoid the project area entirely, which could negatively affect patronage of local businesses.

The potential sites for a bridge assembly/casting yard are unknown at this time. Regardless of the location, it is unlikely to have an impact on land use, but it could temporarily displace other economic activities from the site.

Construction of any of the build alternatives would bring increased employment and spending to the project area during construction. Funds from local or regional sources could be spent by residents and businesses on other economic activities within the region. Federal or state funds that are new to a region can have a measurable economic effect on employment and income gains resulting from project construction. Funds from the federal government and the states of Oregon and Washington will likely be sought for the project. If secured, such funding would provide added local and regional income and job benefits.



### 3.4.5 Potential Mitigation Measures

Most negative economic impacts result from business displacements, losses in parking, or changes in access to businesses. For those businesses displaced by the project, project sponsoring agencies would provide a relocation assistance program. Property acquisitions affecting other uses could also be mitigated by relocation assistance, as described in Section 3.3, Property Acquisitions and Displacements.

Permanent closure of the intersection of Sixth and Washington Streets (with Alternatives 4 and 5) could be mitigated by working with the Vancouver Convention Center and downtown businesses to develop a circulation plan. Mitigation for a supplemental crossing could include finding alternative ways to connect waterfront development with downtown Vancouver. There are planned connections through the Union Pacific railroad berm at Esther Street and elsewhere. Aiding the completion of these projects could help to mitigate impacts of the supplemental crossing, which would preclude the Main Street connection to the waterfront.

The City of Portland's Light Rail transit zoning overlay could aid in the development transitions on Hayden Island. This overlay is not in place now. Similarly, The City of Vancouver could develop transit-oriented development goals and implementing regulations. Vancouver's Design Review Committee could be extended to help guide implementation.

An Interchange Area Management Plan is currently being developed in coordination with the City of Portland Office of Transportation and Bureau of Planning, the Portland Development Commission, ODOT, and business owners on Hayden Island. This effort is linked to the Hayden Island Master Plan, and will address how the design of the Hayden Island interchange will accommodate a local circulation system, access spacing, and land use policies to help manage traffic demand on the interchange. An Interchange Justification Report, in Washington, will serve similar purposes and is also underway. The report includes an analysis of alternatives, access connections, and design, and consistency with transportation and land use plans.

Several measures could reduce the potential for unwanted, induced growth that could result from increased highway capacity. Additional coordination between regional governments could reduce the potential for increased highway capacity to induce changes in future growth patterns. In Washington, public input is required before making the decision to move an urban growth boundary. Input is taken from the cities in Clark County and from regional entities such as Metro and WSDOT. Formalizing the process by which these regionally substantial decisions are made through a broad intergovernmental agreement could allow for more direct participation in the decision on how much land is opened for development in Clark County. Such an agreement could help to protect new highway capacity and balance growth on a regional level.

Loss of on-street parking and access from the project alternatives may need to be mitigated using a variety of techniques. In south-downtown Vancouver there would be a large loss of on-street parking on street(s) where the guideway is proposed. In south-downtown Vancouver currently underutilized off-street facilities might be able to mitigate the

loss of on-street parking. At present most off-street parking facilities are privately owned. With future redevelopment of private facilities, some could be converted into public/private shared facilities if necessary. In northern Vancouver, parking losses from the proposed guideway would largely occur in areas where parking is underutilized. In these areas, it is likely that parking demand could be absorbed by the existing on-street facilities in the surrounding area.

The following mitigation measures would be pursued for temporary (construction) effects of the build alternatives.

Construction of any of the build alternatives would be carefully planned to minimize road closures and to avoid completely closing access to businesses. Signs to identify the location of these access points and the businesses served would be provided during detours or closures. Detours would be carefully routed to reduce travel times and signed to reduce confusion.

Programs to help businesses affected during construction could include business planning assistance, low-interest loans, marketing and retail consulting, business-oriented workshops, and promotions to generate patronage in construction areas. The City of Vancouver is planning to establish a Growth and Transportation Efficiency Center, which would be charged to improve transportation efficiency and could develop and administer a construction communication and mitigation plan.

Efforts would be made to ensure that at least one of the three river navigation channels would remain open during construction.

Coordination with the Port of Portland and businesses in the Rivergate and Portland International Airport industrial areas would identify ways to minimize delays during construction for commercial freight vehicles. Signs would be posted to encourage commercial freight vehicles not serving destinations in the Portland-Vancouver I-5 corridor to shift from I-5 onto I-205 during construction.

### 3.5 Neighborhoods and Environmental Justice

Transportation infrastructure influences neighborhoods and communities. Highways and transit lines connect people with their homes and daily destinations, while local streets and paths provide circulation for motorists, bicyclists, and pedestrians within their neighborhoods. Modifying or building new transportation infrastructure can improve these connections, but can also change the character of communities. For example, a new road or transit station may improve nearby residents' commutes or attract investment in a community, but could also displace an important neighborhood resource. Likewise, highway improvements may reduce congestion and improve air quality, but could increase noise for residents adjacent to the highway.

Careful consideration of new transportation infrastructure can ensure that it benefits surrounding communities and minimizes unintended negative impacts. Consideration of Environmental Justice (EJ) populations, which include low-income and minority populations, is particularly important to ensure these communities are not disproportionately impacted by adverse effects on human health or the environment.

This section evaluates the CRC projects' potential benefits and impacts to neighborhoods and populations, including EJ populations. The information in this section is based on the CRC Neighborhoods and Populations Technical Report and the Environmental Justice Technical Report.

#### 3.5.1 Existing Conditions

The project area extends north-south from SR 500 to Columbia Boulevard, and about one mile, east and west, on each side of the I-5. There are 16 neighborhoods within or near the project area. Each neighborhood has a unique character formed by the residents, community resources, businesses, and landmarks exclusive to its community. Exhibit 3.5-1 compares the demographics of the CRC project area with those of the Portland-Vancouver region.

Overall, the CRC project area has a higher percentage of people with disabilities than the Portland-Vancouver metropolitan area. The Washington State School for the Blind and School for the Deaf are both near the project area. The disabled population rate varies widely between neighborhoods. Esther Short reports a 45 percent disability rate, likely due to the senior housing located in the area. All other neighborhood disability rates fall between 16 and 30 percent. Exhibit 3.5-2 shows the neighborhood boundaries in the CRC project area.

#### TERMS & DEFINITIONS

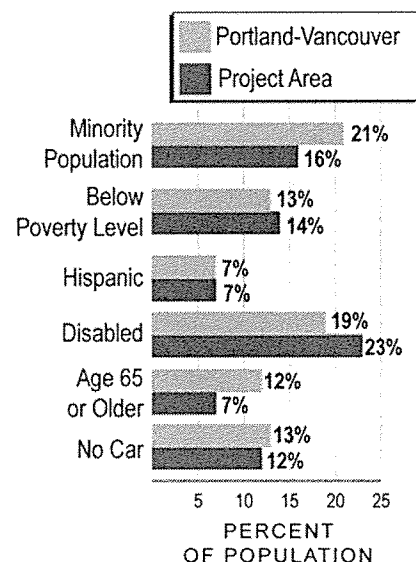
#### Minority and Low-Income Populations

Minority populations are individuals listed in the census as considering themselves to be either nonwhite or Hispanic or Latino, regardless of race. Low-income populations are defined as households with incomes below the federal poverty level.

#### Demographic Data

Data used in this analysis are from the 2000 U.S. Census. Since conditions may have changed since that census was completed, the CRC team also used more recent supplemental data, public meetings, and outreach efforts to communities potentially affected by this project. This helped the team gain a better understanding of the character of each neighborhood and which concerns are most important to these communities. Fully updated information from the U.S. Census will not be available until 2011-2012.

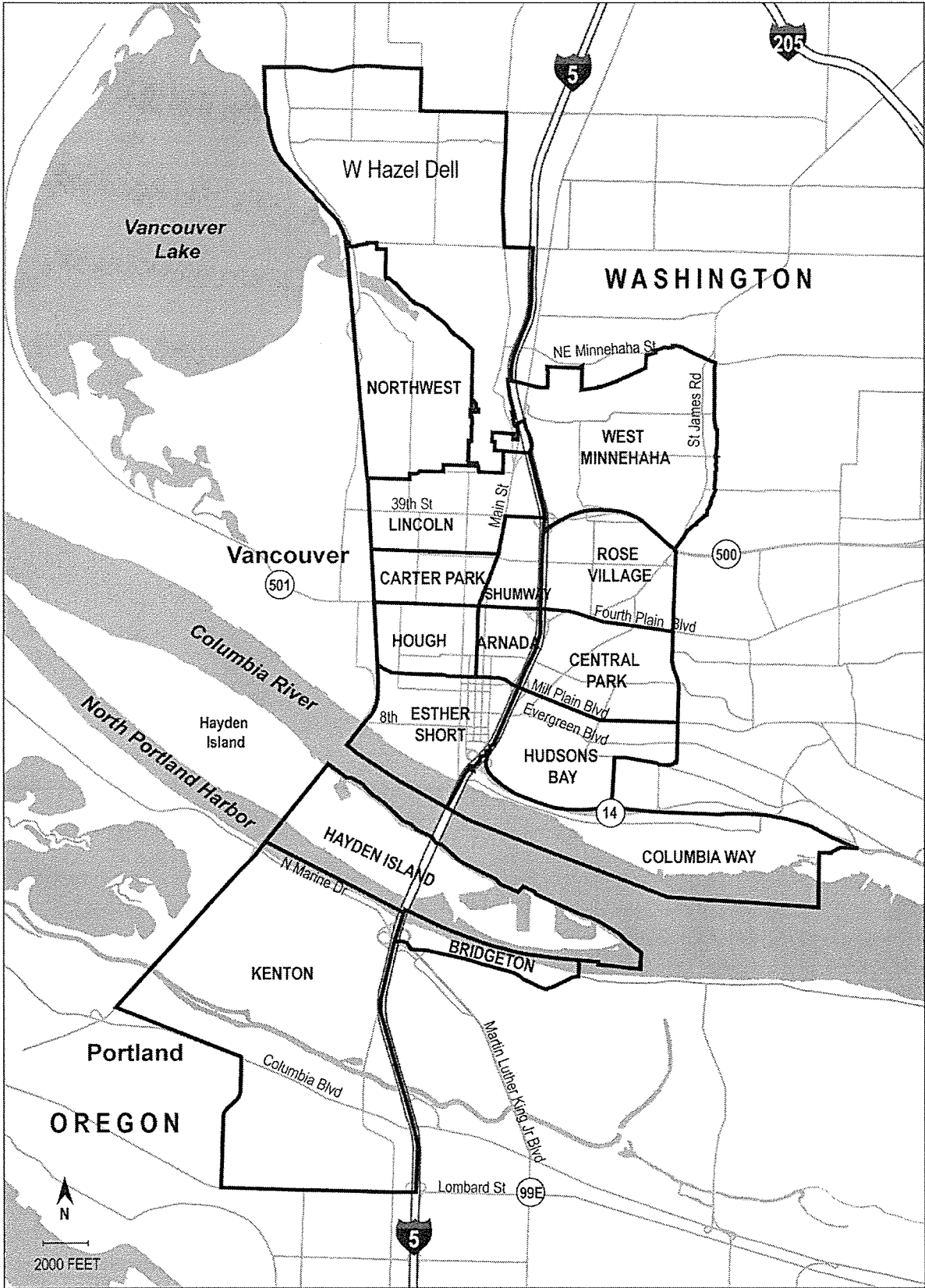
Exhibit 3.5-1  
**Census Demographics**  
CRC Project and Portland-Vancouver Areas



Source: U.S. Census 2000.

Exhibit 3.5-2

Neighborhoods in the CRC Project Area



DIMENSIONS ARE APPROXIMATE.



Exhibit 3.5-3 summarizes demographic characteristics by neighborhood and shows the diversity between them. The Columbia Way neighborhood has by far the largest rate of people over 65, with 21 percent. In all other neighborhoods, the rate of people over age 65 is between 4 and 10 percent, which is lower than the Portland-Vancouver area average.

While the project area has a lower rate of minority populations than the metropolitan region, the Kenton neighborhood has 36 percent minorities. Neighborhoods such as Arnada, with two percent minority residents, lower the average within the project area and illustrate the importance of understanding the diversity among the neighborhoods.

Poverty rates range from a low of 6 percent in the West Hazel Dell neighborhood to a high of 35 percent in the Esther Short neighborhood. Other central Vancouver neighborhoods such as Rose Village, Central Park, and Hough also show higher than average poverty rates of between 20 and 25 percent.

The neighborhoods vary widely in their reliance on auto transportation. Thirty-four percent of households in the Esther Short neighborhood report not owning a car. The Hough and Central Park neighborhoods also show relatively low rates of car ownership; twenty-five percent of residents in these neighborhoods do not own a car. The rate of households without a car varies between 3 and 18 percent in all other neighborhoods.

### **Neighborhood Plans**

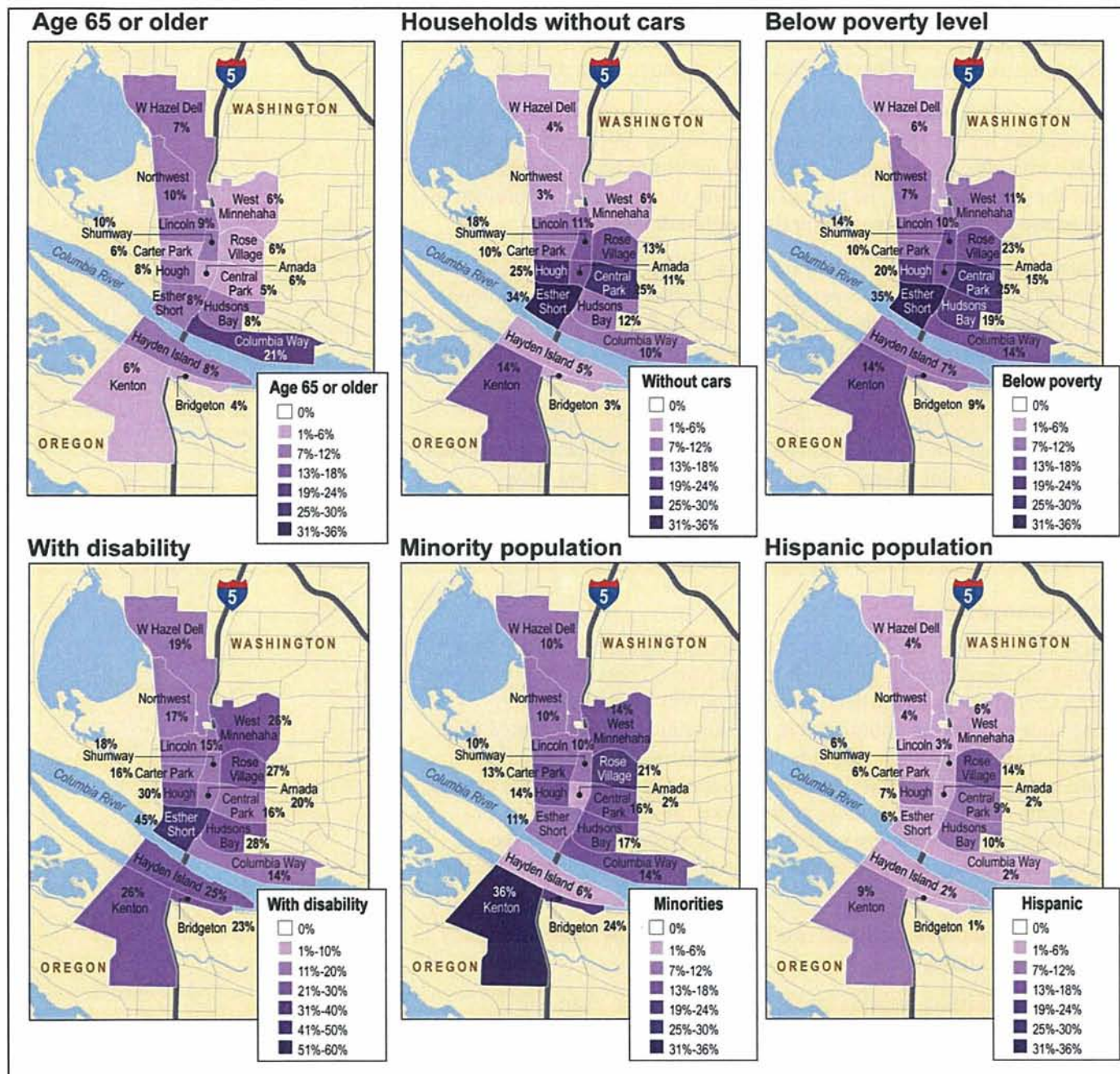
Neighborhoods often define themselves and strengthen their identities through the development of neighborhood plans. These plans are adopted by the City-supported (Portland and Vancouver) neighborhood associations. Every neighborhood in the study area has an adopted plan, except for Hayden Island, which is currently undergoing a planning process with the City of Portland. While some plan goals may be unique to a certain neighborhood, other goals are common to many communities. Following are goals from neighborhood plans in the project area that are relevant to the potential benefits and impacts from the CRC project:

- Minimize the adverse impacts of increased density; support density adjacent to transit
- Preserve existing housing stock; preserve historic character
- Reduce transportation-related noises and odor; mitigate I-5 noise
- Reduce speeding within the neighborhood
- Enhance and maintain on-street parking
- Maintain adequate bus service; support development of light rail
- Improve bicycle and pedestrian facilities and connections
- Protect the Columbia River from contaminants.

Neighborhood associations formally adopt neighborhood plans. The cities do not formally adopt these plans, but they are reviewed and accepted by City Councils. Neighborhood plans do not have the force of the Comprehensive or Subarea Plans.

Exhibit 3.5-3

## Neighborhood Demographics near the CRC Project



Source: CRC Neighborhoods and Populations Technical Report.

## Effects Guidelines

The CRC project team used the following questions to help identify potential effects:

- Does this project displace residents or community resources?
- Does this project separate neighborhood residents from their community resources or commercial service?

- Does this project increase traffic through a neighborhood, or decrease access to transit, bicycle, or pedestrian opportunities?
- Does this project severely impact community cohesion?
- Is this project consistent with adopted neighborhood plan goals?

Impacts to EJ populations are assessed based on Executive Order 12898 and subsequent U.S. Department of Transportation and FHWA regulations that identify disproportionately high and adverse effects as that:

- Are predominantly borne by minority populations or low-income households; or
- Would be experienced by these populations in a way that is appreciably more severe or greater in magnitude than would be experienced by non-minority or non-low-income populations.

For this analysis, “predominantly borne by minority populations or low-income households” means that more minority or low-income people are impacted than non-minority or non-low-income people. Environmental justice impacts from transportation projects may include displacement of households and businesses, disruptions in community cohesion, restricted commercial access, noise impacts, air quality impacts, or other adverse impacts affecting low-income and minority populations.

The CRC Environmental Justice Technical Report describes the Executive Order on Environmental Justice (EO 12898) and guidelines for assessing impacts to low-income and minority populations in detail. Important guidelines for avoiding disproportionately high and adverse effects to EJ populations include:

- Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority and low-income populations.
- Ensure full and fair participation by all potentially affected communities in the decision-making process.
- Prevent the denial of, reduction in, or substantial delay in the receipt of benefits by minority and low-income populations.

### Community Resources

An inventory of community resources within each neighborhood was collected by the project team (Exhibits 3.5-4 and 3.5-5). The project team met with members of the community who identified the resources that were important to them on a map. Project staff identified neighborhood resources within and near the study area that fit the following commonly accepted neighborhood resource categories: parks, schools, locally and nationally recognized historic structures, and emergency services.

Project staff created two draft maps based on these resources, one for Oregon and one for Washington. On September 14, 2006, the Community and Environmental Justice Group reviewed the two draft neighborhood resource maps and identified additional resources. Thereafter, these maps were further reviewed and modified at neighborhood meetings and open houses.

### TERMS & DEFINITIONS

#### Community Resources and Cohesion

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**Community resources** typically include educational, religious, health care, cultural, and recreational facilities.

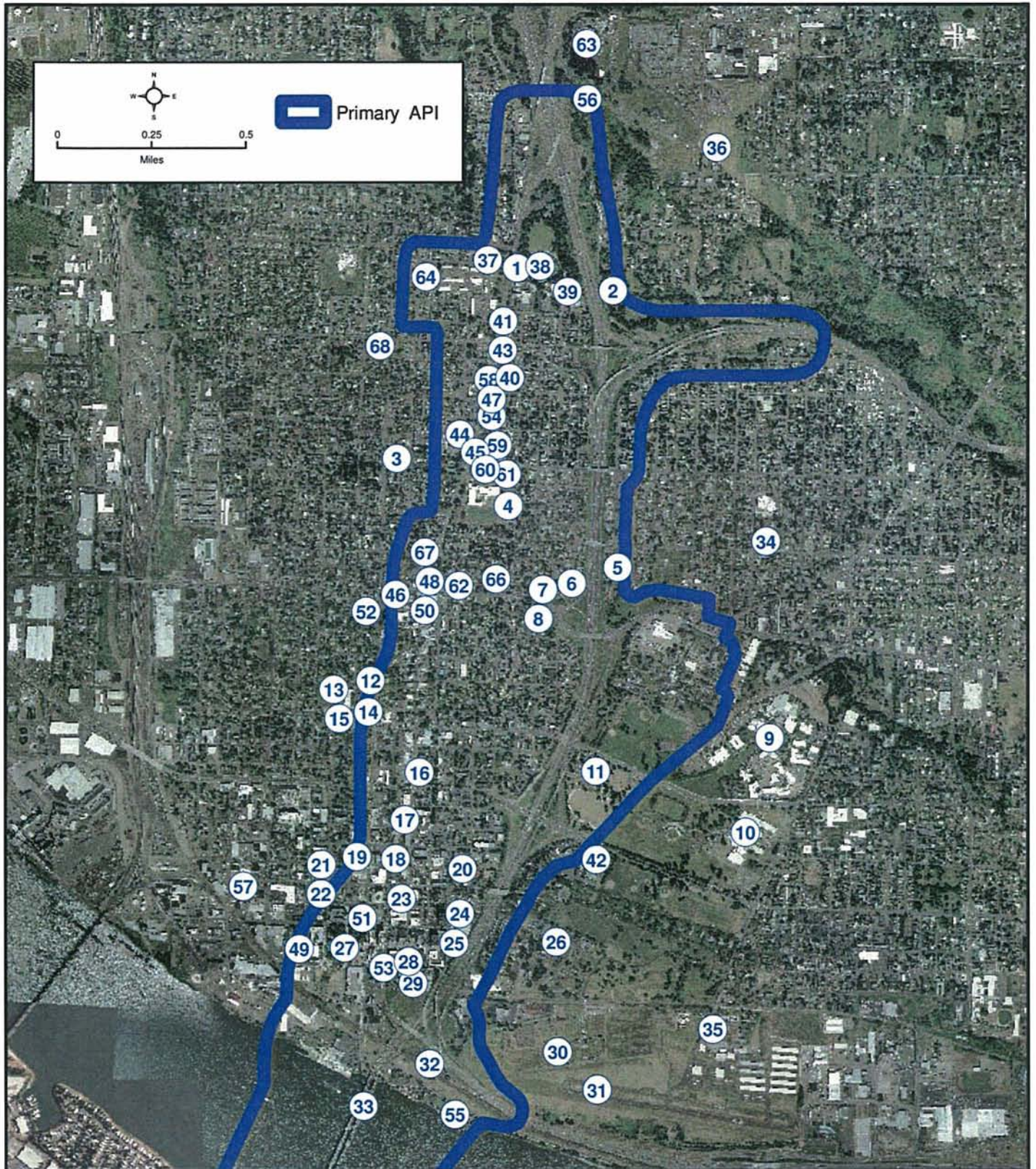
**Community cohesion** measures how well residents can connect with one another within their community. These connections can occur at gathering places such as schools, community centers, parks, or transit stations. High home ownership rates and active neighborhood associations also contribute to cohesion.

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Exhibit 3.5-4 (page 1 of 2)

**Community Resources in Washington**



Resource 65 is outside the map boundaries.



Exhibit 3.5-4 (page 2 of 2)

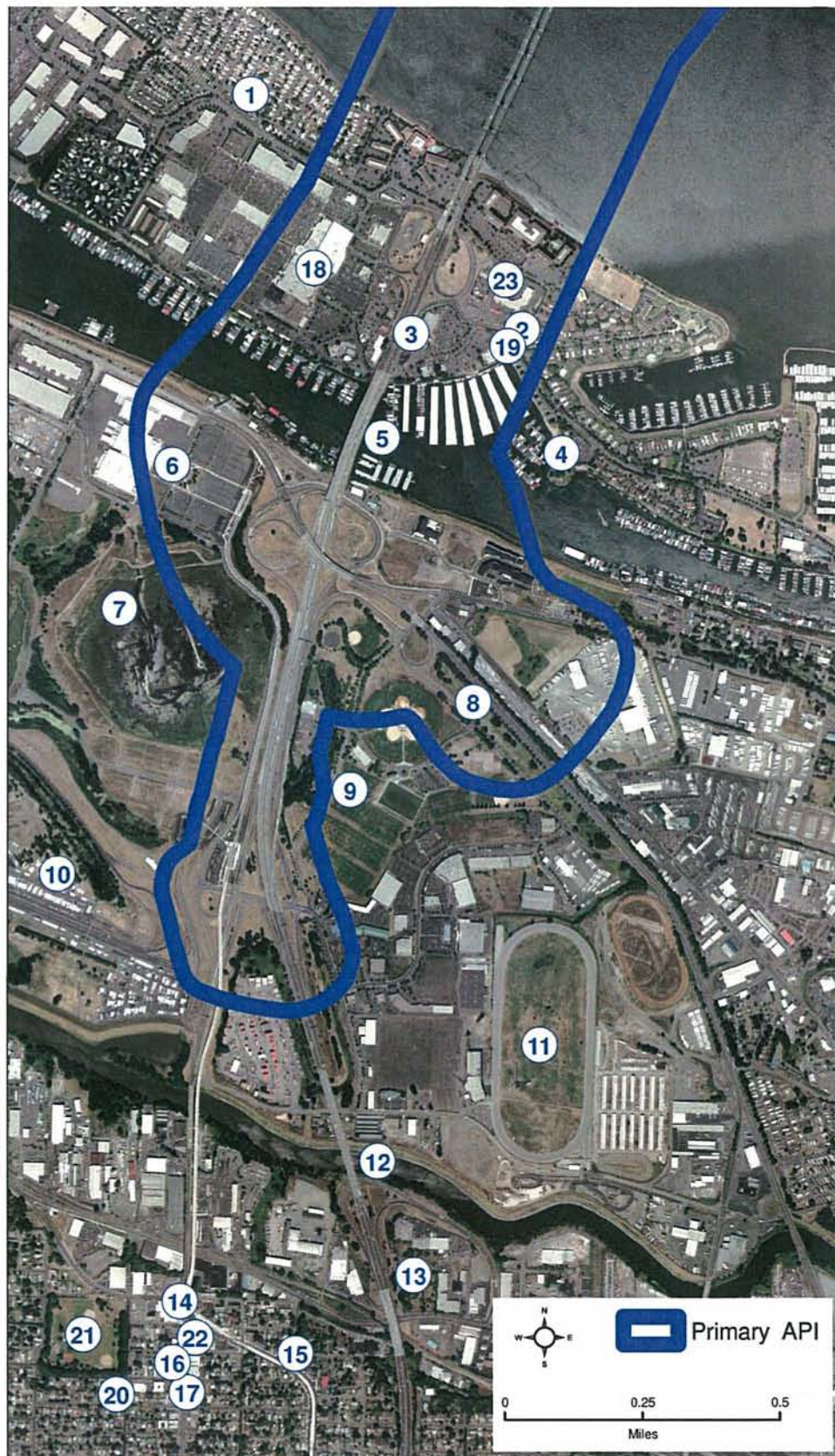
1	<b>Covington House</b> 4201 Main Street <i>historical</i>	24	<b>Future Library</b> <i>educational</i>	47	<b>YWCA</b> 3609 Main Street <i>community center</i>
2	<b>Leverich Park</b> 39th and M Street <i>park</i>	25	<b>Regal Cinema</b> 801 C Street <i>recreational</i>	48	<b>Uptown Village</b> Main Street <i>shopping</i>
3	<b>Carter Park</b> 33rd Street <i>park</i>	26	<b>National Historic Reserve</b> East Reserve Street to I-5 <i>historical</i>	49	<b>Farmers Market</b> 555 W. 8th Street <i>shopping</i>
4	<b>Shumway Park</b> 3014 F Street <i>park</i>	27	<b>Slocum House/Ester Short Park</b> 605 Esther Street <i>historical/park</i>	50	<b>Starbucks</b> 2420 Main Street <i>community/recreation</i>
5	<b>Leach Park</b> 28th and K Street <i>park</i>	28	<b>Heritage Building</b> 601 Main Street <i>historical</i>	51	<b>Starbucks</b> 304 W. 8th Street <i>community/recreation</i>
6	<b>2613 "H" Street House</b> 2613 H Street <i>historical</i>	29	<b>Evergreen Hotel</b> 500 Main Street <i>historical</i>	52	<b>Columbia House</b> 33415 NW Lancaster Road <i>community/recreation</i>
7	<b>Swan House</b> 714 E. 26th Street <i>historical</i>	30	<b>Fort Vancouver</b> 612 E. Reserve Street <i>historical</i>	53	<b>Smith Tower</b> 515 Washington Street <i>senior/low-income</i>
8	<b>Arnada Park</b> W. 25th and G Street <i>park</i>	31	<b>Pearson Field</b> 1115 E. 5th Street <i>historical</i>	54	<b>Pythian Home</b> 3409 Main Street <i>senior/low-income</i>
9	<b>Clark College</b> 1800 E. McLoughlin Boulevard <i>Educational</i>	32	<b>Old Apple Tree Park</b> East of I-5 <i>historical/park</i>	55	<b>Waterfront Park</b> 115 Columbia Way <i>senior/low-income</i>
10	<b>Hudson's Bay High School</b> 1206 E. Reserve Street <i>educational</i>	33	<b>I-5 Bridges</b> <i>historical</i>	56	<b>Discovery &amp; Ellen Davis Trails</b> Highway 99 and I-5 <i>park</i>
11	<b>Marshall and Luepke Centers</b> 1009 E. McLoughlin Boulevard <i>community center</i>	34	<b>Washington Elementary School</b> 2908 S Street <i>educational</i>	57	<b>Vancouver Fire Department, #82</b> 900 W. Evergreen Boulevard <i>public service</i>
12	<b>Hough Elementary School</b> 1900 Daniels Street <i>educational</i>	35	<b>VA Medical Center</b> 1601 E. 4th Plain Boulevard <i>healthcare</i>	58	<b>Vancouver Fire Department, #86</b> 400 E. 37th Street <i>public service</i>
13	<b>Steffan House</b> 2000 Columbia Street <i>Historical</i>	36	<b>Dog Park</b> Between 15th and 18th <i>park</i>	59	<b>Vancouver Health and Rehabilitation Center</b> 400 E. 33rd Street <i>public service</i>
14	<b>Charles Zimmerman House</b> 1812 Columbia Street <i>historical</i>	37	<b>First Presbyterian Church</b> 4300 Main Street <i>religious institution</i>	60	<b>First United Methodist Church of Vancouver</b> 401 E. 33rd Street <i>religious institution</i>
15	<b>Hough Aquatic Center</b> 1801 Esther Street <i>recreational</i>	38	<b>Kiggins Bowl</b> 800 E. 40th Street <i>recreational</i>	61	<b>Evergreen Habitat for Humanity</b> 521 E. 33rd Street <i>public service</i>
16	<b>Carnegie Library</b> 1511 Main Street <i>educational</i>	39	<b>Discovery Middle School</b> 801 E. 40th Street <i>educational</i>	62	<b>First Church of Christ Scientist</b> 204 E. 4th Plain Boulevard <i>religious institution</i>
17	<b>Hidden, Lowell M. House</b> 100 W. 11th Street <i>historical</i>	40	<b>Safeway</b> 3707 Main Street <i>shopping</i>	63	<b>Bonneville Power, Ross Complex</b> 5411 NE Highway 99 <i>public services</i>
18	<b>Vancouver Telephone Exchange</b> 112 W. 11th Street <i>historical</i>	41	<b>Community Wellness Center</b> 317 E. 39th Street <i>healthcare</i>	64	<b>City of Vancouver Water Tower</b> 42nd and NW Washington <i>historical</i>
19	<b>Chumasero-Smith House</b> 310 W. 11th Street <i>historical</i>	42	<b>Fort Vancouver Regional Library</b> 1007 E. Mill Plain <i>educational</i>	68	<b>WSDOT Service Center</b> 11018 NE 51st Circle <i>public service</i>
20	<b>House of Providence (Academy)</b> 400 E Evergreen <i>historical</i>	43	<b>Home Ownership Center</b> 3801-A Main Street <i>public service</i>	66	<b>Saint Luke's Episcopal Church</b> 426 E. 4th Plain Boulevard <i>religious institution</i>
21	<b>Langsdorf House</b> 1010 Esther Street <i>historical</i>	44	<b>SW Washington Medical Center</b> 3400 Main Street <i>healthcare</i>	67	<b>First Baptist Church</b> 108 W. 27th Street <i>religious institution</i>
22	<b>Lloyd DuBois House</b> 902 Esther Street <i>historical</i>	45	<b>Arts &amp; Academics School of Vancouver</b> 3101 Main Street <i>educational</i>	68	<b>Trinity Lutheran Church</b> 309 W. 39th Street <i>religious institution</i>
23	<b>Elks Building</b> 916 Main Street <i>historical</i>	46	<b>Vancouver Housing Authority</b> 2500 Main Street <i>public service</i>		



Exhibit 3.5-5

**Community Resources in Oregon**

- 1 Private Community Center  
N. Arbor Avenue and Alder Street  
*recreational*
- 2 Former Hayden Is. Yacht Club  
120050 N. Jantzen Drive  
*community center*
- 3 Safeway  
11919 N. Jantzen Drive  
*shopping*
- 4 Lotus Isle Park  
N. Tomahawk and Island Drive  
*park*
- 5 Oregon Slough & Industrial Marinas  
*natural resource/housing*
- 6 Expo Center  
2060 N. Marine Drive  
*recreational*
- 7 Vanport Wetlands  
*natural resource*
- 8 Dog Run  
*park*
- 9 Delta Park  
N. Martin Luther King Boulevard and Denver Avenue  
*park*
- 10 Portland International Raceway  
1940 N. Victory Boulevard  
*recreational*
- 11 Portland Meadows  
1001 N. Schmeer Road  
*recreational*
- 12 Columbia Slough  
*recreational*
- 13 Columbia Cemetery  
1151 N. Columbia Boulevard  
*historical*
- 14 Paul Bunyan  
N. Denver Avenue and Interstate Avenue  
*historical*
- 15 Christmas Lights House (NRHP)  
1441 N. McClellan Street  
*historical*
- 16 Kenton Commercial Historic District  
Denver Avenue  
*historical/shopping*
- 17 Kenton Community Policing Office  
8134 N. Denver Avenue  
*public service*
- 18 Jantzen Beach  
*shopping*
- 19 Portland Fire and Rescue, Station #17  
848 North Tomahawk Drive  
*public service*
- 20 Historic Kenton Firehouse  
8105 N Brandon Avenue  
*community center*
- 21 Kenton Park  
8417 N Brwndon Avenue  
*park*
- 22 Wells Fargo Bank  
8324 N Denver Avenue  
*financial services*
- 23 Wells Fargo Bank  
12240 N Jantzen Drive  
*financial services*



## Coordination

Two key principles of Environmental Justice, as defined by the U.S. Environmental Protection Agency (EPA), are the fair treatment and meaningful involvement of all people. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of negative environmental consequences. Meaningful involvement means that: (1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment or health; (2) the public's contribution can influence the regulatory agency's decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) the decision-makers seek out and facilitate the involvement of those potentially affected.

To achieve the goal of meaningful public involvement in the project development process, in August of 2006, the CRC project team formed the Community and Environmental Justice Group (CEJG). The fifteen members of the CEJG come from neighborhoods in the project area and included environmental justice populations, two liaisons from the CRC Task Force, and five at-large members. Together, they represent the diverse interests and perspectives of Vancouver and Portland neighborhoods potentially affected by the project.

The CEJG provides assistance to CRC project staff in identifying community concerns in the project development process; presenting recommendations at key milestones; raising relevant issues of interest (or potential impact) such as air quality, noise, highway interchange alignments and design features to help inform the project's efforts to avoid, minimize, and/or mitigate potential community impacts.

The CRC project team also designated a CRC Tribal Liaison, with the statewide tribal liaisons for both WSDOT and ODOT assisting in tribal coordination efforts, when necessary. All communication with tribes was coordinated through the CRC Tribal Liaison to ensure that information is managed internally and integrated into the government-to-government dialogue with the tribes.

The general approach to government-to-government consultation for the CRC project was as follows.

CRC staff met with interested tribes early in the environmental review process in order to review broad issues and establish the following:

- An understanding of those aspects of the CRC project that were likely to interest the tribes
- Preliminary information about the potential for the project to affect tribal land, historical or cultural resources, fishing and other aquatic resources, or any other issues of tribal concern
- An initial agreement regarding the process for the government-to-government consultations

CRC staff also engaged in both formal and technical consultation with tribal staff. At the request of the tribes, project staff formally met with cultural and natural resource committees, and involved technical staff in

working group meetings concerning applicable issues (for example identification of fish and wildlife habitat).

- At the request of interested tribes, the project team met with the Tribal Council and appropriate committees at major project milestones.
- Technical staff were invited to working group meetings that the tribes may have an interest or expertise in.
- The consultation process integrated both formal and informal contact with the Tribal Council and tribal staff, respectively.

CRC staff sought to resolve issues in parallel with project planning and permitting activities, and kept interested tribes fully informed throughout the project planning, permitting, and development process. In acknowledgement that CRC must afford the interested tribes with more than the opportunity to participate as members of the general public in the planning and permitting process, CRC took the following actions to ensure effective government-to-government consultation:

- Sought tribal input regarding alternatives and opportunities to avoid, reduce, or otherwise mitigate the effects of the CRC project on tribal interests.
- Sought tribal comment throughout the project's environmental review, permitting and regulatory review processes.

The CRC team used information collected from other sources to supplement the data-gathering efforts for the neighborhoods and environmental justice analyses. These additional sources included the 2004 American Community Survey, Section 8 Housing Assistance data, and public school free and subsidized lunch program data. The team contacted local social service agencies to identify recent development projects that serve low-income and/or minority populations.

Information collected through field visits and public outreach events with community and stakeholder groups further supplemented and refined the above data, including attendance at meetings and events such as AsiaFest, Good in the Hood, Alberta Coop Farmers Market, Vietnamese New Year celebration, Say Hey! Partners in Diversity, Juneteenth Festival, and a Slavic Coalition meeting.

Prior to issuance of the CRC project Notice of Intent (NOI) to prepare an EIS, the project team identified limited English proficiency populations using geographic information systems (GIS) and the 2000 US Census data. The data used for limited English proficiency were derived from responses to the Census question of "language spoken at home". The smallest geographic unit for which "language spoken at home" data are available is the census block group. Because of data limitations and the importance of identifying those populations with the greatest likelihood of experiencing direct impact, "language spoken at home" data were collected for all census block groups entirely or partially in the project study area. The data showed that those speaking Spanish, Russian, German, and Vietnamese at home represented at least one percent of the population in the study block groups. Because German speakers tended to also have high levels of English language fluency, Spanish, Russian, and Vietnamese were chosen as the focus languages.



Project information has been routinely translated into those languages, including project newsletters, some project documents, and portions of the project Web site. Russian, Spanish, and Vietnamese interpreters have been made available at numerous public open houses. Russian and Spanish are the two most common languages (except for English) spoken at home in Portland, Vancouver and Clark County. Vietnamese is the third most spoken language in Portland and Vancouver, but not in Clark County.

Press releases advertising the open houses in the fall of 2005 and April 2006 were translated into Spanish, Russian and Vietnamese and distributed to the following newspapers. Advertisements for the open houses were purchased in these same newspapers:

- The Asian Reporter
- El Hispanic News
- Portland Observer
- The Scanner

As the project moves toward a final design and completion of a Final Environmental Impact Statement, coordination will continue and will include specific, potentially affected groups. Such groups will include local schools, the Washington State Schools for the Blind and the Deaf, specific employers (such as the Hayden Island Safeway), administrators, and persons served by the Wellness Project, among others.

### **3.5.2 Long-Term Effects from Project Alternatives**

This section summarizes long-term effects from the project alternatives. Many of the effects that are relevant to neighborhoods and EJ populations, including residential displacements, noise impacts, and air quality, are discussed in detail in their respective sections in this chapter. Exhibits 3.5-6 through 3.5-9, below, summarize the neighborhood and environmental justice impacts for the project alternatives and terminus options.

#### **Alternative 1: No-Build**

The No-Build Alternative would not require displacement of residents, community resources, or jobs. Long-term indirect impacts for neighborhoods would include increased travel times for residents traveling within the I-5 corridor. The No-Build Alternative would not bring high-capacity transit to Hayden Island or Vancouver. Low-income populations use transit at a higher rate than other populations, and would be unable to benefit from high-capacity transit in the project area. There would be no toll, so potential adverse impacts on EJ populations from the expense of tolls would be avoided, as well as the potential benefits of decreased congestion and improved reliability and mobility.

#### **Alternative 2: Replacement Crossing with Bus Rapid Transit**

Exhibit 3.5-6 summarizes the neighborhood and environmental justice impacts for Alternative 2 and its terminus options.

Exhibit 3.5-6

**Neighborhood & Environmental Justice Effects Summary for Alternative 2**

<b>Alternative 2: Replacement Crossing with Bus Rapid Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Residential displacements</b>	29-36 units Minimal except on Hayden Island.	29-36 units Minimal except on Hayden Island and in Lincoln neighborhood.	21-28 units Minimal except on Hayden Island.	21-28 units Minimal except on Hayden Island.
<b>Business displacements</b>	43-52 Minimal except on Hayden Island.	58-68 Minimal except on Hayden Island and in Lincoln neighborhood.	41-50 Minimal except on Hayden Island.	44-46 Minimal except on Hayden Island.
<b>Separation from community resources</b>	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island.
<b>Increased local traffic or decreased access to transit, bike, or pedestrian facilities</b>	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island, north of 4th Plain, and downtown Vancouver. Increased congestion in uptown Vancouver.	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island and downtown Vancouver.
<b>Impacts to community cohesion</b>	Offset HCT alignment on Hayden Island could separate floating home community.	Offset HCT alignment on Hayden Island could separate floating home community.	Offset HCT alignment on Hayden Island could separate floating home community.	Offset HCT alignment on Hayden Island could separate floating home community.
<b>Consistency with neighborhood plans</b>	Generally consistent, though some plans call for light rail.	Generally consistent, though some plans call for light rail.	Generally consistent, though some plans call for light rail.	Generally consistent, though some plans call for light rail.
<b>Noise impacts</b>	Moderate impacts, though reduced impacts after mitigation.	Higher impacts, though reduced after mitigation.	Moderate impacts, though reduced impacts after mitigation.	Moderate impacts, though reduced impacts after mitigation.
<b>Air quality</b>	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
<b>Potentially disproportionate, adverse impacts specific to low-income or minority populations</b>	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation. Displaced Wellness Project would need mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

The replacement crossing with bus rapid transit (BRT) would require displacement of between 13 and 20 floating homes on Hayden Island, depending upon the transit alignment option on Hayden Island (offset or adjacent to I-5). Environmental justice populations may be employed in businesses on Hayden Island that could be displaced by this alternative.

The Lincoln terminus would require displacement of the Wellness Project in the Lincoln neighborhood. To access the Lincoln Park and Ride, the project would have to acquire the northwest and southwest corners of the intersection move of Main Street south of 39th Street, including the Wellness Project). The Wellness Project is important to low-income populations, as it provides free mental health services. The CRC project would need to provide relocation assistance for the Wellness Project if it is displaced.

Neighborhood residents, including EJ populations would benefit from decreased traffic congestion with the replacement crossing. In particular, the replacement crossing would provide substantially improved access between Hayden Island and Marine Drive, with three separated auxiliary lanes in each direction between these two interchanges. These auxiliary lanes make short-distance trips between north Portland and Hayden Island much easier during peak periods because cars can make these trips without merging into mainline freeway traffic. Bus rapid transit would increase access to transit and improve the existing level of transit service, but this mode is not as consistent with some neighborhood plans that call specifically for light rail.

Air quality would generally improve. Emissions from I-5 traffic are projected to decrease between 30 and 90 percent by 2030 for all alternatives.

Noise levels would increase in some areas, but anticipated mitigation measures (sound walls and residential sound insulation) would reduce the number of impacted residents below existing conditions. Noise impacts would still result for all build alternatives. Some residences would experience noise impacts that could be mitigated to within HUD standards via residential sound insulation; depending on transit alignment option chosen, these could include floating homes in North Portland Harbor, residences along Broadway, McLoughlin, or 16th (all in the Arnada neighborhood), or in the Rose Village neighborhood.

In a few locations, new and improved noise walls would not be able to completely mitigate all traffic-related noise impacts. These impacts would occur when noise walls could not be built high enough to block noise to upper floors of apartment buildings (e.g., in the Esther Short neighborhood) or at the openings in noise walls at the 29th street and 33rd Street overpasses (in the Rose Village and Shumway neighborhoods).

None of the homes near the noise wall openings in Shumway or Rose Village have been identified as low-income, although noise impacts in Rose Village, which does have a higher proportion of low-income and minority households, might be more likely to impact these communities. Unmitigated noise impacts in the Esther Short Neighborhood are the most likely to impact low-income individuals, as this neighborhood has the highest proportion of low-income households in the project area. The noise impacts in Esther Short would be limited to two apartment buildings, the Fort Apartments and the Normandy Apartments.

The three-story Normandy Apartments are located at 316 East Seventh Street in Vancouver, directly west of I-5. There are approximately 35 studio and one-bedroom apartments that rent for approximately \$500 to

### Where would acquisitions occur with the different alternatives?

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The Acquisitions section of this chapter includes maps showing where property would likely be acquired. More detailed maps and discussions of property acquisitions are included in the CRC Acquisitions Technical Report.



\$650 per month. Twelve households on the upper floors of the Normandy Apartments currently experience noise levels that exceed FHWA's traffic noise impacts criteria. While noise levels in this area would decrease slightly under the build scenarios compared to the No-Build Alternative, the same 12 households would continue to be impacted. Under current FHWA policy, which does not employ residential sound insulation as a mitigation measure, a noise wall could not be built high enough to block these impacts.

The Fort Apartments are located at 500 E 13th Street in Vancouver directly west of I-5. There are 49 newly remodeled studio, one-bedroom, and two-bedroom units in the Fort Apartments; rent ranges from \$450 to \$500 per month. As with the Normandy Apartments, 12 households on the upper floors of the Fort Apartments currently experience noise levels that exceed FHWA's traffic noise impacts criteria. Noise levels at these units would increase slightly under both the build and No-Build alternatives, but the same 12 units remain impacted.

Bus rapid transit is louder than light rail, so Alternative 2 would create louder outdoor noise levels, even with mitigation.

Tolling could impact EJ populations in general and low-income populations in particular. Impacts of tolling on EJ populations are discussed under Tolling Scenarios, below. Potential mitigation measures are discussed in Section 3.5.5.

### **Alternative 3: Replacement Crossing with Light Rail**

The only difference between this alternative and Alternative 2 is the transit mode. Environmental Justice impacts for Alternative 3 are summarized in Exhibit 3.5-7.

Exhibit 3.5-7

**Neighborhood and Environmental Justice Effects Summary for Alternative 3**

<b>Alternative 3: Replacement Crossing with Light Rail Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Residential displacements</b>	29-36 units Minimal except on Hayden Island.	29-36 units Minimal except on Hayden Island and in Lincoln neighborhood.	21-28 units Minimal except on Hayden Island.	21-28 units Minimal except on Hayden Island.
<b>Business displacements</b>	43-52 Minimal except on Hayden Island.	58-68 Minimal except on Hayden Island and in Lincoln neighborhood.	41-50 Minimal except on Hayden Island.	44-46 Minimal except on Hayden Island.
<b>Separation from community resources</b>	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island.
<b>Increased local traffic or decreased access to transit, bike, or pedestrian facilities</b>	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island, north of 4th Plain & downtown Vancouver. More congestion in uptown Vancouver.	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island and downtown Vancouver.
<b>Impacts to community cohesion</b>	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.
<b>Consistency with neighborhood plans</b>	Highly consistent.	Highly consistent.	Highly consistent.	Highly consistent.
<b>Noise impacts</b>	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.
<b>Air quality</b>	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
<b>Potentially disproportionate, adverse impacts specific to low-income or minority populations</b>	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation. Displaced Wellness Project would need to be mitigated.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

This alternative would have effects similar to those for Alternative 2, with the following exceptions. Light rail would be more consistent with some neighborhood plans that call specifically for light rail.

However, light rail would require expanding the existing TriMet maintenance facility in Gresham, displacing up to seven homes. Census data for the area surrounding the site indicate that 40 percent of residents

are minority and 35 percent have incomes below the poverty line. Specific house-by-house analysis is needed to determine the proportion of EJ residents on these parcels impacted.

#### Alternative 4: Supplemental Crossing with Bus Rapid Transit

Alternative 4 would have similar effects to those for Alternative 2 described above, with differences noted below in Exhibit 3.5-8.

Exhibit 3.5-8

#### Neighborhood and Environmental Justice Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Residential displacements	26-27 Minimal except on Hayden Island.	32-33 Minimal except on Hayden Island and Lincoln.	24-25 Minimal except on Hayden Island.	24-25 Minimal except on Hayden Island.
Business displacements	40-48 Minimal except on Hayden Island.	56-64 Minimal except on Hayden Island and in Lincoln neighborhood.	34-43 Minimal except on Hayden Island.	37-39 Minimal except on Hayden Island.
Separation from community resources	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island.
Increased local traffic or decreased access to transit, bike, or pedestrian facilities	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island, downtown Vancouver, and uptown Vancouver.	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island and downtown Vancouver.
Impacts to community cohesion	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on could separate floating home community.	Offset alignment could separate floating home community.
Consistency with neighborhood plans	Generally consistent, but some plans call for light rail.	Generally consistent, but some plans call for light rail.	Generally consistent, but some plans call for light rail.	Generally consistent, but some plans call for light rail.
Noise impacts	High impacts, but reduced after mitigation.	Very high impacts, but reduced after mitigation.	High impacts, but reduced after mitigation.	High impacts, but reduced after mitigation.
Air quality	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
Potentially disproportionate, adverse impacts specific to low-income or minority populations	Tolls require higher share of income for low-income populations and could impact these populations without mitigation.	Tolls require higher share of income for low-income populations and could impact these populations without mitigation. Displaced Wellness Project would need to be mitigated.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.



Alternative 4 would require displacement of up to 23 floating homes on Hayden Island. Alternative 4 would require acquisition of fewer commercial buildings on Hayden Island. While this could result in fewer impacts to low-wage retail and service industry employees, the supplemental crossing's displacement of the only grocery store on the island could have a profound effect, as it likely employs and serves those that live on the island.

The Smith Tower, which accepts Section 8 Housing Choice Vouchers, is the only identified low-income housing that might experience noise impacts resulting from Alternative 4. The Smith Tower is an elderly-care facility with one-bedroom units, located at 515 Washington Street in the Esther Short neighborhood. Smith Tower would experience noise impacts as a result of bus rapid transit when paired with a supplemental river crossing. With this crossing, the transit guideway would descend into Vancouver from a higher elevation. Due to the grade threshold for transit vehicles, the transit bridge would not touch down until after Sixth on Washington, putting the ramp near the higher units of the Smith Tower Apartments. A noise impact would only occur with bus rapid transit, but could be completely mitigated through residential sound insulation.

The higher toll packaged with Alternatives 4 and 5 could have an impact on EJ populations if mitigation is not included (mitigation is discussed in Section 3.5.5).

The supplemental river crossing would lead to worse congestion and mobility than the replacement crossing, especially around the Marine Drive, Hayden Island, and SR 14 interchanges.

#### **Alternative 5: Supplemental Crossing with Light Rail**

The only difference between this alternative and Alternative 4 is the transit mode. Environmental justice impacts for Alternative 5 are summarized in Exhibit 3.5-9, below.

Exhibit 3.5-9

**Neighborhood and Environmental Justice Effects Summary for Alternative 5**

<b>Alternative 5: Supplemental Crossing with Light Rail Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Residential displacements</b>	Minimal except on Hayden Island.	Minimal except on Hayden Island and Lincoln.	Minimal except on Hayden Island.	Minimal except on Hayden Island.
<b>Business displacements</b>	26-27 Minimal except on Hayden Island.	32-33 Minimal except on Hayden Island and in Lincoln neighborhood.	24-25 Minimal except on Hayden Island.	24-25 Minimal except on Hayden Island.
<b>Separation from community resources</b>	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island.
<b>Increased local traffic or decreased access to transit, bike, or pedestrian facilities</b>	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island, downtown Vancouver, and uptown Vancouver.	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island and downtown Vancouver.
<b>Impacts to community cohesion</b>	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.
<b>Consistency with neighborhood plans</b>	Highly consistent.	Highly consistent.	Highly consistent.	Highly consistent.
<b>Noise impacts</b>	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.
<b>Air quality</b>	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
<b>Potentially disproportionate, adverse impacts specific to low-income or minority populations</b>	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation.	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation. Displaced Wellness Project would need to be mitigated.	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation.	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.

This alternative would have effects similar to Alternative 4, with two exceptions.

First, light rail would require expanding the existing TriMet maintenance facility in Gresham, resulting in displacement of up to seven homes. Census data for this area indicates that 40 percent of residents are minority and 35 percent have incomes below the poverty line. Specific

house-by-house analysis is needed to determine the proportion of EJ residents on these parcels impacted.

Second, light rail would be more consistent with some neighborhood plans that call specifically for light rail.

### **3.5.3 Long-Term Effects from Project Components**

This section describes the effects or impacts of the components and various options that make up the project alternatives. Transportation demand and system management options would not result in a substantial effect on neighborhoods or EJ, and are therefore not discussed in detail below. Likewise, the stacked transit/highway bridge (STHB) design for the replacement river crossing is not discussed, as it has little potential to affect neighborhoods or EJ populations.

#### **Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)**

The replacement crossing would substantially improve connections from Hayden Island to Marine Drive and to SR 14, downtown Vancouver, Mill Plain and Fourth Plain. It would have two or three auxiliary lanes, allowing traffic to travel between these destinations without merging with mainline highway traffic. This is especially beneficial between Hayden Island and Marine Drive, where these lanes are physically separated from the mainline highway, and would act similar to an arterial connection between the island and the mainland. These improved connections would provide improved access to community resources for neighborhood residents.

The supplemental crossing would only provide some of these transportation improvements for neighborhoods. Increased I-5 capacity over the No-Build Alternative would reduce congestion and improve travel time reliability on I-5. However, compared to the replacement crossing, the supplemental crossing design between the Marine Drive and Mill Plain interchanges would lead to increased congestion on local streets in the Kenton, Hayden Island, Esther Short, Columbia Way, and Hudson's Bay neighborhoods.

The replacement and supplemental crossings would both require property acquisitions, some of which would displace residents and businesses. Because the highway improvements of the supplemental crossing would have a narrower footprint, this crossing would require fewer displacements and less overall property acquisition. Exhibits 3.5-10 and 3.5-11 summarize the demographics and location, respectively, of each neighborhood where acquisitions could occur. The percentages of EJ populations (minority and low-income) are given for each neighborhood as an indication of the potential for these displacements and property acquisitions to affect EJ populations.



Exhibit 3.5-10

**Potential Displacements from Highway Acquisitions by Neighborhood**

	Percent Minority	Percent Low-Income	Residences Displaced		Total Acres (All property types) <sup>a</sup>	
			Replacement	Supplemental	Replacement	Supplemental
Vancouver Neighborhoods						
Arnada	2%	15%	0	0	0.1	0
Central Park	16%	10%	0	0	3.6	1.7
Columbia Way	14%	14%	0	0	0.2	0.1
Esther Short	11%	35%	1	0	2.3	1.2
Hudson's Bay	17%	19%	0	0	0.6	0.1
Lincoln	10%	10%	3	0	0.5	0.1
Rose Village	21%	23%	1	1	0.1	0.3
Shumway	11%	14%	1	0	0.4	0.1
West Minnehaha	14%	11%	0	0	0.4	0.3
Portland Neighborhoods						
Bridgeton	24%	9%	0	0	0.5	1
Hayden Island	7%	7%	13	15	18.6	19.9
Kenton	37%	14%	1	0	1.4	1.2
Total	16%	14%	20	16	28.7	26

Source: CRC Neighborhoods and Populations Technical Report.

<sup>a</sup> Does not include land already owned by the state Departments of Transportation.

Acquisition of residential property would have some direct impacts or require displacements in Portland neighborhoods. The Kenton and Bridgeton neighborhoods have the highest percentage of minority populations (37 percent and 24 percent, respectively) and low-income populations (14 percent and 9 percent, respectively). However, in these neighborhoods, the replacement crossing would require only one residential displacement, and the supplemental crossing would require no displacements. Hayden Island would require the most displacements (13 floating home displacements for the replacement crossing, 15 floating home displacements for the supplemental crossing) and has among the lowest concentration impacts on low-income and minority populations. Given the low number of overall displacements and distribution of displacements in neighborhoods with low concentrations of EJ populations, it does not appear likely that these effects would be disproportionately borne by EJ populations. For the FEIS, additional evaluations of potential EJ impacts will include assessments of individual households and businesses.

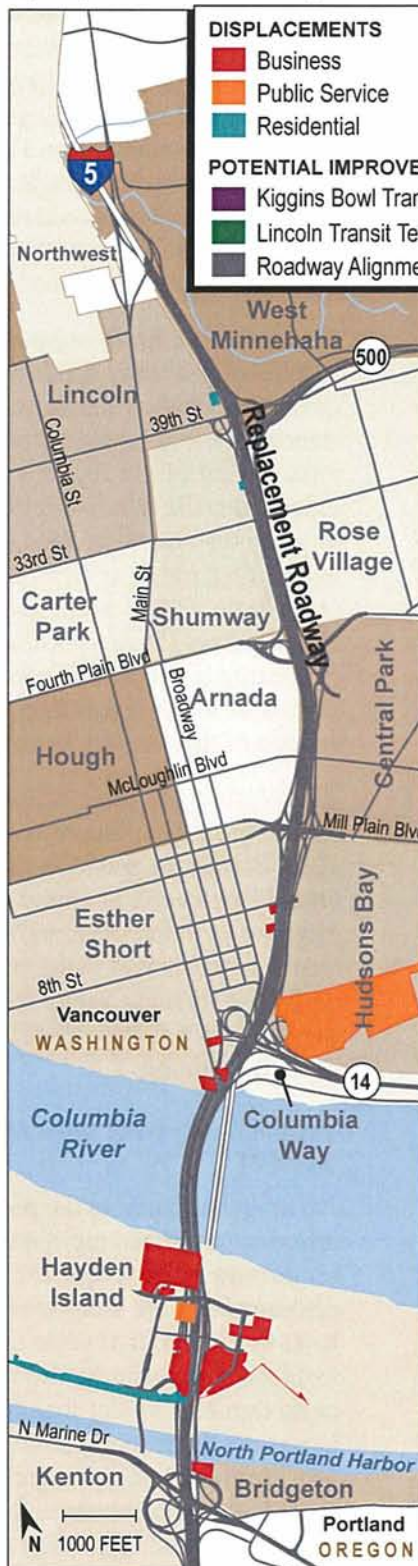
Exhibit 3.5-11

## Displacements\* with Neighborhood Boundaries

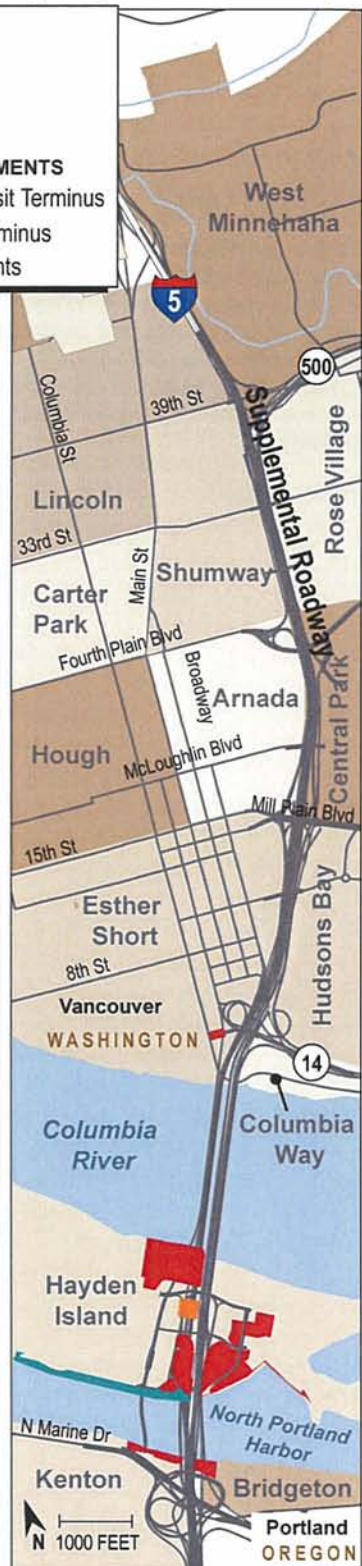
Displacements Caused  
by Transit Terminus Options



Displacements Caused  
by Replacement Roadway



Displacements Caused  
by Supplemental Roadway



- DISPLACEMENTS**
- Business
  - Public Service
  - Residential
- POTENTIAL IMPROVEMENTS**
- Kiggins Bowl Transit Terminus
  - Lincoln Transit Terminus
  - Roadway Alignments

DIMENSIONS ARE APPROXIMATE.

\*Entire parcels where displacements occur are highlighted.

## How would the project address noise?

The Noise and Vibration section of this chapter describes where noise could potentially increase, where it would likely become quieter, and what could be done to reduce its effects. The CRC highway improvements, combined with new sound walls, would result in fewer noise impacts than today.

The supplemental and replacement crossings could have impacts on businesses. Both river crossings could require displacement of the Safeway on Hayden Island, the only grocery store on the island, although the replacement crossing could be designed to avoid it. The supplemental crossing would require substantial exceptions to highway design standards to avoid the Safeway. Unless mitigated, displacing Safeway would be an adverse impact to the neighborhood, as it would require residents to make much longer trips to shop for groceries. Low-income populations may be employed at the Safeway store as well as other businesses at locations on Hayden Island that could be displaced by either river crossing. The Southern and Diagonal Marine Drive interchange options could require acquisitions of a portion of the Vanport wetlands or the Portland Expo Center, which have been identified as community resources (see Exhibit 3.4-5).

Traffic-related noise impacts resulting from the highway improvements would not generally differ between the replacement and supplemental crossings. Most of the noise impacts that exceed FHWA or state standards could be mitigated by the placement of new sound walls or the replacement of old sound walls. In a few locations, new sound walls or extended walls would not be able to completely mitigate all traffic-related noise impacts. This would occur when noise walls could not be built high enough to block impacts to upper floors of apartment buildings (e.g., in the Esther Short neighborhood), or at the openings in noise walls at overpasses (in Rose Village and Shumway neighborhoods). Overall, mitigating highway noise for either river crossing would reduce noise to similar or lower levels than current conditions. The Noise and Vibration section of this chapter has more information on potential noise impacts.

The Washington State Schools for the Blind and the Deaf are near the project area. The School for the Blind is at 2214 E 13th Street near Mill Plain Boulevard and E Reserve Street. The School for the Deaf is at 611 Grand Boulevard, at Grand and Evergreen. The School for the Blind provides mobility classes, including instruction on crossing streets, business area travel skills, and bus travel. The project team will work with the City and County to ensure that the project does not result in unnecessary adverse impacts to sidewalks and other facilities used for mobility training.

### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

All neighborhoods in the project area would benefit from the introduction of bus rapid transit or light rail. With context sensitive, security-minded design, the transit stations could become community resources that are integrated with the neighborhoods, that attract investment, and that serve as common meeting places for neighborhood residents. The primary differences between these modes are noise (bus rapid transit is louder than light rail) and consistency with local plans (some neighborhood plans call specifically for light rail). Light rail also provides better transit mobility and thus provides more benefits to neighborhood residents and EJ populations that are more reliant on transit than other segments of the population.

Light rail would require expanding the existing TriMet maintenance facility in Gresham and displacing up to seven homes, some of which

may contain businesses as well. Census data for this area indicate that 40 percent of residents are minority and 35 percent have incomes below the poverty line. Specific house-by-house analysis is needed to determine the proportion of EJ residents on these parcels that would be impacted by each transit mode.

Transit noise impacts would be more prevalent and severe with bus rapid transit than with light rail. Additionally, quieter residential areas along McLoughlin Boulevard, 16th Street and Broadway Street would experience a more dramatic noise impact from the introduction of transit than areas with higher existing noise levels such as in downtown Vancouver. Exhibit 3.5-12 summarizes the potential transit-related noise impacts by neighborhood. The table lists the number of buildings/units where potential noise impacts would occur.

Exhibit 3.5-12

**Potential Transit-Related Noise Impacts by Neighborhood**

Neighborhood	Percent Minority	Percent Low-Income		Total Noise Impacts <sup>a</sup>	Severe Noise Impacts	Noise Impacts After Mitigation	Total Noise Impacts <sup>a</sup>	Severe Noise Impacts	Noise Impacts After Mitigation
				Offset Alignment			Adjacent Alignment		
Hayden Island	7%	7%	BRT	42	21	0	35	7	0
			LRT	21	0	0	7	0	0
				Lincoln terminus (B)			Kiggins Bowl terminus (A)		
Arnada	2%	15%	BRT	40-47	1-30	0	31-49	17-31	0
			LRT	0-30	0	0	10-19	0	0
Carter Park	16%	10%	BRT	7-11	0-8	0	0	0	0
			LRT	0	0	0	0	0	0
Esther Short	11%	35%	BRT	0-20	0	0	0-20	0	0
			LRT	0	0	0	0	0	0
Rose Village	21%	23%	BRT	0	0	0	15	12	0
			LRT	0	0	0	0	0	0
Shumway	11%	14%	BRT	3-7	0	0	0	0	0
			LRT	0	0	0	0	0	0

Source: CRC Noise and Vibration Technical Report.

<sup>a</sup> Includes "moderate" and "severe" impacts, as defined in Section 3.11 Noise and Vibration.

A residential sound insulation program<sup>20</sup> could mitigate transit noise in the interior of affected residences, including floating homes on Hayden Island and residences along Broadway or 16th Streets in the Arnada neighborhood and in the Rose Village neighborhood. While only one residential structure affected by transit noise has been identified as low-income housing (the Smith Tower in the Esther Short neighborhood), other units may also be residences for low-income or minority individuals. For additional information for specific neighborhoods with EJ populations, see the Environmental Justice Technical Report.

<sup>20</sup> Residential Sound Insulation is an FTA-allowed measure (for transit impacts), not traditionally funded by the FHWA (for highway impacts).



Neighborhood plans for the Esther Short and Hough neighborhoods call for light rail. All of the project alternatives would have high-capacity transit running through the Esther Short and Hough neighborhoods, and access to transit would improve over current conditions. However, alternatives with light rail would more closely fulfill these neighborhood goals.

Residents of Hayden Island would benefit greatly from new transit service. The transit guideway and station would provide greatly improved transit service to and from the island and an alternative to highway travel between the island and downtown Portland and Vancouver. Both transit modes would provide access to downtown Vancouver without a transfer, and light rail would allow access to downtown Portland without a transfer.

Bus rapid transit would have longer travel times than light rail and would be less reliable, thus providing less benefit than light rail to low-income persons, who rely more heavily on public transit. Bus rapid transit would also require a C-Tran maintenance facility in eastern Vancouver, near the intersection of 18th Street and 65th Avenue, displacing up to two homes. Census data for this area indicate that 17 percent of residents are minority and 7 percent have incomes below the poverty line.

#### **Transit Terminus Options (with all Alternatives)**

The Lincoln and Kiggins Bowl terminus options would require some residential displacements in northern Vancouver neighborhoods, as summarized in Exhibit 3.5-13 (Hayden Island displacements are discussed below under Transit Alignment Options). The Arnada, Carter Park, Central Park, Hough and West Minnehaha neighborhoods would not have displacements. The Lincoln neighborhood would have seven displacements with the Lincoln terminus and two displacements with the Kiggins Bowl terminus. Shumway would have one displacement with the Lincoln terminus and one to eight displacements with the Kiggins Bowl terminus (the wider footprint of the replacement crossing highway improvements would cause eight displacements when paired with the Kiggins Bowl terminus, while the supplemental would only require one displacement). Rose Village would have one displacement with the Kiggins Bowl terminus.

Exhibit 3.5-13

**Potential Displacements in North Vancouver<sup>a</sup> from Terminus options**

	Percent Minority	Percent Low-Income	Residences Displaced		Total Acres <sup>b</sup> (All property types)	
			Lincoln Terminus (B)	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Kiggins Bowl Terminus (A)
Arnada	2%	15%	0	0	0.3	<0.1–0.3
Carter Park	13%	10%	0	0	0.1	0
Central Park	16%	25%	0	0	6.1	6.1
Hough	14%	20%	0	0	0	0.1
Lincoln	10%	10%	7	2	5.6–6.0	3.3–3.4
Rose Village	21%	23%	0	1	0	<0.1–0.2
Shumway	11%	14%	1	1–8	0.6–0.7	0.1–1.1
West Minnehaha	14%	11%	0	0	0	<0.1
<b>Total</b>	<b>13%</b>	<b>17%</b>	<b>8</b>	<b>4–11</b>	<b>12.7–13.2</b>	<b>9.6–11.2</b>

Source: CRC Neighborhoods and Populations Technical Report and Acquisitions Technical Report.

<sup>a</sup> North of 16th Street.<sup>b</sup> Range depends on roadway alignment pairing.

Transit stations along the Lincoln terminus could have a greater effect on the surrounding community, where conducive zoning and existing land uses are more likely to accommodate new pedestrian- and transit-oriented development. Such development encourages greater interaction among residents and could enhance cohesion in the community.

The Lincoln terminus would displace the Wellness Project. While it is a non-profit rather than a public (governmental) facility, the Project does primarily serve a low-income population that may not have easy access to other medical care. If the Lincoln terminus is selected, plans would need to be made to relocate the facility within the same general area, or in a new location that offers substantially the same or better accessibility to the Center's clientele, as the current location. If the new Wellness Project location is served by high-capacity transit, persons traveling there could benefit from the project. If the Wellness Project is not successfully relocated, this could have a high adverse effect on low-income populations.

The Lincoln Park and Ride with the Lincoln terminus would result in displacement of seven homes immediately south of the existing WSDOT maintenance facility. This would have a local effect on neighborhood cohesion, but would not likely have a substantial impact on the broader Lincoln neighborhood. The park and ride would primarily serve travelers outside of the Lincoln neighborhood, and would attract traffic and increase congestion, particularly on Main Street where automobile capacity would be reduced. Traffic coming into the park and ride from other points could increase noise and congestion on neighborhood streets. The introduction of the Lincoln Park and Ride could disrupt neighborhood cohesion if the facility is not properly designed to fit with the existing community character.

The Kiggins Bowl terminus would have fewer direct impacts on neighborhoods than the Lincoln terminus, but would provide less benefit to Vancouver communities. Stations along the Kiggins Bowl terminus are less likely to attract economic investment and redevelopment, and are unlikely to encourage as great a level of interaction among residents or enhance cohesion in the community. The Kiggins Bowl Park and Ride is associated with full acquisition of three parcels and partial acquisition of five parcels. The Kiggins Bowl Park and Ride would result in building impacts to two retail buildings which currently house a computer services business and a furniture resale store.

In most areas, new sound walls would make noise levels on properties adjacent to I-5 quieter than today. Traffic coming into the park and ride at Kiggins Bowl from locations outside the project area could increase local congestion on neighborhood streets. In general, displacements, increased noise, and congestion impacts would conflict with neighborhood plan goals, but could be offset by advancing other goals, such as improved access to transit.

In addition to the full length transit alignments, there are two shorter-length alignments referred to as minimum operable segments (MOS): the Mill Plain MOS and the Clark College MOS. Both MOS options, particularly Mill Plain, would avoid most direct impacts to neighborhoods in north Vancouver. However, these shorter-length options would not provide the potential benefits, such as improved transit access, to these neighborhoods.

The Mill Plain MOS (D) terminus option would require displacement of the U.S. Bank Building between 16th and 17th Streets, to make space for a park and ride with potential ground floor retail. Impacting this business would displace (or relocate) approximately 30 employees. This business is a potential community resource, but its displacement would likely be offset by the introduction of high-capacity transit and redevelopment around this new station area.

Residential displacements and noise impacts associated with the Lincoln and Kiggins Bowl terminus options in northern Vancouver would largely be avoided by these MOS options. The Clark College MOS (C) would still incur the noise impacts associated with the Kiggins Bowl terminus along 16th Street or McLoughlin Boulevard.

Neither MOS would provide the improved high-capacity transit access in northern Vancouver afforded by the Lincoln or Kiggins Bowl terminus options. The Clark College MOS would provide better access to the Rose Village and Central Park neighborhoods than the Mill Plain MOS. The Mill Plain MOS would not provide direct, high-capacity transit service to Clark College or to the Marshall Community Center, both of which would be served by the Clark College MOS.

### **Transit Alignment Options (with all Alternatives)**

The specific neighborhood and EJ impacts from the alignment options for the Lincoln and Kiggins Bowl terminus options are discussed below.

**OFFSET OR ADJACENT**

At the south end of the project, the offset alignment would require displacement of more floating homes on Hayden Island than the adjacent alignment, and would separate one group of floating homes from the rest of the floating home community. In the case of the adjacent alignment option, these floating home displacements will be influenced by the river crossing that it is paired with. The adjacent alignment option would displace no additional floating homes when paired with the replacement crossing, but would add eight displacements when paired with the supplemental crossing. The offset alignment option would displace seven floating homes when paired with either river crossing.

The offset alignment would also increase the number of potential noise impacts, although these could all likely be mitigated.

The offset transit alignment option could affect the cohesion of the floating home community by separating some floating homes from the larger community and placing them between the highway and the new transit guideway. The floating home community does not have a relatively high concentration of low-income or minority residents.<sup>21</sup>

**TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET**

There are no known substantial impacts to neighborhoods or EJ populations as a result of these alignment options in downtown Vancouver.

**16TH STREET OR MCLOUGHLIN**

These two alignment options are for the Kiggins Bowl and Clark College MOS terminus options. The McLoughlin option would use McLoughlin Boulevard. McLoughlin Boulevard may serve as a pedestrian route for students of the Washington State School for the Blind and the School for the Deaf, both located in the project area. The School for the Blind provides mobility classes with instruction on crossing streets, business area travel skills, and bus travel. Further coordination will be required to ensure that the project does not result in unnecessary adverse impacts to McLoughlin or other east-west connections across I-5 that are used by these schools.

Transit on 16th Street would increase traffic congestion and noise in an otherwise quiet residential and commercial area.

**TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET**

These alignment options are for the Lincoln terminus. There are no known substantial impacts to the neighborhoods or EJ populations resulting from these two alignment options in northern Vancouver. Impacts north of these options resulting from the Lincoln terminus are discussed above under Transit Terminus Options.

**Transit Operations**

Increased transit operations would cause additional noise impacts because transit rapid transit vehicles would operate more frequently. Bus rapid transit is inherently louder than light rail and must operate more

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<sup>21</sup> CRC Demographic Survey of JBMI, 2007.



frequently in general because buses have less capacity than trains. Exhibit 3.5-14 summarizes these noise impacts.

Exhibit 3.5-14

**Noise Impacts by Transit Alignment Option, Mode, and Transit Operations<sup>a</sup>**

	Light Rail		Bus Rapid Transit	
	Efficient	Increased	Efficient	Increased
Hayden Island Adjacent	7	7	35	35
Hayden Island Offset	21	21	42	42
Washington 2-Way	0	0	0	3
Broadway/Washington Couplet	0	0	0	3
Kiggins, McLoughlin option	16	19	22	34
Kiggins, 16th Street	10	10	16	17
Kiggins north of Clark College	0	0	15	15
Lincoln, Broadway 2-way	24	30	39	39
Lincoln, Broadway/Main Couplet	0	0	39	39
Lincoln north of 29th Street	0	0	1	8

Source: CRC Noise and Vibration Technical Report.

<sup>a</sup> Includes number of properties affected by both "moderate" and "severe" impacts.

### Tolling Scenarios

Tolling could impact low-income populations, and the higher toll packaged with supplemental crossing Alternatives 4 and 5 would have a correspondingly higher impact on low-income populations. While these tolls would be paid by all motorists using the river crossing, they would represent a proportionally greater expense for low-income individuals. However, tolling the I-5 crossing also would reduce congestion and improve travel time reliability. (See Section 3.1 Transportation for information on tolling effects on transportation improvement.)

Electronic toll collection systems that use transponders would present difficulties for some low-income users, but would also provide opportunities for mitigation, as discussed below. Transponder users must normally link the transponder to a bank account or a credit card. Some low-income populations may not be able to purchase a transponder<sup>22</sup> due to large set-up fees or lack of a credit card and bank account. This would potentially be a disproportionate impact on those low-income populations affected. In addition, new tolls could present difficulties if used in areas where some individuals lack the English language skills to quickly learn the new tolling system.

The adverse impact of tolling on low-income populations could be mitigated by measures such as financial assistance programs, outreach and education, and increasing accessibility to transponders for low-income persons. It is particularly important to provide low-income and minority communities with information on how to obtain transponders, and with possible financial assistance. These programs do not currently exist, but are listed under, and described further as, potential mitigation measures, below.

<sup>22</sup> Parknay, 2004.

Not tolling the crossing might avoid some of the disproportionate adverse impact on low-income persons using the bridge. However, without a toll, the demand for the crossing capacity would increase, and reduce the transportation benefits of this project. Including a toll would reduce congestion, improve travel times, and could even result in a slight improvement in air quality by reducing emissions.

### 3.5.4 Temporary Effects

Neighborhoods in the project area would experience temporary effects from construction of the CRC project. These effects would generally increase with proximity to the physical improvements, and could include:

- Noise and vibration from construction
- Dust and fumes from construction
- Traffic delays, detours, and traffic spillover into neighborhoods
- Property easements for temporary construction staging areas

Neighborhoods that are the site of major bridge construction activity, such as Hayden Island and the Esther Short neighborhood, could experience some of these effects for several years. Roadway and transit construction effects in other areas could cause traffic disruption and noise for several months.

Construction impacts important to EJ populations include increased congestion, reduced mobility, reduced transit service, and increased noise. Temporary congestion during construction may have an impact on the EJ populations in the project area and the organizations that serve them. Environmental justice populations rely more on transit, which could be affected by construction-related congestion.

The potential sites for a bridge assembly/casting yard are unknown at this time, but it is unlikely that this would be in a residential area. However, truck traffic could increase noise and air emissions along access and haul routes to and from the site.

### 3.5.5 Potential Mitigation Measures

Several options are available to potentially mitigate the adverse long-term effects of the project identified for neighborhoods and EJ populations.

#### Potential Mitigation for Displacements

Most aspects of mitigation for property acquisition are addressed by federal and state regulations, which require that property be purchased at fair market value and that all residential displacements be provided with replacement housing and relocation assistance. Federal regulations and state statutes, such as the Uniform Relocation Act, determine the standards and procedures for providing such replacement housing, based on the characteristics of individual households. Relocation benefit packages usually include replacement housing for owners and renters, moving costs, and assistance in locating replacement housing.

Relocation benefits for businesses can include moving costs, site search expenses and business reestablishment expenses. As with residential

displacements, relocation packages are determined on an individual basis based on ownership or tenant status. In general, an attempt would be made to minimize relocation impacts to residences, businesses, and public facilities. Eligibility and terms of relocation assistance will be determined during future project planning.

Displacement of residents and community resources could be mitigated by exploring relocation options within their neighborhoods to reduce impacts to residents and avoid the loss of these resources to their communities. This is especially important for neighborhood resources such as the Wellness Project, which serves low-income clients.

Impacts to the floating home community on Hayden Island could be mitigated by relocating displaced homes and/or residents. Ideally, relocations would be near their original location, although this may not be possible. Very few floating home slips in the metropolitan area are vacant, and there is no planned increase in the number of marinas. If there were sufficient spaces available, there would be additional difficulties. The displaced floating homes may not physically fit in the available slips or meet architectural design standards at other marinas. Relocation assistance programs for floating home residents should include provisions for addressing inconsistencies with new slip sizes and standards.

### **Potential Mitigation for Loss of Community Resources and Neighborhood Cohesion**

The offset transit alignment option has the potential to divide the floating home community. To minimize any loss of community cohesion, mitigation measures could include providing physical connections (new walkways) between the newly separated piers of floating homes.

Relocation of the Safeway grocery store on Hayden Island would be considered to avoid removing the residents' only grocery store. The project team has also identified highway alignment refinements for the replacement crossing that could avoid displacing the Safeway store. Relocation of the Wellness Project would be considered to avoid removing this community resource.

Potential community disruption from the introduction of the Lincoln Park and Ride could be mitigated by low-impact development techniques. These could include using Leadership in Energy and Environmental Design (LEED) methods or landscaping. Designs could include public amenities that would benefit the Lincoln neighborhood.

### **Potential Mitigation for Noise Impacts**

Transit noise impacts at residences could be mitigated using residential sound insulation. Residential sound insulation is an FTA-allowed measure for transit impacts, but is not traditionally funded by the FHWA for highway impacts.

Traffic-related noise impacts may be mitigated depending on whether or not the decibel level exceeds FHWA and state standards for mitigation. New sound walls or replacing old sound walls may be recommended near residences and other noise-sensitive locations.

### Potential Mitigation for Tolling

Several potential strategies could mitigate impacts of tolling on low-income populations. Since toll facilities are uncommon for most Washington-Oregon residents, educational program materials will be made available that explain how tolling works. All such communications of this sort need to be made available in selected non-English languages, as appropriate.

This project could provide assistance to programs to increase their levels of service and encourage more people to take transit or bike. C-TRAN offers programs that assist low-income populations and the disabled to obtain a reduced fare. TriMet offers similar programs that may assist low-income, senior, and disabled populations. Other programs include:

- The Community Cycling Center is a nonprofit organization dedicated to reaching children, restoring communities, and recycling bicycles. The center offers classes in safety, bike repair, commuting, and riding, and helps low-income youth and adults obtain bicycles.
- The Create a Commuter project provides bicycles to low-income individuals for work trips.
- The Job Access and Reverse Commute program includes late-night and weekend service, Guaranteed Ride Home Programs, vanpools or shuttle services to improve access to employment or training sites, car-share or other projects to improve access to autos, and access to child care and training.

A variety of methods could potentially improve low-income drivers' access to transponders used by the electronic tolling system. Two examples of existing programs in other areas of the country include:

**MDX SunPass Direct:** The Miami-Dade Expressway Authority (MDX) has created the SunPass Direct program to issue a limited number of free SunPass transponders to low-income Miami-Dade County residents. In addition to ease of use, the SunPass transponder saves about 20 percent of the toll each time it is used. Personal Accounts can be established online, by phone, mail, fax, or in person. Information and forms are available in English and Spanish

**Illinois Tollway, I-PASS Assist:** The Illinois Tollway has launched the I-PASS Assist program, using income-eligibility criteria to qualify people who could purchase an I-PASS at a reduced rate (\$20 versus the typical \$50).

For this project, potential mitigation for possible impacts of tolling on EJ populations includes:

- Providing information about transponders in multiple languages
- Locating venues for acquiring transponders near lower income and minority communities
- Enabling people without credit cards or checking accounts to obtain transponders
- Sharing information with and through other public service providers
- Subsidizing transponders to low-income drivers



**Potential Mitigation for Temporary Effects**

Measures for minimizing and/or mitigating temporary effects on neighborhoods and EJ populations could include:

- Providing effective detours that minimize out-of-direction travel and delays for travelers
- Maintaining transit service where possible throughout construction
- Using best management practices to reduce noise, dust, and fumes during construction
- Using existing or newly acquired right-of-way for construction staging to minimize additional temporary property acquisitions
- Communicating information about construction activities and impacts throughout neighborhoods, with focused outreach to ensure compliance with federal guidance regarding limited-English-proficiency populations.

## 3.6 Public Services and Utilities

Public services such as schools, emergency response, government offices, and hospitals are vital to the health of a community and can be affected by large construction projects and changes to the transportation network. Similarly, utilities such as private or public providers of electricity, water, sewer, natural gas, telephone, data, fiber optic, and other communications, can be affected by construction activities. This section identifies public services and utilities in the project area and evaluates the potential long-term and construction-related effects to them as a result of any of the build alternatives. The information presented in this section is based on the Public Services Technical Report and Utilities Technical Report.

In this analysis utilities include private or public providers of electricity, water, sewer, natural gas, telephone, data, fiber optic, and other communications. The information presented in this section is based on the Utilities Technical Report.

### 3.6.1 Existing Conditions

Several fire stations, police stations, medical centers, schools, and other public services are located within the project area, as shown on Exhibit 3.6-1. Emergency mobile service providers include two fire stations, one police station, and one medical center. These service providers depend on the local and highway transportation network to respond to emergencies, and though they are given signal priority, are negatively affected by traffic congestion.

### What is a public service?

For the purpose of this analysis, public services are defined as fire and medical services, law enforcement, school transportation, cemeteries, postal services, and municipal solid waste service. Potential impacts to other community resources such as libraries, non-profit medical clinics, community centers or meeting spaces, etc. are analyzed in Section 3.5, Neighborhoods and Environmental Justice. Potential impacts to parks, trails, and other recreational resources are analyzed in Section 3.7, Parks and Recreation.

Exhibit 3.6-1  
Public Service Locations



Source: CRC Public Services Technical Report.

Emergency mobile service providers designate critical access routes they rely on to provide rapid emergency response. I-5 is an important north-south access route through the area, and the only access route to and from Hayden Island. In Vancouver, other critical north-south access routes include NW Hazel Dell Avenue and SR 99. In Portland, critical north-south access routes include N Interstate, Vancouver, and Williams Avenues and NE Martin Luther King Jr. Boulevard.

Five Vancouver School District schools, two Washington State schools, and one college are located in the project area. These schools are stationary, but their students rely on safe and efficient transportation facilities to reach them.

Utilities in the project area are described in Exhibit 3.6-2.

Exhibit 3.6-2

**Utilities with Infrastructure in the CRC Project Area**

Utility Owner	Type of Utility	Notes
AT&T	Communications	Local network services only.
Chevron	Fuel pipeline	Serves Portland International Airport. It will not be affected by the project.
Clark Public Utilities	Power	Serves the area north of the Columbia River.
Comcast	Communications	
Integra Telecom	Communications	Fiber-optic network formerly owned by Electric Lightwave.
NW Natural	Natural gas	Natural gas service provider for the area.
ODOT	Communications	
Pacific Power & Light	Power	Generally serves the area east of I-5 and south of Oregon Slough.
Portland, City of	Water, sewer and communications	
Portland General Electric	Power	Generally serves Hayden Island and the area west of I-5 and south of Oregon Slough.
Qwest	Communications	General telephone service provider for the area.
Sawtooth Technologies	Communications	Owns a fiber-optic line between the BPA Ross Complex and Vancouver VA Medical Center.
Time Warner Telecom	Communications	Fiber-optic network.
TriMet	Power & communications	Data provided showed changes made to existing utilities when the Interstate MAX Project light rail line was extended to the Expo Center.
Vancouver, City of	Water, sewer and communications	
WSDOT	Communications	

Source: Utilities Technical Report.

Several important utility lines travel across the Columbia River to provide services to Hayden Island and to connect the services between two states. These include a major water main, a natural gas feed line, and telephone, television, data, and fiber optic trunk lines carried on the I-5 crossing of North Portland Harbor. Additionally, trunk communication



lines (telephone, TV, data, and fiber optics) are carried on the Columbia River Crossing and an underwater power cable immediately west of the crossing supplies Hayden Island.

Other important utility lines or structures that could be affected by the project include the main electrical switching station for Hayden Island which adjoins I-5, a natural gas supply line under Main Street in Vancouver, and water mains that cross I-5 at McLoughlin Boulevard, Mill Plain Boulevard, Fifth Street, 16th Street, and 40th Street. Additionally, there is a gas main along the entire length of Main Street, as well as a water main and communications tower on the WSDOT Maintenance Facility at 39th and Main.

While there are a significant number of utilities that could be affected by the project (for example, overhead and underground lines and pipes located on Hayden Island and in Vancouver), the discussion focuses on major infrastructure considered to be important to utility operations.

In general, transportation agencies and utility owners prefer that utilities not be located parallel to and under high-use corridors, such as a freeway or transit guideway, because they are difficult and expensive to maintain, repair and replace in such locations.

### **3.6.2 Long-term Effects from Project Alternatives**

Project alternatives vary in their physical impact on public service facilities (i.e., buildings) and the amount of congestion that the project alternatives create, which can impact mobile public services (i.e., fire, ambulance, school bus). The following tables and associated discussion summarize these impacts.

#### **Alternative 1: No-Build**

As Section 3.1, Transportation describes, traffic congestion will increase substantially in the I-5 corridor over the next 20 years, as the number of vehicles increases and the bridge capacity does not. This could have substantial negative effects for emergency service providers, especially for police and ambulance response on Hayden Island, which does not have alternative access routes when the highway is congested.

Traffic analysis predicts that five intersections along Mill Plain Boulevard in Vancouver would fail to meet traffic standards. Mill Plain Boulevard serves as an important east-west connector across I-5, and delays could present an obstacle to emergency response.

The existing bridges do not comply with modern seismic standards and are vulnerable to damage or collapse in a severe earthquake. This would have serious effects to public services and utilities on Hayden Island, as medical and police emergency services have no alternate routes, and water, natural gas, and communications lines carried on the bridge could be damaged and fail. Additionally, existing utilities along I-5 and potential transit alignments would continue to age and require maintenance repairs or replacement.

#### **Alternative 2: Replacement Crossing with Bus Rapid Transit**

Exhibit 3.6-3 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 2.

Exhibit 3.6-3

**Public Service and Utilities Effects Summary for Alternative 2**

<b>Alternative 2: Replacement Crossing with Bus Rapid Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Potential effect of traffic congestion on mobile public services (on Interstate)</b>	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build
<b>Potential effect of traffic congestion on mobile public services (in Vancouver)</b>	Moderate	Moderate-High	Moderate	Moderate-High
<b>Potential displacement of stationary public services</b>	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and the WSDOT maintenance facility. <sup>a</sup>	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and WSDOT maintenance facility.
<b>Potential need to relocate utilities as a result of transit component</b>	Low-Moderate	Moderate- High	Low-Moderate	Moderate

Source: CRC Public Services Technical Report and Utilities Technical Report.

<sup>a</sup> See discussion of this impact in Transit Terminus options section.

Note: The STHB design does not result in different effects for the metrics listed in the above table, and is therefore not included.

Alternative 2 would have increased highway capacity, improved interchange movements and weaving distances, and standardized highway features, which would result in better travel times and the shortest duration of congestion both on and off the highway. This would substantially improve the ability of emergency services to access emergencies on I-5 and travel between Vancouver and Hayden Island.

Traffic congestion in downtown Vancouver could affect the ability of emergency vehicles to travel to and from an emergency, and is influenced by many different factors, including the river crossing choice, length of transit terminus option and associated park and rides. As compared to No-Build, the replacement river crossing would result in fewer trips using local streets to navigate around congestion on I-5, thereby resulting in less congestion in downtown.

The full-length Kiggins Bowl and Lincoln terminus options would affect local traffic more as they are longer in length, as would those options that travel predominately on local streets. The Lincoln terminus, therefore, could have a greater effect on local traffic than the Kiggins Bowl terminus. The Clark College MOS would likely result in similar traffic effects as the Kiggins Bowl terminus option, while the Mill Plain MOS, although shortest in length, is associated with multiple park and rides in downtown Vancouver, which could increase in local traffic.

The additional of a separate transit crossing across the Columbia River could improve emergency service access across the river. Additionally,

emergency services could access the at-grade transit guideway on local streets to access emergencies in the City of Vancouver.

The replacement crossing when paired with any of the transit terminus options would require the displacement of the ODOT permitting center on Hayden Island, the Clark Public Utilities offices adjacent to the highway in Vancouver, and possibly a portion of the FHWA Western Federal Lands building on the Vancouver National Historic Reserve (VNHR). In addition, the Lincoln terminus option and Mill Plain MOS would displace the WSDOT maintenance facility at 39th and Main Street.

Alternative 2 would require the relocation of utilities currently carried on the river crossing, but would be less likely than light rail alternatives to require local street utility relocation. The Lincoln terminus option and Mill Plain MOS would have a higher potential to require the relocation of major utilities as a result of transit, because there are major utilities at the site of the proposed Lincoln Park and Ride and along Main Street north of Fourth Plain Boulevard.

### Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.6-4 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 3.

Exhibit 3.6-4

#### Public Service and Utilities Effects Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Potential effect of traffic congestion on mobile public services (on Interstate)	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build
Potential effect of traffic congestion on mobile public services (in Vancouver)	Moderate	Moderate-High	Moderate	Moderate-High
Potential displacement of stationary public services	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and the WSDOT maintenance facility. <sup>a</sup>	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and WSDOT maintenance facility.
Potential need to relocate utilities as a result of transit component	Moderate	High	Moderate	Moderate-High

Source: CRC Public Services Technical Report and Utilities Technical Report.

<sup>a</sup> See discussion of this impact in Transit Terminus options section.

Note: The STHB design does not result in different effects for the metrics listed in the above table, and is therefore not included.

Effects to public services for Alternative 3 would be the same as those for Alternative 2. This alternative would also require the relocation of utilities that currently reside on the river crossing, and would be more likely than alternatives that involve bus rapid transit to require the relocation of underground utilities located along the potential alignments.

#### **Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Exhibit 3.6-5 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 4.

Exhibit 3.6-5

#### **Public Service and Utilities Effects Summary for Alternative 4**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Potential effect of traffic congestion on mobile public services (on Interstate)</b>	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build
<b>Potential effect of traffic congestion on mobile public services (in Vancouver)</b>	Moderate-High	High	Moderate-High	High
<b>Potential displacement of stationary public services</b>	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and the WSDOT maintenance facility.	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and the WSDOT maintenance facility.
<b>Potential need to relocate utilities as a result of transit component</b>	Low-Moderate	Moderate- High	Low-Moderate	Moderate

Source: CRC Public Services Technical Report and Utilities Technical Report.

Alternative 4 would not substantially increase highway capacity, would be unable to substantially improve some interchange movements and weaving distances, and would keep some substandard highway features. These limited highway improvements would be slightly offset by a highway toll and increased transit use to cross the river, resulting in some congestion relief on I-5. This could improve the ability of emergency services to access emergencies on I-5 and travel between Vancouver and Hayden Island.

Traffic congestion in downtown Vancouver could affect the ability of emergency vehicles to travel to and from an emergency, and is influenced by many different factors including the river crossing choice, length of transit terminus options, and associated park and rides.

The supplemental river crossing could result in greater transit use and somewhat fewer trips using local streets to navigate around congestion on I-5, thereby resulting in some congestion relief. The Lincoln terminus could have a greater effect on local traffic than the Kiggins Bowl terminus. The Clark College MOS could likely result in similar traffic effects as the Kiggins Bowl terminus option, while the Mill Plain MOS,



although shortest in length, could have multiple park and rides in downtown Vancouver and could likely result in increases in local traffic.

The addition of transit crossing and at-grade local street guideway could improve emergency vehicle access as described with Alternative 2.

All of the alternatives would displace the ODOT permitting center on Hayden Island and the Clark Public Utilities office adjacent to the highway in Vancouver. Alternatives 4B and 4D would also displace the WSDOT maintenance facility at 39th and Main Street.

The potential for utility relocation with Alternative 4 would be the same as described in Alternative 2.

### Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.6-6 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 5.

Exhibit 3.6-6

#### Public Service and Utilities Effects Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Potential effect of traffic congestion on mobile public services (on Interstate)	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build
Potential effect of traffic congestion on mobile public services (in Vancouver)	Moderate-High	High	Moderate-High	High
Potential displacement of stationary public services	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and WSDOT maintenance facility.	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and WSDOT maintenance facility.
Potential need to relocate utilities as a result of transit component	Moderate	High	Moderate	Moderate-High

Source: CRC Public Services Technical Report and Utilities Technical Report.

Effects to public services for Alternative 5 (A, B, C, and D) would be the same as those for Alternative 4. This alternative would also require the relocation of utilities that currently reside on the river crossing, and would be more likely than alternatives that involve bus rapid transit to require the relocation of utilities located in the local street network.

### 3.6.3 Long-term Effects from Project Components

This section describes the effects of the specific project components and various options. The tolling scenarios and transportation demand and system management options would not have a meaningful effect on public services and utilities and are therefore not discussed below.

### **Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)**

The replacement crossing would provide greater capacity and more highway improvements, therefore resulting in less congestion on the highway than the supplemental crossing. Less congestion on the highway could discourage drivers from exiting onto local streets to navigate around highway traffic. Decreasing congestion on I-5 would improve the ability for mobile services providers to respond to emergencies throughout the project area.

Either river crossing could result in the loss of a few parking spaces in the Discovery Middle School parking lot, but would not affect the operation of this facility after construction of the project. The Clark Public Utilities office adjoining I-5 in Vancouver and the ODOT Permit Center on Hayden Island would need to relocate for either the replacement or supplemental crossing.

The replacement crossing could impact a portion of the FHWA Western Federal Lands building on the Vancouver National Historic Reserve. The impacted portion of the FHWA Western Federal Lands building would be an annex that could potentially be removed without the displacement of the entire building. Design refinements of the replacement crossing may avoid this impact, although access through that area from Anderson Road would still be eliminated.

The supplemental crossings' constraints on the transit bridge design may result in the closure of the intersection of Sixth Street and Washington Street, which could affect the mobility of emergency services on this critical east-west connection through south downtown Vancouver.

Both river crossings are expected to require the relocation of utilities on the existing river crossing. The new river crossings, including the transit bridge, could potentially carry the displaced utilities.

Interchange construction could require relocating utilities if they involve tunnel construction. No long-term change to utility service levels for existing uses is expected from either river crossing or associated highway improvements.

The Southern Realignment Marine Drive interchange design option as described in chapter 2 could slow down large emergency response vehicles on the segment of Marine Drive west of I-5, which could increase emergency response times. Neither the Standard nor Diagonal Marine Drive interchange options would result in this impact.

The stacked transit/highway bridge design for the replacement river crossing would operate high-capacity transit beneath the traffic deck and within the structure of the bridge for approximately 2,600 feet. Fire and life safety access to transit passengers and egress of passengers in case of an emergency will be evaluated in the FEIS, as the bridge type and design are refined. Please see the CRC Stacked Transit/Highway Bridge Technical Memorandum for more information.

### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

As bus rapid transit (BRT) vehicles have lower capacity than light rail vehicles, more would be needed to operate the shorter headways that would be required to provide the same capacity, resulting in congestion and potentially posing as additional obstacles for emergency response.

In general, utility impacts associated with bus rapid transit could be less for light rail, because light rail often requires less excavation. This does not apply to station locations, as they are designed to have the same footprint for both BRT and light rail. Additionally, buses can be temporarily re-routed onto adjacent streets when access to underground utilities is required. Agencies and utility providers would jointly determine whether utilities under the transit guideway need to be relocated. Key considerations would be the 1) permanency of the guideway, 2) the need for uninterrupted transit service, 3) the cost and responsibility for relocation, and 4) land use policies and service standards. The Transit Terminus and Alignments Options discussion below and the Utilities Technical Report provide more information regarding utility relocation.

The operation of light rail would require the construction of power substations along the alignment. The existing MAX light rail line uses a 750-volt DC system to deliver power to the cars from the overhead electrical lines (catenary wires). Other elements of the light rail system—such as lighting, signals, and switches—use either AC or DC electricity for power. As described in Chapter 2, light rail would require power substations to provide power to the catenary system used to propel light rail vehicles. Substations are placed based on voltage load but are generally located about every mile along the alignment but especially near steep grades such as bridges. Three would be located within MOS option alignments; one on Hayden Island, one in downtown Vancouver near the bridge and another near, or in, the Mill Plain District. A fourth sub-station would be placed nearer a full-length terminus for full-length options. Signal and Communications buildings would also need to be placed near, or on, every station. Siting for both sub-station and Signal and Communications buildings would occur during Preliminary Engineering.

The expansion of either the C-TRAN bus maintenance facility in east Vancouver or the TriMet Ruby Junction light rail maintenance facility in Gresham is not expected to affect the provision of any public service. No impacts to major utilities have been identified for the two maintenance base expansions. Additionally, as construction would involve only development of existing maintenance facilities or contiguous property, utility impacts would be limited to infrastructure serving those bases and located on the property being developed.

### **Transit Terminus Options (with all Alternatives)**

The Lincoln terminus (B) would reduce automobile capacity on northern Vancouver streets and could increase congestion in this area, potentially increasing emergency response times. The Kiggins Bowl terminus (A) would avoid these traffic impacts in northern Vancouver and could improve public access to Clark College, as would the Clark College

MOS (C). Both the Clark College (C) and Mill Plain (D) minimum operable segments would not extend transit north of about McLoughlin Boulevard and would therefore have less impact on traffic in that area. The park and ride facilities associated with the Mill Plain MOS (D) in and near the I-5/SR 14 interchange could potentially result in greater congestion and travel delay, and thus impacts on the provision of mobile public services, in downtown Vancouver, compared to the Clark College MOS (C) or full-length alignments (A or B).

With any terminus option, emergency vehicles could access the transit guideway to navigate around local traffic when responding to emergencies.

Currently, the design of the Lincoln terminus (B) and the Mill Plain MOS (D) would acquire the WSDOT maintenance facility at 39th and Main Street for the Lincoln Park and Ride. WSDOT has had plans in place for many years to move this facility to another location. Independent of the CRC project, WSDOT has obtained funding to study two potential relocation sites for their facility, which they plan to complete by the end of 2008.<sup>23</sup> If either site is deemed viable, WSDOT will move forward with the acquisitions and begin relocation as soon as possible. Relocation of this facility will likely occur before construction. If the Lincoln terminus (B) or the Mill Plain MOS (D) is selected, with the Lincoln Park and Ride, as the preferred alternative, and construction of the park and ride has to begin before the relocation of the facility, this would be considered a displacement.

The Lincoln terminus (B) would travel directly in front of the Vancouver Academy of Arts and Academics and the SW Washington Medical Center. This would require minor strip acquisitions from both properties, but would improve transit access to these resources. This terminus option may also result in temporary impacts during construction to public services located on Main Street, such as the Academy of Arts and Academics, SW Washington Medical Center, Fire Station #86, and the WSDOT maintenance facility. See the Temporary Effects section for more information. The Kiggins Bowl terminus option, and Clark College and Mill Plain MOSs would avoid these effects.

A water main on the southern edge of the WSDOT maintenance facility, and a communications tower in the southwest corner would also be affected by the Lincoln terminus (B) or Mill Plain MOS (D) and associated Lincoln Park and Ride. Additionally, a gas feed line on Main Street north of 29th and communications trunk line north of 39th could be affected by the Lincoln terminus (B). The Kiggins Bowl terminus would avoid these impacts. Specific impacts to utilities as a result of the transit alignment options from Hayden Island through northern Vancouver are discussed below.

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<sup>23</sup> Canter, Personal Communication, 2008.



## **Transit Alignment Options (with all Alternatives)**

### **OFFSET OR ADJACENT**

The adjacent transit alignment option on Hayden Island could likely acquire additional portions of the ODOT permitting center parcel, potentially making its relocation on the same parcel more challenging. The offset transit alignment would avoid this parcel.

The only impacts to utilities would be the result of pier location, as the transit guideway is elevated, and would likely be limited to the main electrical feed to and switches for the Jantzen Beach mall.

### **TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET**

There is not expected to be a meaningful effect to the provisions of public services from the two-way Washington transit or Washington-Broadway couplet alignment options.

Communication trunk lines belonging to two services are located along Washington Street south of Eighth Street could be effected by either alignment option. Additionally, a water main on 16th between Main and Broadway and a communications trunk line on Sixth between Washington and Main could be impacted if the alignments travel on these streets.

### **16TH STREET OR MCLOUGHLIN**

These two transit alignment options apply to the Kiggins Bowl terminus (A) and the Clark College MOS (C). Travel delay or congestion as a result of transit on McLoughlin Boulevard could result in greater impacts to mobile public services than on 16th, as McLoughlin is one of the few east-west connections across the highway in Vancouver.

In addition to potential traffic impacts, water mains cross the highway along both 16th and McLoughlin, and may have to be relocated because height requirements for the McLoughlin Boulevard underpass or 16th Street tunnel may require substantial excavation.

### **TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET**

These two transit alignment options apply to the Lincoln terminus (B). There is not expected to be a meaningful effect to the provisions of public services or utilities from the two-way Broadway or Broadway-Main couplet transit alignment options. Impacts to public services and utilities common to both alignment options along Main Street north of Fourth Plain Boulevard are addressed in the Transit Terminus Options discussion above.

## **Transit Operations**

The higher transit frequencies associated with Increased transit operations (part of Alternatives 4 and 5) could result in additional traffic impacts in Vancouver over those expected with Efficient operations (part of Alternatives 2 and 3). Increased congestion as a result of these higher frequencies could impact the provision of mobile public services, such as emergency vehicles.

## **Tolling Scenarios**

The I-5 bridge toll is not expected to affect the provision of public services or utilities.

## **Transportation Demand and System Management**

Transportation demand and system management program levels are not expected to affect the provision of public services or utilities.

### **3.6.4 Temporary Effects**

Construction of the river crossing, highway interchanges, and transit alignments in Vancouver could cause temporary delays for emergency services such as police, fire, or ambulances. For emergency services that use I-5 to access downtown Vancouver or Hayden Island, these effects would be most strongly felt at and around the SR 14 and Hayden Island interchanges. While certain movements through the SR 14 interchange could be closed completely for two to three years, the Hayden Island interchange would largely remain open (with possible detours) throughout construction. In addition to the SR 14 interchange construction, emergency vehicles in downtown Vancouver would likely have to navigate transit guideway construction on local streets.

If construction of the project causes congestion on I-5, critical access routes must be available in order for emergency service providers to serve their communities. The full transit terminus options could take approximately 2.5 to 3.5 years to build, and would likely be constructed at the same time as the river crossing and interchanges. More information regarding construction related closures and traffic delays can be found in Section 3.1, Transportation.

Construction near the Discovery Middle School (Kiggins Bowl terminus) or the Academy of Arts and Academics and SW Washington Memorial Center (Lincoln terminus) in Vancouver could cause temporary increases in noise, vibration, or traffic delays.

The Lincoln terminus would involve construction near Fire Station 86 at 37th and Main Street, though no property would be acquired from the parcel. The Vancouver Fire Department has plans to relocate this station and is currently looking at possible locations, although the plans have not finalized as of the preparation of this DEIS.<sup>24</sup> Construction in this area will require carefully planned staging to maintain access for the fire station if it remains at this location during the construction time frame.

For the replacement river crossing, or during seismic retrofitting of the existing bridges (part of the supplemental crossing), utility lines on the existing crossing and underwater cables that could be damaged by construction would need to be re-routed.

The potential sites for a bridge assembly/casting yard are unknown at this time. A remote bridge assembly/casting yard could require the temporary extension of utilities to the site if they are not already adequately serving the site.

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<sup>24</sup> Deputy Chief Tom Miletich, August 2007, Personal Communication.

### 3.6.5 Potential Mitigation Measures

During the planning and design process, the CRC team has attempted to avoid and minimize effects to public services and utilities by modifying alignments where possible and considering access and travel times during construction and operation of the project. This process of minimizing impact will continue as designs are refined.

The project team will continue to work with the local service providers to alleviate concerns about transit projects near schools and other sensitive uses. The transit guideway can be designed in a way that separates it from local traffic, but allows emergency vehicles to cross into the guideway to access emergencies and navigate around local traffic. The project team has contacted the City of Vancouver Fire and Police departments, the Clark County Fire Marshall, the City of Portland Police Bureau and Fire and Rescue, emergency services staff at local hospitals, as well as local schools. Future coordination will focus on identifying potential mitigation measures that would assure safety during construction and operation of the project. See the Public Services Technical Report for more information regarding this coordination.

The displacement of publicly owned facilities, such as the ODOT permit Center, FHWA Western Federal Land building, or WSDOT maintenance facility could be mitigated by functionally replacing the property acquired with another facility that would provide equivalent utility.

If the stacked transit/highway bridge design moves forward, the design team would address the unique fire, life, safety and security concerns associated with operating transit within the structure of the bridge though the type of the structure will be identified in the FEIS. This would include a Safety and Security Management Plan developed in accordance with federal requirements and in close coordination with the transit agencies, the cities of Vancouver and Portland, Clark and Multnomah counties, the ports of Vancouver and Portland, and all associated police and fire departments, during the preliminary and final design, construction and operation of the project. The plan would provide reliable emergency access, develop alternate plans or routes to avoid delays in response times, and institute other features as necessary so that safety and emergency services are not compromised.

The project team would work closely with utility service providers to reduce the number and extent of service outages during construction or relocation activities, and to provide advance notice when such outages might occur. Any utility relocation would occur in accordance with state and federal policy. Detailed Composite Utility Plans that show existing utilities, and propose temporary and permanent utility relocations could be developed after the selection of a locally preferred alternative.

It would be beneficial to the project to develop agreement(s) with affected utility owners for utilities to be relocated, were feasible, prior to the start of the project. It is possible that some of the unavoidable utility relocations may provide the opportunity for substandard infrastructure to be brought up to standard.

## 3.7 Parks and Recreation

Existing and planned parks and recreation facilities are important resources, highly valued by local governments and community members. Park and recreation facilities of local, regional, and national significance are located within the project area. This section discloses potential effects by project alternatives to all park and recreation resources currently open to the public or those that will be in the foreseeable future. These include school facilities, public docks, interpretative or community centers, or trails, in addition to traditional open spaces. Additionally, this analysis looks at potential impacts to recreational events and activities. Some, but not all of the park and recreation resources in the project area are protected by federal regulation. The evaluation of use of park and recreation resources in accordance with Section 4(f) of the Department of Transportation Act (49 USC 303) can be found in the Draft Section 4(f) Evaluation (Chapter 5) of this DEIS. An analysis of potential impacts to park and recreation resources protected under Section 6(f) of the federal Land and Water Conservation Fund Act is included later in this section.

The information presented in this section is based on the Parks and Recreation Technical Report which is included as an electronic Appendix to this document.

### 3.7.1 Existing Conditions

Exhibit 3.7-1 shows the location of all park and recreational facilities in the CRC project area. Exhibit 3.7-2 summarizes these park facilities and their amenities.



Exhibit 3.7-1  
**Parks in the CRC Project Area**



DIMENSIONS ARE APPROXIMATE.

Exhibit 3.7-2 (page 1 of 2)

**Parks and Recreation Facilities in or Near the Project Area**

	Type	Location	Agency with Jurisdiction	Amenities
<b>East Delta Park</b>	Regional park	Adjoins I-5 to the east in Oregon.	City of Portland	Sports complex: 5 softball fields, 8 soccer fields; 6 volleyball courts, playground, picnic tables, restrooms, parking, support buildings, nature trails, and dog off-leash area.
<b>Marine Drive multi-use path</b>	Multi-use trail	Adjoins I-5 to the west in Oregon, connects to trails on existing bridges.	City of Portland	Paved multi-use non motorized trail. Access to Columbia River; Smith and Bybee Lakes natural area, & Kelley Point Park to the west.
<b>Proposed Bridgeton Trail</b>	Proposed multi-use trail	Would adjoin I-5 to the east in Oregon	City of Portland	Paved multi-use non motorized trail. Would connect Bridgeton neighborhood with the Marine Drive multi-use path west of I-5.
<b>Lotus Isle Park</b>	Neighborhood park	East of I-5 on Hayden Island, Oregon.	City of Portland	Paved paths, picnic tables, playground
<b>Lower Columbia River Water Trail</b>	Recreational and commercial waterway.	Passes under I-5 bridges in Washington.	Lower Columbia River Estuary Partnership	Boat ramps, marinas, fueling stations, dock-side restaurants, scenic views, fishing, boating recreation (within 5 miles of the bridge).
<b>Waterfront Park</b>	Regional park	Adjoins I-5 to the east in Washington.	National Park Service (NPS).	Scenic views, public access, start of Waterfront Renaissance Trail; Boat of Discovery artwork, Cptn George Vancouver Monument, Illichee statue, viewing plaza.
<b>Waterfront Renaissance Trail</b>	Multi-use trail	Crosses under I-5 in WA, connects to trails on existing bridges.	City of Vancouver/ NPS.	Paved multi-use non motorized trail along waterfront. Connects to VNHR & Old Apple Tree Park via confluence land bridge.
<b>Vancouver Landing</b>	City amphitheater and public dock	Approx. 1,000 feet west of I-5 in WA.	City of Vancouver	Public moorage facility/dock, amphitheater.
<b>Old Apple Tree Park</b>	Community park	Adjoins I-5 to the east in Washington.	City of Vancouver	Oldest apple tree in the Pacific NW, benches, and paved plaza
<b>Vancouver National Historic Reserve (VNHR)</b>	Includes a National Historic Site, Historic District	Adjoins I-5 to the east in Washington.	NPS, City of Vancouver, WA. State, and US Army; supported by VNHR Trust.	Historic interpretive sites and replica structures, confluence land bridge, large annual events, trails, picnic tables and shelter, recreation fields.

Exhibit 3.7 2 (page 2 of 2)

	Type	Location	Agency with Jurisdiction	Amenities
<b>Esther Short Park</b>	Community park	1 block from proposed transit station in Washington.	City of Vancouver	Event pavilion, play equipment, benches, paved walkways, landscaping, paved square, interactive water feature.
<b>Clark College Recreational Fields</b>	College facilities open to the public	Adjoins proposed park and ride facility in WA.	Clark College	Sports fields, benches, landscaping
<b>Leach Park</b>	Community park	50 feet east of I-5 in WA.	City of Vancouver	Playground, benches
<b>Marshall Community Park/Center</b>	Community center, park, and pool.	Adjoins I-5 to the east in Washington.	City of Vancouver	Playground, community gardens, trail, picnic tables, ball fields, horseshoes, public pool, fitness center, basketball, gym, commercial kitchen, meeting rooms.
<b>Waterworks Park</b>	Community park	Less than 1 mile east of I-5	City of Vancouver	Walking trails, play equipment, picnic shelters, restrooms, skatepark, community amphitheater.
<b>Arnada Park</b>	Neighborhood park	Adjoins I-5/ Fourth Plain interchange to the southwest.	City of Vancouver	Gazebo, picnic shelter, play equipment, lighting, sports court, benches, paved walkway.
<b>Shumway Park</b>	Neighborhood park	1 block east of transit design option on Main St.	City of Vancouver	Play equipment, benches, picnic tables, and a walkway.
<b>Leverich Park</b>	Regional park	Adjoins I-5 to the east and SR 500 to the south in Washington.	City of Vancouver	Ball fields, picnic tables and shelter, paved walkway, restroom, BBQ stands, horseshoes, access to Burnt Bridge Creek Greenway.
<b>Burnt Bridge Creek Greenway and Trail</b>	Natural area, multi-use trail	Trail crosses I-5 north of SR 500 via a pedestrian overpass.	City of Vancouver	8-mile long interconnected trails providing access to creek, natural areas, and developed parks.
<b>Kiggins Bowl</b>	Sports venue	Adjoins proposed of park and ride facility in Washington.	Vancouver School District	Natural area, sports fields, Trail connection to Burnt Bridge Creek Greenway.

Source: CRC Parks and Recreation Technical Report.



Important recreational events within the project area include the Fort Vancouver fireworks display at the Fort Vancouver National Historic Site, the Wine and Jazz Festival at Esther Short Park, Hot July Nights at Esther Short Park, and Hoops on the River at the Vancouver Landing.

Additionally, recreational activities, such as fishing, occur in the Columbia River throughout the year. For impacts to recreational fishing, please see Section 3.14, Ecosystems.

The Columbia Slough has been defined as a scenic waterway by the City of Portland, which could be considered a recreational resource. Information regarding impacts to this visual resource can be found in Section 3.9, Visual and Aesthetic Qualities.

### **Potential 6(f) Resources**

Section 6(f) of the federal Land and Water Conservation Fund Act prohibits the conversion of property, primarily park and recreation facilities, acquired or developed with grant funds provided through the act, unless replacement land of at least equivalent property and recreational value is identified, approved, and acquired. State-funded and implemented programs that are very similar to the federal LWCF program include the Oregon Local Government Grant Program, Oregon County Opportunity Grant Program, and Washington Salmon Recovery Funding Board.

Currently, of all the park or recreation facilities potentially affected, the only facilities known to have received funding from the Land and Water Conservation Fund (LWCF) are a portion of the trail within the Burnt Bridge Creek Greenway near SR 500 (grant in 2007)<sup>25</sup>, Waterworks Park (grant received in 1984)<sup>26</sup>, and Vancouver Landing.<sup>27</sup> See Exhibit 3.7-3 for locations of these resources. See Exhibit 3.7-2 for information about each resource.

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<sup>25</sup> Washington State Recreation and Conservation Office Lands and Water Conservation Fund (LWCF), Grant Project Locations, 2008.

<sup>26</sup> Washington State Recreation and Conservation Office Lands and Water Conservation Fund (LWCF), Grant Project Locations, 2008.

<sup>27</sup> City of Vancouver, Personal Communication, 2008.



Exhibit 3.7-3

**Known and Potential 6(f) Resources**

DIMENSIONS ARE APPROXIMATE.

The project alternatives would not directly affect the Burnt Bridge Creek Trail, although they may require the realignment of a local connection to the trail. The project alternatives would not directly impact Waterworks Park or Vancouver Landing.

A final Section 6(f) evaluation will be provided in the Final EIS, following the development of more refined designs and staging information and further consultation with parks and recreation officials. Though not currently expected, if any of the build alternatives were to require the acquisition of land protected by Section 6(f) or other land protected by similar state program grants, the FHWA and/or FTA would coordinate with the agencies owning the resources, state LWCF managing agencies, and if appropriate, the National Park Service to develop formal conversion documentation. Additionally, the FHWA and/or the FTA would be required to acquire replacement lands of equal value, location, and usefulness.

### 3.7.2 Long-term Effects from Project Alternatives

The build alternatives, as described in the Description of Alternatives (Chapter 2), comprise different combinations of river crossing, high-capacity transit mode, and transit terminus options and alignment options. The following tables and associated discussions summarize the acquisition of park and recreation resources, including trails that could occur as a result of the project alternatives, as well as the potential improvements in transit access to these parks.

#### Alternative 1: No-Build

If the CRC project does not go forward there would be no CRC-related impacts to park or recreation resources. The pedestrian and bicycle connection on the existing bridges, which connects multi-use trails in Vancouver and Portland, would remain poor. Large events such as the Fort Vancouver fireworks display, Wine and Jazz Festival, Hot July Nights, and Hoops on the River would continue to have limited traffic and transit access, particularly from Portland.

#### Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.7-4 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 2.

Exhibit 3.7-4

#### Parks and Recreation Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus(B)	Clark College MOS (C)	Mill Plain MOS (D)
Acres of park and recreation resources potentially acquired <sup>a</sup>	5.26 to 6.47	4.90 to 6.11	4.90 to 6.11	4.90 to 6.11
Acres of the VNHR potentially acquired <sup>b</sup>	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70
Linear feet of trails potentially realigned	230	230	230	230
Transit access to park and recreation resources	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

<sup>a</sup> For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.

<sup>b</sup> Included in the totals in the above row.

Note: The impacts with the STHB design for the river crossing would be the slightly different for multi-use trail connections, as the text below describes.

The Kiggins Bowl terminus paired with the replacement river crossing (Alternative 2A), would acquire 5.26 to 6.47 acres of park and recreation resources, including 1.73 to 2.70 acres of the Vancouver National Historic Reserve (VNHR). Acquisition impacts for Alternative 2 would be slightly less with the Lincoln, Clark College, and Mill Plain terminus options, as compared to the Kiggins Bowl terminus option, because they avoid the transit related impacts to Leverich Park (0.01 acre) and the

additional impacts to Kiggins Bowl sports venue (0.35 acre). Effects to the VNHHR are not influenced by the transit terminus options.

Alternative 2 would require the relocation of 50 feet of a local connection to the Burnt Bridge Creek Greenway trail near Kiggins Bowl, and would travel over approximately 180 feet of the Waterfront Renaissance Trail, requiring the realignment of any portion of this section of trail.

Alternative 2 would improve transit access to parks to different degrees depending on the transit terminus option. The Kiggins Bowl terminus option would provide direct bus rapid transit access to large regional parks such as the Clark College Recreational fields, Marshall Community Center and Park, Kiggins Bowl, and Leverich Park, while the Lincoln terminus option could provide improved transit access to smaller community and neighborhoods parks on the west side of I-5 south of 39th Street. Like the Kiggins Bowl terminus option, the Clark College MOS would provide direct bus rapid transit access to Clark College Recreational fields and Marshall Community Center and Park, but would not provide access to the large parks further north. As the Mill Plain MOS does not extend as far east and/or north as the other alternatives it would only improve transit access for those resources in south downtown Vancouver, such as Waterfront Park, Waterfront Renaissance Trail, Vancouver Landing, and Esther Short Park.

Alternative 2 would have greater highway capacity than Alternatives 4 and 5, and therefore less traffic congestion. It could improve access to and from major recreation events at the Vancouver National Historic Reserve, Esther Short Park, and the Vancouver waterfront areas. Additionally, Alternative 2 would result in improved bicycle and pedestrian connections over the Columbia River and North Portland Harbor, as users would no longer have to navigate local streets on Hayden Island to move between the two crossings.

The stacked transit/highway bridge design for a replacement crossing would cause slightly different effects in the Vancouver shoreline area. The multi-use trail over the river would likely be located on the east rather than west side of the bridge, though adequate trail connections for users heading both east and west along the shoreline would be provided. Users connecting to trails in Portland would have to use local streets to cross under the highway on Hayden Island and reconnect with the trail on the separated transit guideway there.

### **Alternative 3: Replacement Crossing with Light Rail**

Exhibit 3.7-5 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 3.

Exhibit 3.7-5

**Parks and Recreation Effects Summary for Alternative 3**

<b>Alternative 3: Replacement Crossing with Light Rail</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Acres of park and recreation resources potentially acquired<sup>a</sup></b>	4.91 to 6.12	4.90 to 6.11	4.90 to 6.11	4.90 to 6.11
<b>Acres of the VNHR potentially acquired<sup>b</sup></b>	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70
<b>Linear feet of trails potentially realigned</b>	230	230	230	230
<b>Transit access to park and recreation resources</b>	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

<sup>a</sup> For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.

<sup>b</sup> Included in the totals in the above row.

Note: The impacts with the STHB design for the river crossing would be the slightly different for multi-use trail connections, as the text below describes.

Alternative 3 would result in the same effects as Alternative 2 for park and recreation resources, except for the total acres of park and recreation resources required for Alternative 3 when paired with the Kiggins Bowl terminus option. As Alternative 3 uses light rail instead of bus rapid transit, it avoids a 0.35 acre acquisition of forested area from the parcel on which the Kiggins Bowl sports venue is located.

This alternative would improve transit access to park and recreation resources in the same way as described for Alternative 2. Alternative 3 could also include the STHB design, resulting in the same changes to trail configuration as mentioned under Alternative 2.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Exhibit 3.7-6 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 4.



Exhibit 3.7-6

**Parks and Recreation Effects Summary for Alternative 4**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Acres of park and recreation resources potentially acquired<sup>a</sup></b>	3.66	3.30	3.30	3.30
<b>Acres of the VNHR potentially acquired<sup>b</sup></b>	0.28	0.28	0.28	0.28
<b>Linear feet of trails potentially realigned</b>	143	143	143	143
<b>Transit access to park and recreation resources</b>	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

<sup>a</sup> For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.

<sup>b</sup> Included in the totals in the above row.

The Kiggins Bowl terminus, when paired with the replacement river crossing, would acquire 3.66 acres of park and recreation resources, including 0.28 acre of the Vancouver National Historic Reserve (VNHR). Acquisition impacts for Alternative 4 would be slightly less for the Lincoln, Clark College, and Mill Plain terminus options, as compared to the Kiggins Bowl terminus option, because they avoid the transit related impacts to Leverich Park (0.01 acres) and the additional impacts to Kiggins Bowl sports venue (0.35 acres).

Alternative 4 would require the relocation of 50 feet of a local connection to the Burnt Bridge Creek Greenway trail near Kiggins Bowl, and would travel over approximately 93 feet of the Waterfront Renaissance Trail, requiring the realignment of any portion of this section of trail.

This alternative would improve transit access to park and recreation resources in the same way as described for Alternative 2.

Alternative 4 would not provide substantial congestion relief and would therefore not result in a considerable improvement to access to and from important recreational events in Vancouver. This option would also potentially increase the number of bridge piers in the waters, making marine navigation more difficult, and possibly impeding recreational use of the Columbia River Water Trail and North Portland Harbor. Last, this alternative would not provide a grade-separated bicycle and pedestrian pathway across Hayden Island.

#### **Alternative 5: Supplemental Crossing with Light Rail**

Exhibit 3.7-7 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 5.

Exhibit 3.7-7

**Parks and Recreation Effects Summary for Alternative 5**

Alternative 5: Supplemental Crossing with Light Rail				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Acres of park and recreation resources potentially acquired <sup>a</sup>	3.31	3.30	3.30	3.30
Acres of the VNHR potentially acquired <sup>b</sup>	0.28	0.28	0.28	0.28
Linear feet of trails potentially realigned	143	143	143	143
Transit access to park and recreation resources	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

<sup>a</sup> For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.<sup>b</sup> Included in the totals in the above row.

Alternative 5 would result in the same effects as Alternative 4 for park and recreation resources, except for the total acres of park and recreation resources required for the Kiggins Bowl terminus option As Alternative 5 uses light rail instead of bus rapid transit it avoids a 0.35 acre acquisition of forested area from the parcel on which the Kiggins Bowl sports venue is located.

This alternative would improve transit access to park and recreation resources in the same way as described for Alternative 4.

**3.7.3 Long-term Effects from Project Components**

This section describes the effects of the project components and various options. Operational components (tolling scenarios, transit operations and TDM/TSM) would not affect parks and recreation facilities and are therefore not discussed in detail below.

**Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)**

The highway widening associated with either river crossing could require a strip of land used for three horseshoe courts that adjoins parking and fields at Marshall Community Park (totaling 1.2 acres). In Leverich Park, highway construction could require between 0.24 acre (supplemental) and 0.33 acre (replacement) adjoining the highway. This contains landscaping, berms, and part of the park main entrance road. The guideway would be elevated in this section.

Either river crossing could interfere with the proposed route of the Bridgeton multi-use trail, which would connect the East and West Marine Drive trails. However, the replacement crossing and Marine Drive interchange improvements would improve pedestrian and bicycle conditions compared to the No-Build Alternative, and a connection to the

planned Bridgeton trail could be incorporated into the design. The land where the Bridgeton trail is proposed is not publicly owned.

With the supplemental river crossing recreational use of the Lower Columbia River Water Trail could suffer due to the increased number of piers in the water and potential increased river navigation hazard.

The replacement crossing could acquire up to 0.27 acre of Old Apple Tree Park, although the tree itself would not be displaced. Shading from the bridge ramps may increase. The supplemental river crossing and associated interchange improvements would not impact the park, nor displace the tree or increase shading.

The replacement crossing would travel over approximately 180 feet of the Waterfront Renaissance Trail. Any portion of this may need to be realigned as a result of pier placement. With the replacement crossing bicycles and pedestrians would access the crossing from the west side and travel uninterrupted across the Columbia River and North Portland Harbor. With the supplemental crossing, up to 93 feet of the trail could potentially need to be relocated. Users would access the river crossing pathway from the east side of the bridge, and would be forced to navigate local streets on Hayden Island to complete the crossing, as is currently the case.

Exhibit 3.7-8  
**Existing Low Clearance at  
Waterfront Park**



The bridge landing with the replacement river crossing may shade up to 0.23 acre of Waterfront Park viewing area, which includes a portion of the Waterfront Renaissance Trail. Currently, the existing bridges shade a similar-sized portion of the park and trail. The existing bridge landing would be removed, potentially providing better park access from downtown Vancouver and more space in a currently constricted area of the park. The bridge deck's increased height clearance over the shoreline (as seen in Exhibit 3.7-8) could also improve park conditions compared to the No-Build Alternative. The supplemental river crossing would shade approximately 0.17 acre of the park, in addition to the area shaded by the existing bridges, and would not improve existing low clearance over the park. Current designs indicate that the art pieces located at this site, the Capitan George Vancouver Monument and the Boat of Discovery, would not be displaced by either crossing.

Depending on the design of the SR 14 interchange, between 1.76 (for left-loop design) and 2.70 acres (for dual loop design) of Vancouver National Historic Reserve, (which includes the Fort Vancouver National Historic Site) could be acquired for the replacement crossing. The supplemental crossing would require approximately 0.31 acre of the Vancouver National Historic Reserve, including the Fort Vancouver National Historic Site. No built recreational facilities would be impacted in this area, but it could detract from the nearby replica of the Hudson's Bay Company Village. Park plans also include future recreational uses of the FHWA Western Federal Lands Mule Barn and possibly the City of Vancouver Police Administration site, neither of which would likely be affected by the strip acquisitions required for both crossings along the western edge of these two parcels.<sup>28</sup> The Description of Alternatives (Chapter 2) and Draft Section 4(f) Evaluation (Chapter 5) describe the

<sup>28</sup> National Park Service, 2003.

potential SR 14 interchange designs and impacts to the Vancouver National Historic Reserve, as well as future plans for the Vancouver National Historic Reserve, in more detail.

The planned Seventh Street pedestrian connection, as indicated in City of Vancouver and NPS plans, across I-5 would be more difficult with the supplemental river crossing than with the replacement crossing, as the supplemental bridge would be higher than existing grade in this area. The replacement crossing would match the existing grade in this area. The replacement river crossing would also allow for another use (through an airspace lease) of the property for Fifth Street to cross under I-5. This would provide a new connection between downtown Vancouver and Vancouver National Historic Reserve.

The stacked transit/highway bridge design for a replacement crossing would cause slightly different effects in the Vancouver shoreline area. The multi-use trail over the river would likely be located on the east rather than west side of the bridge, though adequate trail connections for users heading both east and west along the shoreline would be provided. Users connecting to trails in Portland would have to use local streets to cross under the highway on Hayden Island and reconnect with the trail on the separated transit guideway there.

#### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

The only impact to park and recreation resources that differentiates the two transit modes is a bus rapid transit related impact to the parcel on which the Kiggins Bowl sports field is located. In order for the transit guideway for bus rapid transit to access the proposed Kiggins Park and Ride from the Kiggins Bowl terminus (A), it must transition over I-5 further south than light rail, and would therefore travel over approximately 0.35 acre of this forested area before terminating at the park and ride. As piers would be placed in a forested portion of this parcel, this impact would not be expected to interfere with the functional use of the Kiggins Bowl playing field.

The expansion of either the C-TRAN maintenance facility in East Vancouver or the TriMet Ruby Junction facility in Gresham would not be expected to affect any park or recreation resources. The planned Gresham/Fairview Trail through this area would run along the east side of the existing TriMet Ruby Junction facility, and therefore would not be impacted by the expansion, which would occur to the west.

#### **Transit Terminus Options (with all Alternatives)**

The Kiggins Bowl (A), Lincoln (B), Clark College (C), and Mill Plain (D) terminus options could all acquire up to 1.24 acres of the Clark College recreational fields for the construction of the Clark College Park and Ride. This acquisition would require mostly passive recreational space, but could displace a batting cage. Building a transit station at this location, as would occur with the Kiggins Bowl terminus (A) and Clark College minimum operable segment (C), would improve access to the recreational facilities at Clark College and Marshall Community Center and Park.



The Kiggins Park and Ride, located directly north of the Kiggins Bowl sports venue, would be included with all transit terminus options. Its construction would require the realignment of 50 feet of trail that connects Main Street to the Burnt Bridge Creek Greenway Trail and would acquire 0.14 acre of landscaping and a road/trail to the Kiggins Bowl sports fields. An additional 0.35 acre of forested area of this parcel may also be acquired by the Kiggins Bowl terminus (A), if bus rapid transit is the preferred mode. Transit access to the Kiggins Bowl sports fields would likely improve more with the Kiggins Bowl terminus (A), which ends in this location, as compared to the Lincoln terminus (B) which ends two to three blocks south of the sports venue, or either MOS (C and D).

The Kiggins Bowl terminus (A) would cross over approximately 0.01 acre (370 square feet) of Leverich Park, which is east of I-5 along the Burnt Bridge Creek Greenway. These impacts are in addition to those caused by the highway improvements. The transit guideway would transition over I-5 at this location, and would cross over landscaping and berms. The Lincoln (B), Clark College (C) and Mill Plain (D) terminus options would avoid transit-related impacts to Leverich Park

#### **Transit Alignment Options (with all Alternatives)**

None of the transit alignment option would result in impacts to park and recreation resources.

#### **Transit Operations**

Transit operations options are not expected to result in impacts to park and recreation resources.

#### **Tolling Scenarios**

I-5 bridge tolling is not expected to result in impacts to park and recreation resources.

#### **Transportation Demand and System Management**

Transportation demand and system management options are not expected to result in impacts to park and recreation resources.

#### **3.7.4 Temporary Effects**

Temporary effects from construction are likely to be similar for any of the build alternatives and include issues relating to access, noise, dust, or travel delays. The location and duration of these effects would differ depending on the alternative chosen as discussed below.

Between 0.13 acre for the supplemental river crossing and 0.54 acre for the replacement river crossing, of the Vancouver National Historic Reserve could be temporarily acquired as construction easements. These would likely be required to construct a retaining wall and/or sound walls along SR 14 or I-5.

#### **Where are the regional multi-use trails?**

Section 3.1, Transportation contains a map showing the routes and connections of the region's non-motorized multi-use trails.

For some people, construction of a project on the scale of the Columbia River Crossing would be interesting, and facilities with views of the bridge, such as Vancouver Waterfront Park, the Confluence Land Bridge (part of the VNHR), or the Columbia River would be appealing vantage points to watch construction. Others will find the noise and sight of construction activities detract from their recreation experience.

At times, construction of the bridge could require channel closure of the Columbia River or North Portland Harbor. Although efforts would be made to ensure at least one shipping channel is passable, in-water construction could detract from enjoyment and increase the hazard to recreational boating near the bridges and enjoyment of the Lower Columbia River Water Trail may be affected.

Interchange construction near Marine Drive could make access to East Delta Park, the West Marine Drive Multi-use Trail, and the planned Bridgeton Trail more difficult. Construction at the bridge footing in Vancouver and the SR 14 interchange could affect access to Waterfront Park, the Renaissance Trail, Old Apple Tree Park, the confluence land bridge, and associated recreation facilities. Transit construction in downtown Vancouver could temporarily reduce access to Esther Short Park and Vancouver Landing. Construction at the SR 500 to I-5 northbound ramp may temporarily affect access to Leverich Park from 39th Street.

Construction activities such as demolition, movement of heavy equipment, regrading, etc. have the potential to affect the health of the Heritage Apple Tree (see Exhibit 3.7-9), located in Old Apple Tree Park, which would be very close to these activities. Extreme care to avoid damaging this tree during construction would be necessary. The supplemental alternatives would not require demolition of the existing ramps here, and could pose less of a construction hazard to the heritage tree. Vancouver urban forestry experts would be consulted to ensure that all appropriate measures are taken to preserve the health of the Heritage Apple Tree and other trees in the park.

Delays associated with transit, bridge, and highway construction could affect the attendance at large events such as the Fort Vancouver Independence Day Fireworks display, the Wine and Jazz Festival, Hot July Nights, Hoops on the River, as well as the docking of the Portland Spirit.

A discussion of potential temporary impacts to recreational fishing in the Columbia River is discussed in Section 3.14, Ecosystems.

Construction could close or limit bicycle or pedestrian access along the transit alignments and on the river crossing, which could affect recreation in Vancouver and Portland, and the connection between multi-use trails in both cities.

The potential sites for a bridge assembly/casting yard are unknown at this time. The bridge assembly/casting yard could potentially impact unknown public parks or recreation facilities. However, avoiding public parks and recreation facilities will be a priority for siting this temporary facility.

Exhibit 3.7-9  
**Heritage Apple Tree with SR 14  
Ramp in Background**



### 3.7.5 Potential Mitigation Measures

Construction closures could be timed to minimize effects to large events such as the Fort Vancouver fireworks, Wine and Jazz Festival, Hot July Nights, Hoops on the River, and the docking on the Portland Spirit. Certain construction staging, described in Section 3.1, Transportation, could retain pedestrian and bike connectivity during construction.

The construction plan for the SR 14 interchange could include specific protection measures to reduce the potential of harm to the Heritage Apple Tree, located in Old Apple Tree Park. These could include debris or dust shielding, barriers to prevent construction equipment from accidentally damaging the tree, or scheduling work during the fall and winter when the tree is dormant. The project team would consult with the Vancouver Urban Forester, National Park Service cultural landscape specialists, and an urban forestry specialist to determine the best methods of protecting the tree.

At Leverich Park and Kiggins Bowl, the project could provide re-routed access to the Burnt Bridge Creek Greenway, and create or retain a forested landscape buffer between the park and ride and the greenway. The project staff would consult Vancouver Parks and Recreation Department staff on design and implementation.

Best management practices, including those already developed in WSDOT and ODOT construction manuals, could also be developed to protect the art installations in Waterfront Park—Captain George Vancouver Monument and the Boat of Discovery—from construction related impacts such as dust, vibration, or accidental damage from construction equipment.

Other potential measures for reducing impacts to the parks and recreation facilities are discussed in the Draft Section 4(f) Evaluation of this DEIS.

## 3.8 Historic and Archaeological Resources

The CRC project team has collected information on cultural resources in the project area, and has analyzed the CRC alternatives' potential adverse effects to these resources. Cultural resources include the historic built environment, historic features, and potential archaeological features. The project area contains several hundred cultural resources (including the northbound I-5 bridge), a substantial number of historic buildings in downtown Vancouver, the Vancouver National Historic Reserve, and numerous archaeological sites.

### 3.8.1 Cultural Resources Regulations

Cultural resources consist of a broad range of tangible and intangible aspects of human existence that have, or had, value for maintaining lifeways. Cultural resources may include, but are not limited to, buildings or materials that are used in living as well as beliefs or customs attached to physical places or landscapes. Because of their importance, various cultural resources are protected by federal, state and/or local laws. The National Historic Preservation Act (NHPA) of 1966 (as amended) establishes a program for the preservation of historic and cultural resources throughout the United States. In particular, Section 106 provides the foundation for ensuring that federal agencies such as the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) take into account the effects of their undertakings on any district, site, building, structure, or object that is included on or eligible for inclusion on the National Register of Historic Places (NRHP). This law focuses on tangible historic resources—things and places. For this project, historic resources have been broadly categorized as “historic built environment” (typically above-ground buildings, structures, objects, and districts), “archaeological” (typically below-ground remnants of human activity), and traditional cultural properties.

#### Section 106 Compliance

Section 106 applies whenever there is a federal nexus to a project, that is, whenever the project requires a federal permit, uses federal dollars, or takes place (in whole or in part) on federal lands. Title 36, Part 800 of the Code of Federal Regulations (36 CFR 800) instructs federal agencies how to implement the requirements of section 106. Primary themes in these regulations are early and frequent consultation, systematic investigations, and achieving historic preservation objectives through careful consideration of avoidance, minimization, and mitigation of unavoidable adverse effects.

These regulations also stipulate or outline the procedures by which federal agencies are to conduct their accounting. The procedures are organized in a stepped fashion, generally starting with initiating the section 106 process (36 CFR 800.3), then identifying historic properties (36 CFR 800.4), assessing adverse effects (36 CFR 800.5), and resolution of adverse effects (36 CFR 800.6). While the steps afford practitioners a level of certainty and consistency for many situations, the regulations also allow flexibility in choosing both how to carry out the steps technically and how to organize them, considering the opportunities

#### TERMS & DEFINITIONS

##### Traditional Cultural Properties

The National Park Service's *Guidelines for Identifying and Documenting Traditional Cultural Properties* defines a traditional cultural property as a site that is “eligible for inclusion on the National Register [of Historic Places] because of its association with cultural practices or beliefs or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community.” These properties could include, but are not limited to, ceremonial sites, traditional homes of a particular cultural group, or locations of historic economic, artistic, or other cultural practices.

Source: Parker and King, 1998.



and constraints afforded by the proposed project and the context underlying the historic resources environment.

The following discussion describes how the CRC project is complying, and will continue to comply, with the procedural steps of 36 CFR 800 regarding the historic built environment and archaeological resources.

### **36 CFR 800.3 – INITIATION OF THE SECTION 106 PROCESS**

The CRC project is an Undertaking (36 CFR 800.16(y)), because the project build alternatives would involve the type of activities that have the potential to cause effects to historic properties. Specifically, the build alternatives would directly involve the northbound I-5 Columbia River Bridge, which is a National Register-listed historic property, as well as other National Register-listed or -eligible historic resources.

Section 106 requires that “consulting parties” be included in decisions regarding eligibility for listing on the National Register and as findings of effect (see sidebar). The section 106 consulting parties identified by FHWA and FTA for the CRC project include:

#### **TERMS & DEFINITIONS**

##### **Consulting Party**

Section 106 requires that “consulting parties” be involved in all findings of effect and determinations of eligibility during the section 106 process. These consulting parties include the State Historic Preservation Offices (SHPOs), federally and non-federally recognized tribes, local government, and the public.

- Chinook Tribe
- City of Portland
- City of Vancouver
- Confederated Tribes and Bands of the Yakama Nation, Washington
- Confederated Tribes of the Grand Ronde Community of Oregon
- Confederated Tribes of the Siletz Reservation, Oregon
- Confederated Tribes of the Umatilla Reservation, Oregon
- Confederated Tribes of the Warm Springs Reservation of Oregon
- Cowlitz Indian Tribe, Washington
- National Park Service (NPS)
- Nez Perce Tribe of Idaho
- Oregon State Historic Preservation Office (SHPO)
- Spokane Tribe of the Spokane Reservation, Washington
- Vancouver National Historic Reserve Trust
- Washington Department of Archaeology and Historic Preservation (DAHP)

Information about the project’s consideration of historic properties, excluding sensitive archaeological resources, was discussed publicly through the project’s public involvement program. These discussions occurred in the project’s conceptual alternative development and evaluation phases.

### **36 CFR 800.4 THROUGH 36 CFR 800.6 – IDENTIFICATION OF HISTORIC PROPERTIES, ASSESSMENT OF ADVERSE EFFECTS, AND RESOLUTION OF ADVERSE EFFECTS**

#### **Determine Scope of Identification Efforts**

The CRC project team coordinated with the Oregon SHPO, Washington DAHP, the nine consulting tribes, and other section 106 consulting parties listed above to determine the project’s Cultural Area of Potential

Effect (APE). On May 29, 2007, the CRC project team solicited formal input and asked for formal concurrence from Section 106 consulting parties regarding the APE. Comments received were limited, and no revisions to the APE were needed.

The APE was defined as the area that could potentially experience direct or indirect impacts from the range of alternatives that are being advanced for consideration in the DEIS (Exhibit 3.8-1). Because assessment techniques vary by resource type, the CRC project has created three areas of concern within the APE. These areas of concern reflect different boundaries for the historic-period built environment and archaeological resources.

The CRC team held several meetings with the nine consulting tribes, DAHP and SHPO, and others to seek information regarding historic properties. The consulting parties were afforded review opportunities of the technical report and research design, and appropriate modifications were made to these based on comments received. Please refer to the Tribal Consultation section or Appendix A at the end of this document for a more detailed discussion of tribal consultation.

## ARCHAEOLOGY

### Determine Scope of Identification Efforts

The archaeological area of concern within the APE (Exhibit 3.8-2) was developed by making a good faith effort to review and analyze background technical reports and maps regarding the location of formally recorded archaeological sites, and by conducting initial consultations with the section 106 consulting parties, especially tribes, to identify known or potential resource areas and concerns.

The project team hosted a History Seminar on March 20, 2007, with representatives from all nine tribes, the CRC project team, USDOT leadership, state DOT leadership, the National Park Service, and other academics and historians. The purpose of this seminar was to provide the project team, including engineers, transportation planners, and document production staff with the same level of historical context for this project area as the project moves forward in design.

The archaeological area of concern within the APE included all areas within which ground-disturbing impacts might occur, plus a 50 foot buffer of additional land to accommodate potential staging areas. This area of concern includes landforms that date back to the Pleistocene (12,000 years BP). These are landforms that are deeply buried in some parts of the APE.

### Background Research

Background research included a thorough review of existing information on geology, geomorphology, prehistory, ethnography, ethnohistory, history, and archaeology (historic-period and pre-contact) within the APE. This background research is documented in more detail in the Archaeology Technical Report.

Previously recorded archaeological sites were mapped and data about these sites were analyzed. A pedestrian reconnaissance survey was conducted of the existing rights-of-way within the archaeological area of concern in order to characterize ground surface and natural- and human-

Exhibit 3.8-1  
**Cultural Resources  
Area of Potential Effect (APE)**



modified topography. This information was used to develop a probability map that illustrates the likelihood of finding archaeological resources throughout the APE. Consulting parties reviewed the Archaeology Research Design and the Inadvertent Discovery Plan. The Draft Research Design was developed based on guidance in *Archaeology and Historic Preservation: Secretary of Interior's Standards and Guidelines*. The Draft Inadvertent Discovery Plan, developed in consultation with affected tribes, outlines the specific procedures that will be followed to prepare for and manage unanticipated discoveries of cultural resources or human remains; this document will be updated for construction activities. These documents were prepared and reviewed by multiple professional archaeologists and other specialists meeting the Secretary of Interior's professional standards. The APE and each report are designed to be living documents and tools that will be supplemented and modified as needed to reflect new information as it is obtained from ongoing cultural resource investigations.

Information about geotechnical boring samples gathered during previous studies (between 1954 and 2006; see the CRC Archaeology Technical Report for more detail on previous studies) within the Columbia River and North Portland Harbor were analyzed in order to better characterize the subsurface geomorphology and the probable presence or absence of archaeologically sensitive materials.

The CRC project is developing service contracts with interested tribes to participate in monitoring ground-disturbing activities during the project. Further coordination with tribes and their participation in monitoring ground-disturbing activities is expected to help inform further design refinements for any alternative. Potential impacts to traditional cultural properties or sacred sites are not expected to differ substantially between alternatives.

The CRC project collected information in accordance with steps outlined in 36 CFR 800. Background research, including the archaeology probability map and information about known archaeological sites, provided information that helped to disclose potential archaeological impacts for the various alternatives during this phase. For this phase, the background research and pedestrian survey provided sufficient scientific and analytical substance to provide a basis for evaluating the comparative merits of the alternatives, which will inform the selection of a Locally Preferred Alternative (LPA).

The CRC project benefits from the fact that much of the project's APE, especially areas within or adjacent to it, has been archaeologically investigated as part of other projects. These past studies provide a wealth of information regarding appropriate archaeological methods for the area and archaeological resources in the area. For example,

- The Vancouver National Historic Reserve (VNHR) has been extensively investigated by the NPS.
- Previous highway construction projects along I-5 and SR 14 have required archaeological investigations.
- Several archaeological investigations have occurred in downtown Vancouver very near the CRC project.



- Archaeological investigations have occurred at the Delta Park interchange in Oregon.

Exhibit 3.8-2

**Archaeological Area of Concern**

DIMENSIONS ARE APPROXIMATE.

Exhibit 3.8-3

**Historic Built Environment Area of Concern**



This extensive archaeological work allows for a material and substantive understanding of the archaeological context of the area, as well as identifying recorded historic (archaeological) properties, and determining the likelihood of encountering them within the archaeological area of concern. This information, in addition to the initial archaeological research and identification performed by the CRC project team, will assist local decision-makers to make an informed and reasoned decision regarding a locally preferred alternative. Each alternative has been analyzed to a comparable level of detail. If archaeological resources are found during future testing, attempts will be made to avoid these resources through further design refinement.

#### **Next Steps**

The project will continue to follow the steps identified in 36 CFR 800. Depending on circumstances, the following steps may be sequential or concurrent; estimated times to complete are shown in parentheses.

- Non-invasive Ground Penetrating Radar (GPR) to identify subsurface soil anomalies that could indicate the location of potential archaeological features (approximately four months).
- Collect geo-core samples at geotechnical drilling locations to investigate the potential for presence of archaeological resources (approximately four months).
- Monitor geotechnical drilling to identify presence or absence of archaeological resources in the samples (approximately eight months, possibly more).
- Conduct ethnographic/oral histories to assist in identifying historic and archaeological resources important to Native Americans, including, but not limited to, traditional cultural properties (approximately five months).
- Perform pedestrian surveys followed by initial discovery probing (hand excavation) to locate archaeological deposits that may be obscured (approximately seven months).
- Perform subsurface archaeological testing to evaluate the historic significance of archaeological sites identified during previous archaeological investigation steps.
- Assess project effects to National Register-eligible archaeological sites.
- Prepare a Memorandum of Agreement (MOA) for resolution of adverse effects, including those to archaeological sites. The MOA will contain a programmatic element that stipulates and guides how archaeological work will be conducted after the Record of Decision (ROD). The MOA is scheduled to be completed by the Final EIS.

#### **HISTORIC BUILT ENVIRONMENT**

##### **Determine Scope of Identification Efforts**

The historic built environment area of concern within the APE is divided into two subareas: where direct impacts could be expected to occur; or where indirect impacts, could be expected to occur (Exhibit 3.8.3). Indirect impacts could potentially occur in the area identified as being at risk for direct impacts. As currently defined, the direct impact subarea of

the APE extends one block on either side of the project highway and transit alternatives. It starts north of the I-5/Main Street interchange in Washington, and runs to the I-5/Columbia Boulevard interchange in Oregon. North of the river, the APE expands west into downtown Vancouver, and east near Clark College to include potential high-capacity transit alignments and park and ride locations. Within this area, potential effects to the historic built environment could include demolition or displacement of historic properties, noise or visual effects to historic properties due to increased traffic levels, or introduction of new features that compromise the integrity of the property.

The indirect impact subarea of the APE represents the area where indirect impacts, such as development changes, could occur from the proposed alternatives. The study team relied primarily on data from other CRC project technical reports to evaluate indirect project impacts. The indirect impact subarea consists of an area defined by a 0.25-mile radius around each of the potential transit stop sites. Traffic projections, land use, and neighborhood analyses were used to determine the geographic extent of potential indirect impacts.

#### **Background Research**

The CRC project team coordinated with ODOT, WSDOT, Oregon SHPO and Washington DAHP to determine survey requirements. The historic resources team surveyed the direct impact subarea by mapping, photographing, and describing each resource constructed prior to 1967 listed in state SHPO databases or on Section 106 forms. Resources were inventoried using the 1967 construction date to take into consideration resources that would become 50 years old within the time allotted for the project to be constructed. The project team compared the information gathered regarding historic resources with project maps and potential right-of-way acquisitions to determine what resources could be affected.

The project team collected data for this evaluation in phases. During the first phase, the team reviewed existing historic resources surveys and information from Washington DAHP, City of Vancouver, Clark County, Oregon SHPO, City of Portland, National Park Service, local museums, and published research. Additionally, historic maps were reviewed to help establish an understanding of the historic context underlying the historical development of the project area. This information formed the basis for developing the APE and refining methods for the historic property identification step of the project.

#### **Phased Identification and Evaluation (36 CFR 800.4(b)(2))**

The project team concentrated historic resource inventories within the direct impact subarea based on an agreement with DAHP. After completing the field investigations to identify historic properties and evaluating them for National Register eligibility, the project team, in coordination with WSDOT and ODOT, provided DAHP and SHPO with copies of cultural resource forms and database reports for their concurrence regarding the NRHP eligibility of discovered resources. The NPS and the Native American tribes, as consulting parties, were also offered the opportunity to review the Historic Built Environment Technical Report, which included background information and recommendations.

A Section 106 Determination of Eligibility Form for Oregon's only NRHP-eligible property (Pier 99) was verbally concurred with by the Oregon SHPO staff in November 2007, and it is anticipated that the formal, signed concurrence will be completed by or before May 2008.

DAHP's National Register Coordinator and the section 106 review staff are currently reviewing the 870 DAHP historic inventory forms submitted for the Washington Historic Resources Database. DAHP has verbally concurred on the determination of eligibility for all resources potentially affected by the project alternatives, as well as all resources preliminarily determined to be eligible for the NRHP, and is now reviewing forms submitted for unaffected non-eligible resources. The comments from DAHP staff are being incorporated into a final database submittal, which is anticipated to be completed Spring 2008.

Preliminary Section 106 Findings of Effect have been prepared for the affected NRHP properties and it is anticipated that they will be reviewed by Oregon SHPO and Washington DAHP and concurrence completed by May 2008. A Memorandum of Agreement to mitigate for project effects to the historic built environment will be prepared in consultation with ODOT, WSDOT, FHWA, FTA, Oregon SHPO and Washington DAHP by the Record of Decision.

#### TRIBAL CONSULTATION

##### Introduction

The Columbia River Crossing project team has conducted extensive consultation with interested tribes since December 2005. The project's Environmental Manager led the consultation effort until January 2007, when a Tribal Liaison was dedicated to the project. This report summarizes the following:

- Who we are consulting with and why
- Summary of consultation activities to date
- Current/upcoming consultation efforts
- Key tribal concerns
- Tribal meeting record
- Upcoming tribal meetings

##### Who are we consulting with and why?

To determine which tribes to consult with, the CRC project team met with WSDOT and ODOT Tribal Liaisons. They also submitted a formal letter to the Oregon Commission on Indian Services requesting their input, as required by Oregon law. Eight federally recognized tribes and one non-federally recognized tribe were identified through those efforts.

The National Park Service has a list of approximately 35 tribes and tribal organizations that have ancestors buried within Fort Vancouver. The CRC project team sent a letter to each of these tribes to determine if they were interested in consulting on this project. The Spokane Tribe was the only one to respond with a request to be a consulting party. As such, the remaining 34 tribes contacted are not being consulted with on this project. However, if human remains are found on National Park Service property, then the NPS will be the lead for complying with the

Archaeological Resources Protection Act (ARPA) and the Native American Graves Protection and Repatriation Act (NAGPRA). In addition, if human remains are found on property belonging to the US Army Reserve or FHWA, each federal agency will be responsible for complying with ARPA and NAGPRA on their respective properties. If the remains are determined to be post-contact Native Americans, the park service will notify all 35 tribes and tribal organizations of the find.

The following is a list of the nine tribes we are actively consulting with on this project. The Chinook Tribe, which is non-federally recognized, is being consulted as an “additional consulting party” under Section 106 of the National Historic Preservation Act (NHPA). The other, federally recognized tribes consulting on the project have not objected to the participation of the Chinook, and Chinook representatives have participated in intertribal meetings and are included in this report. Each tribe received a formal letter initiating consultation in December 2005.

#### **Federally Recognized Tribes**

- Confederated Tribes and Bands of the Yakama Nation, Washington\*
- Confederated Tribes of the Grand Ronde Community of Oregon
- Confederated Tribes of the Siletz Reservation, Oregon
- Confederated Tribes of the Umatilla Reservation, Oregon\*
- Confederated Tribes of the Warm Springs Reservation of Oregon\*
- Cowlitz Indian Tribe, Washington
- Nez Perce Tribe of Idaho\*
- Spokane Tribe of the Spokane Reservation, Washington

\* *Tribes with court adjudicated treaty fishing rights on the Columbia River, upstream of the project area.*

#### **Non Federally Recognized Tribes**

- Chinook Tribe

The project team is consulting with both the natural and cultural resource offices of each affected tribe, and the team meets periodically with tribal councils and committees, when requested.

#### **Consultation Activities to Date**

The CRC project team has provided the following opportunities for the tribes to consult on the CRC project.

- Initiated consultation with the tribes in December 2005.
- Conducted face-to-face meetings with each tribe (see meeting record below).
- Sent invitations to be participating agencies under SAFETEA-LU to all the tribes in March 2006. The Grand Ronde and Cowlitz Tribes accepted.
- Held several meetings to solicit input on methods for analyzing impacts to resources in the DEIS, which the Cowlitz and Grand Ronde both attended.
- Provided the following products for tribal review:



- Purpose and Need statement
- Methods and data reports
- Range of alternatives
- Area of Potential Effects for section 106
- Tribal consultation plan
- Overwater geotechnical boring plan
- Inadvertent Discovery Plan
- Jurisdictional Wetlands and Waters technical report
- Geology and Soils technical report
- Water Quality technical report
- Geology and Soils technical report
- Hazardous Materials technical report
- Ecosystems technical report
- Acquisitions and Relations technical report
- Historic Resources technical report
- Archaeological technical report
- Draft research design for archaeological discovery field investigations
- Hosted a History Seminar on March 20, 2007, to educate the project team about the important history of the project area. Each tribe sent a speaker to tell their history and experiences in the area. There were also four non-tribal historians who gave presentations on the non-tribal and environmental history of the project area.
- Coordinated with the Grand Ronde tribes (as requested) to participate in the pedestrian archeology survey in July 2007 and to observe cultural resources monitoring for geotechnical borings in February 2008.
- Consulted with 17 tribes and agencies (including FHWA, FTA, NPS, Oregon and Washington SHPOs, WSDOT and ODOT archaeologists) on an Inadvertent Discovery Plan (IDP) for any ground-disturbing activity on the project. Held two intertribal/interagency meeting to review the plan. Consulted on four drafts of the plan before it was “finalized” in October 2007. The plan is being applied to ground-disturbing activities such as testing. This is a living document that the project team, in coordination with the consulting parties, will amend in the future as needed. It will likely be revised before construction.
- Held multi-tribal/agency meetings to discuss preliminary findings for the natural and cultural resource discipline reports.
- Held pre-DEIS meetings with individual tribes between November and January.

- Hosted an intertribal meeting with presentations by the NPS and CRC project team. The purpose of the meeting was to look at detailed archaeological information in relation to the detailed CRC design maps.

#### **Current/Upcoming Consultation Activities**

The following lists known upcoming consultation opportunities. The project intends to consult with the tribes at all project milestones.

- Consult on the DEIS.
- Host a Tribe and Agency Leadership Meeting, modeled after one hosted by the Alaskan Way Viaduct and Seawall Replacement project. The meeting will include the leaders of involved tribes, FHWA, FTA, WSDOT, ODOT, City of Portland, City of Vancouver, National Parks Service, Washington and Oregon Governor's Offices, and others. This meeting occurred on April 1, 2008.
- Develop contracts with tribes to conduct oral history studies for the project area. (Six tribes have expressed an interest. Four tribes have submitted scopes of work. Three tribes have declined).
- Develop service contracts with interested tribes to conduct cultural resource monitoring during ground-disturbing activities on the project.
- Consult on the on-land geotechnical borings plan and associated cultural resources monitoring plan.
- Consult on the biological assessment for the Endangered Species Act.

#### **Key Tribal Concerns and Positions Expressed to Project Team**

The following is a general list of concerns expressed by multiple tribes throughout the consultation process.

- Tribes are concerned about the high probability of disturbing human remains throughout project testing and construction.
- Tribes are concerned about the high probability of disturbing cultural resources and sacred sites throughout project testing and construction.
- Tribes are concerned about potential impacts to fish and other marine life throughout project construction. Substantial impacts to aquatic life could affect treaty fishing rights upstream.
- Tribes want cultural resource monitoring conducted for ground-disturbing work.
- During consultation on the range of alternatives, many tribes stated a preference for the downstream replacement bridge alignment over the upstream replacement bridge alignment because of the upstream alignment's higher probability to disturb human remains and/or cultural resources. The upstream replacement bridge alignment has since been dropped from further consideration.

- During the pre-DEIS meetings, tribes were asked if they were willing to enter into agreements to address disinterment and reburial of remains if found in parts of the project that would be impossible to avoid/design around. The tribes were not willing to enter into advanced decision making agreements because the context of the find will greatly affect the tribes' support or opposition to disinterment (such as how many burials, how old, where they are located, etc.). The tribes are willing to talk about general principles. These are included in the Inadvertent Discovery Plan mentioned in the background research section of Archaeology on the previous pages.

**Tribal Meeting Record**

Unless otherwise noted, the meetings listed in Exhibit 3.8-4 took place at the tribal offices.

Exhibit 3.8-4 (page 1 of 2)

**Tribal Meeting Record to Date**

Date	Tribe	Purpose
11/9/05	Cowlitz Tribe	To introduce the project to the tribe and hear initial concerns about cultural and natural resources in the project area.
12/9/05	Grand Ronde Tribe	To introduce the project to the tribe and hear initial concerns about cultural and natural resources in the project area.
2/21/06	Umatilla Cultural Resources Sub-Committee	To present initial baseline cultural resource information to the sub-committee and introduce the project.
3/3/06	Grand Ronde Tribal Council	To discuss the project and Tribal Council involvement.
3/7/06	Nez Perce Natural Resource Sub-Committee	To present initial baseline natural resource information to the sub-committee and introduce the project.
3/14/06	Umatilla Natural Resources Sub-Committee	To present initial baseline natural resource information to the sub-committee and introduce the project.
5/17/06	Spokane Tribe	To present initial baseline cultural resource information and introduce the project.
9/28/06	Intertribal Meeting (Yakama, Grand Ronde, Cowlitz and Siletz staff attended) (Portland)	To discuss preliminary screening findings for natural and cultural resources.
11/3/06	Intertribal Meeting (Yakama, Grand Ronde, Spokane, Nez Perce, Cowlitz and Siletz staff attended) (Portland)	The tribes wanted a chance to discuss how they will coordinate amongst themselves.
12/05/06	Nez Perce Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/4/07	Grand Ronde Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/8/07	Cowlitz Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/24/07	Umatilla Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/25/07	Warm Springs Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
2/5/07	Yakama Nation	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.



Exhibit 3.8-4 (page 2 of 2)

Date	Tribe	Purpose
2/27/07	Intertribal/Interagency cultural resources meeting (Portland)	The purpose of the meeting was to discuss: <ul style="list-style-type: none"> <li>▪ Inadvertent discovery plan</li> <li>▪ Scope of work for archaeology survey</li> <li>▪ Introduce the cultural resources consultant and archaeological consultant to the tribes</li> </ul>
3/1/07	Siletz Tribe	Project update; Recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
3/20/07	Intertribal/Interagency Seminar (Chinook, Cowlitz, Grand Ronde, Nez Perce, Siletz, Spokane, Umatilla, Warm Springs, Yakama attended) (Vancouver)	History Seminar. Give the project team and its partners an opportunity to learn about the important and diverse history of the project area.
3/22/07	Columbia River Intertribal Fish Commission	Project introduction; consultation approach.
6/5/07	Intertribal Meeting (Cowlitz, Umatilla cultural resources staff attended). (Vancouver)	Discuss human remains examination protocols with tribes.
7/24/07	Intertribal/Interagency Meeting (Grand Ronde tribe attended). (Portland)	Interagency meeting to discuss the natural resources discipline reports.
8/6/07	Intertribal/Interagency Meeting (Umatilla Tribe called in. Difficulty with phone system prevented Grand Ronde from participating). (Portland)	Interagency meeting to discuss the cultural resources discipline reports.
9/10/07	Intertribal/Interagency Meeting (Cowlitz Tribe attended). (Vancouver)	Interagency meeting to discuss the cultural resources discipline reports.
9/27/07	Intertribal/Interagency Meeting (Cowlitz and Grand Ronde staff attended). (Vancouver)	Interagency meeting to discuss the natural resources technical reports.
10/15/07	Grand Ronde Tribe	Discuss the possibility of contracting with Grand Ronde to conduct an oral history study.
11/19/07	Cowlitz Tribe	Provide a project update, discuss the DEIS, technical report findings.
11/20/07	Grand Ronde Tribe	Provide a project update, discuss the DEIS, technical report findings.
12/4/07	Umatilla Tribe, Cultural Resources Subcommittee	Provide a project update, discuss the DEIS, technical report findings.
12/5/07	Warm Springs Tribe	Provide a project update, discuss the DEIS, technical report findings.
12/17/07	Spokane Tribe	Provide a project update, discuss the DEIS, technical report findings.
12/18/07	Nez Perce Tribe	Provide a project update, discuss the DEIS, technical report findings.
1/8/08	Chinook Tribe, Cultural Resource Committee	Project introduction; Discuss the DEIS, technical report findings.
1/22/08	Affiliated Tribes of Northwest Indians Conference. Culture and Elder's Committee	Project introduction, discuss tribal consultation approach and the DEIS.
3/13/08	CRC/NPS Intertribal Cultural Resources meeting (Cowlitz, Grand Ronde, Spokane, Warm Springs and Yakama attended) (Vancouver)	Review detailed archaeological information in relation to the detailed CRC design maps.

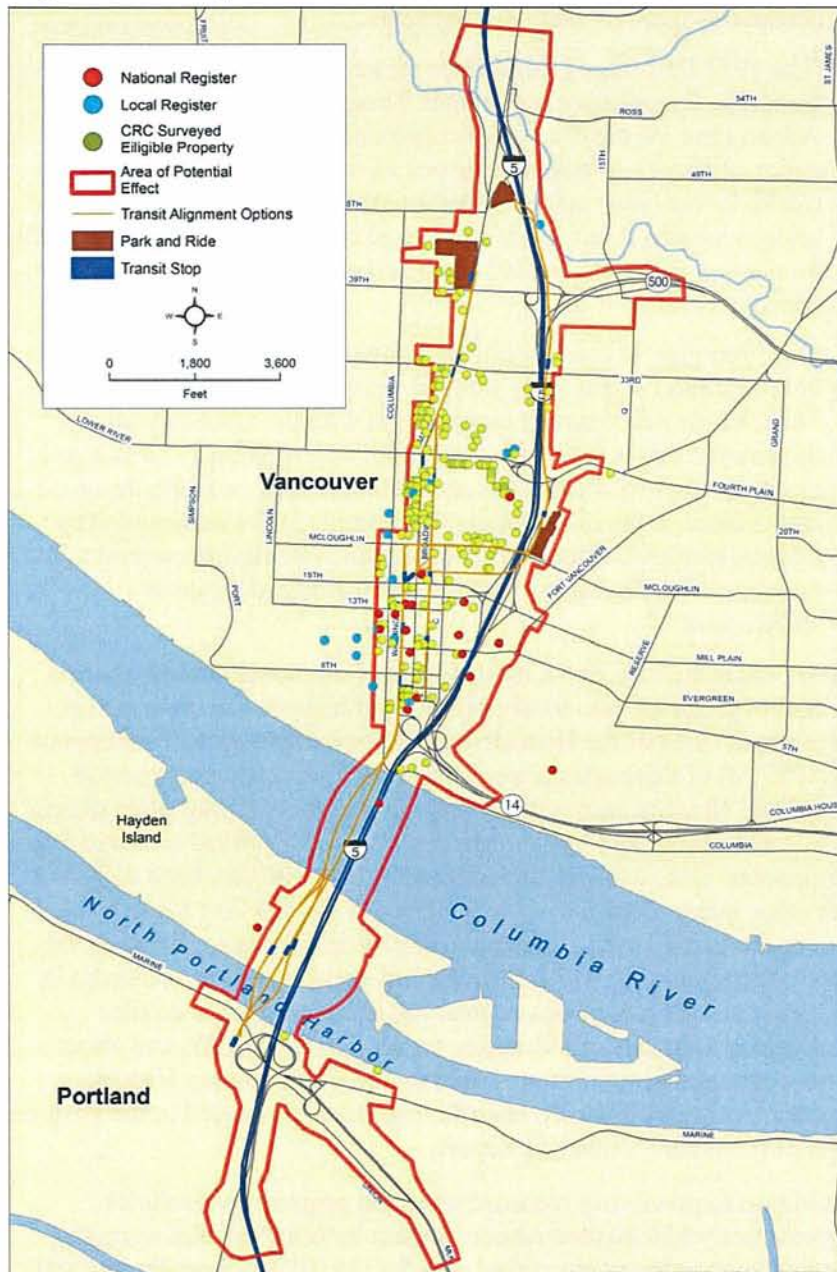
### 3.8.2 Existing Conditions

#### Historic Buildings, Sites, and Resources

Of the approximately 870 resources constructed prior to 1967 surveyed by the CRC project team, approximately 218 were preliminarily identified as NRHP-listed or are considered eligible for listing. Nationally and locally registered historic properties, as well as the eligible historic resources within the APE are mapped in Exhibit 3.8-5. This exhibit provides a general picture of the distribution of historic resources throughout the project area. More detailed maps can be found in the Historic Built Environment Technical Report. Appendix E at the end of this document contains a list of all of these resources.

Exhibit 3.8-5

#### Registered and Eligible Historic Resources Within the APE



Source: CRC Historic Built Environment Technical Report.

Very few previously inventoried historic resources are located within the APE in Oregon. Only four resources have been previously identified as a Portland Historic Landmarks or NRHP-listed or eligible. They include:

- The NRHP-listed Carrousel located at Jantzen Beach.
- Waddles restaurant (now Hooters), which is no longer considered a Portland Landmark because of recent alterations.
- The Columbia Slough and Levee System, which was determined eligible on July 22, 2005, for the Multnomah County Drainage District No. 1 by the Oregon SHPO as contributing elements of the Columbia Slough Drainage Districts Historic District (CSDDHD). The CSDDHD is a group of four geographically contiguous Columbia Slough drainage districts that are located on the Columbia River floodplain between the Willamette River and the Sandy River, occupying approximately 10,000 acres.
- The 1917 I-5 bridge (northbound structure), which crosses the Columbia River between Portland, Oregon and Vancouver, Washington. At the time of its construction, it was considered a major engineering feat and was one of the largest bridges in the world. It was listed on the NRHP in 1982. It is now part of two bridges located side by side and joined by a common foundation; this foundation was added in 1958, when the northbound structure was added. (Exhibit 3.8-6).
- The 1960 Pier 99 commercial building (originally called the Totem Pole Marina) has not been previously identified as NRHP-eligible. The CRC project team, in consultation with the OR SHP has determined that it is NRHP-eligible for two reasons: (1) it is a good example of a Mid-Century Modern Commercial building designed and constructed in the “Googie” style, and (2) it was designed by Oregon architect, John Storrs, whose innovative designs were a important contribution to the Northwest Regional style of architecture.

Exhibit 3.8-6

**The 1917 Bridge and Ferry**

DAHP, Clark County, and City of Vancouver records contain historic site record forms for previously inventoried historic resources in the direct impact area of the Historic Built Environment area of concern of the APE. All of these sites were occupied during the historic period (more than 50 years ago) or were related to activity taking place during the historic period, and some of these sites have historical archaeological components. One, the Fort Vancouver Historic Site, has been combined with other major elements of the VNHR to form the Fort Vancouver National Register District. Seventeen other properties are listed on the NRHP, including the 1917 I-5 bridge and various historic resources in the Vancouver-Fort Vancouver area. All of the properties on the Washington State Historic Register are also on the NRHP, and about a dozen additional properties are listed on the Clark County Historic Register. A list of all known historic resources is included in the Historic Built Environment Technical Report.

In addition to previously recorded sites, the project area includes approximately 850 historic resources built before 1967 that were not previously inventoried or entered into the DAHP database. Project staff evaluated the buildings using NRHP criteria and determined that there



are approximately 218 historic properties in the direct impact subarea of the Historic Built Environment area of concern that are eligible for listing on the NRHP. Areas of concentration are located in the downtown Vancouver commercial core and Uptown Village, and include the area containing residential buildings adjacent to the project in the Esther Short, Arnada, Hough, Carter Park, Rose Village, and Shumway neighborhoods. All surveyed historic resources (both eligible and not eligible) are being entered into the DAHP Historic Property Inventory database.

The Vancouver National Historic Reserve (VNHR), located east of downtown Vancouver on the east site of I-5, is cooperatively managed by the National Park Service (NPS), City of Vancouver, U.S. Army, and Vancouver National Historic Reserve Trust. This resource encompasses 366 acres, and contains the following cultural and historic resources:

- VNHR Historic District (Exhibit 3.8-7) was designated in 2007 for the NRHP, and included 252 acres the westernmost portion of the VNHR that contains both contributing and non-contributing resources.

Exhibit 3.8-7

**VNHR Historic District****Vancouver National Historic Reserve (VNHR) Historic District**



Exhibit 3.8-8  
Fort Vancouver Bastion



- Fort Vancouver National Historic Site, including the reconstructed fort (see Exhibit 3.8-8 for the bastion), adjacent Fort Vancouver Village (“Kanaka” Village), and the Parade Ground
- Officers Row and the Vancouver Barracks, including the Barracks Post Hospital
- Pearson Air Field (the oldest operating airfield in the United States) and Pearson Air Museum (home of the second oldest wooden hangar in the United States)
- Columbia River Waterfront
- The Water Resources Education Center

The Vancouver National Historic Reserve is a complex cultural landscape. Use and occupation of the land now within the Reserve by Native Americans, the Hudson’s Bay Company, the U.S. Army, and the NPS has influenced and reflected the history of the Pacific Northwest region. Over one million visitors come to the Reserve each year to explore this physical link to the past.

### Archaeological Sites and Resources

Previous archaeological research has demonstrated the presence of Native American settlements along the Columbia River spanning at least the last 3,500 years. This includes research completed by specialists outside the CRC project, but within or adjacent to the APE. There has been extensive discovery, testing and recovery conducted in the APE, including area in the Vancouver National Historic Reserve and on the west side of I-5 in Vancouver. The breadth of available data from these past activities exceeds the level of such data typically available during this phase in the NEPA process, and has helped inform the identification and screening of alternatives as well as the conceptual design of the current range of alternatives. These studies have also helped establish a context and framework for how the project archaeological specialists, through consultation, have and will continue to conduct archaeological research, including field methodologies, and what might be encountered in different locations.

### REGIONAL HISTORY

The CRC project area is located within the Lower Columbia River Valley, which has long been recognized as a pivotal area in Pacific Northwest prehistory. As used here, the term Lower Columbia refers to that portion of the valley extending downstream from The Dalles to the Pacific Ocean. As a near-sea-level connection between the interior Columbia Plateau and the coastal lowlands of western Oregon and Washington, the Lower Columbia served as a route of transmission for populations, cultural traits, and trade throughout prehistory.

### Pre-Contact Development

At the time of Euro-American contact, the shores of the Lower Columbia River were occupied by Chinookan peoples. A review of linguistic and ethnographic information indicates that the CRC project area falls along the boundary between groups that spoke different dialects of the Upper Chinookan language. The groups downstream, notably in the concentration of villages on Sauvie Island and the adjacent mainland on

both sides of the Columbia, spoke the Multnomah dialect. The groups upstream on the Columbia around the Cascades and at The Dalles, as well as those at Willamette Falls on the Willamette River, spoke the Kiksht dialect.

On the south (Oregon) shore of the Columbia River, the closest identified village upstream from the CRC project area is *Neerchokioo* just below the last island in the Government Island chain. The closest identified village downstream from the CRC project area is *Waksin* at the mouth of the Willamette River.

The primary ethnographic sources seem to indicate the existence of a long gap in the distribution of villages on the north (Washington) shore of the Columbia River in the CRC project area vicinity (e.g., Hajda 1984:85; Silverstein 1990:534). The closest identified village upstream from the CRC project area is *Washuhwal* at present-day Washougal. The closest identified village downstream from the CRC project area is *Wakanasisi* nearly opposite the mouth of the Willamette River below Vancouver.

No pre-contact archaeological sites have been identified on the south shore of the Columbia River within the CRC project APE. No pre-contact Indian villages were noted by the Lewis and Clark expedition in the CRC project area, nor has any present day research identified any.

#### Historic Period Development

In 1825, dramatic changes occurred for the Indians residing near the confluence of the Willamette and Columbia rivers. Executives administering the Hudson's Bay Company concluded that they needed a site better suited to their economic objectives than Fort George (formerly Fort Astoria) at the mouth of the river. Under the leadership of Dr. John McLoughlin, Chief Factor, the company initiated construction of Fort Vancouver.

The fort soon became a commercial depot at the crossroads of the Pacific Northwest and the site of disparate enterprises. The setting on the north bank of the Columbia—in the midst of a Native American population—underwent rapid transformation (Rich 1959:606- 655).

Construction and operation of Fort Vancouver inaugurated a little more than twenty years of trade opportunities for the Indians of southwestern Washington and northwestern Oregon. The company constructed and operated an "Indian Trade Shop" inside the fort's stockade. This facility received furs from visiting Indians and exchanged a variety of material goods: beads, clothing, blankets, tools, foods, and other items. The building, as identified in 1845, measured 80 by 32 feet, confirmation that trade relations with regional tribes were an important part of the company's enterprise (Hussey 1957:189-190).

Several tribes engaged in the trade at Fort Vancouver. The local Upper Chinookans, Cowlitz, and Kalapuyans of the Willamette Valley were important customers. The Klikitats, outfitted with horses and eager to travel via a trail through the Western Cascades into the Lewis River watershed, were another important trade partner. A number of Klikitats by the 1830s settled in the vicinity of Fort Vancouver, an event

## Historical and Pre-Historic Archaeology

In the Pacific Northwest, **historical archaeology** dates from after the beginning of Euro-American settlement of the area.

**Pre-historic or Pre-contact archaeology** dates from before this time, and generally concerns sites associated with Native American peoples, culture, and settlements, and encompass both Native American and Euro-American settlements.

documented in Catholic sacramental registers and in enrollment of Klikitat children in the post school.

The Fort Vancouver Village ("Kanaka" Village) was one of the largest settlements in the West during its time. Housing the workers and their families, and the fur brigades when they returned from their expeditions, the population of the Village exceeded 600 people. The Village was culturally, home to area natives, Cree people, people with a French Canadian and Iroquois background, native Hawaiians, Scots, etc.

During the late 1840s and early 1850s, there was a shift away from the fur trade, toward a more diversified mercantile exchange. The numbers of Hawaiian employees increased, leading to the Village being known as "Kanaka Town," or "Kanaka Village," referring to the Hawaiian word for "person." During the last few years, NPS and WSDOT archaeologists conducted survey level archeological work to identify the location of the houses located in the Fort Vancouver Village ("Kanaka" Village).

### ARCHAEOLOGICAL EVIDENCE

As described above, evidence of pre-contact Native American occupation is present in the CRC project vicinity on the north shore of the Columbia River in Washington. To date, no archaeological investigations have uncovered evidence of pre-contact Native American occupation on the south shore of the Columbia River in Oregon within the APE.

A study of the geology and geomorphology of the Oregon south shore helped to identify ancient and modern landforms on which archaeological resources may be preserved, many of which are deeply buried. The temporal focus of this study was on the last 12,000 years. This date coincides with the estimated age of the last of the Missoula Floods, which were responsible for creating much of the modern landscape in the Lower Columbia Valley. Archaeological evidence greater than 12,000 years old is unlikely to be encountered in the CRC project area. Advance testing of the landforms identified as having the potential for supporting archaeological remains will help ensure that important archaeological resources will not be inadvertently damaged or destroyed during CRC project construction. This will occur in the upcoming discovery phase.

The CRC APE on the Oregon shore includes the I-5 corridor from the Columbia River south approximately to Victory Boulevard. From the Columbia River shoreline, the APE crosses Hayden Island, North Portland Harbor, and extends southward for approximately 0.75-mile on the south shore flood plain.

Hayden Island is separated from Vancouver by the main channel of the Columbia River and from Portland by North Portland Harbor. Both channels have been subject to extensive dredging and channel modifications to improve navigability. Hayden Island is named for the Hayden family, which settled there in 1851 and established a short-lived farm on the north shore. Over the years this island has been referred to as "Image Canoe Island," "Menzie's Island," "Vancouver Island," "Shaw's Island," and "Hayden's Island." Much if not all of Hayden Island was inundated every year or two by spring floods. The eastern (upstream) end

of Hayden Island, in which the CRC APE is situated, appears on historic maps as a shoal, suggesting it formed in the relatively recent past.

Today, this eastern portion of Hayden Island is highly developed, with hotels, shopping centers, residential communities, and other commercial activities. Likewise, most of the south shore flood plain adjacent to the I-5 corridor has been substantially altered from its natural state by agricultural, industrial, and urban developments. While upland, riparian, and wetland natural areas still exist on the south shore flood plain, recent developments have substantially reduced the visibility of any archaeological resources in the CRC APE on the Oregon shore.

No evidence of pre-contact Native American occupation has been found in the Oregon portion of the APE via archaeological investigations, although pre-contact archaeological sites have been found in similar locations in other places along the Columbia. The closest recorded site is a small charcoal and fire-cracked rock feature about one-half mile west of I-5. Seasonal flooding on the Oregon shore in the CRC project area made permanent settlements unlikely. To date, Native American burials have not been encountered during any excavations on the south shore floodplain. Nonetheless, during the course of the CRC project, representatives of Tribal consulting parties have expressed general concern about possible Native American burials on Columbia River islands, such as Hayden Island.

The CRC APE in Washington encompasses the I-5 corridor as it extends from the Columbia River northward through the intensively developed city of Vancouver, with the Vancouver National Historic Reserve (VNHR) to the east, and the business district and adjacent residential neighborhoods on the west and north. Just north of the Columbia River, the BNSF railroad extends east-west across the APE, and the intersection of SR 14 and I-5 is immediately north of the Columbia River on the northeast side of the APE. In contrast to the Oregon shore, the environmental setting in the CRC APE on the Washington shore of the Columbia River has been relatively stable over the last 12,000 years.

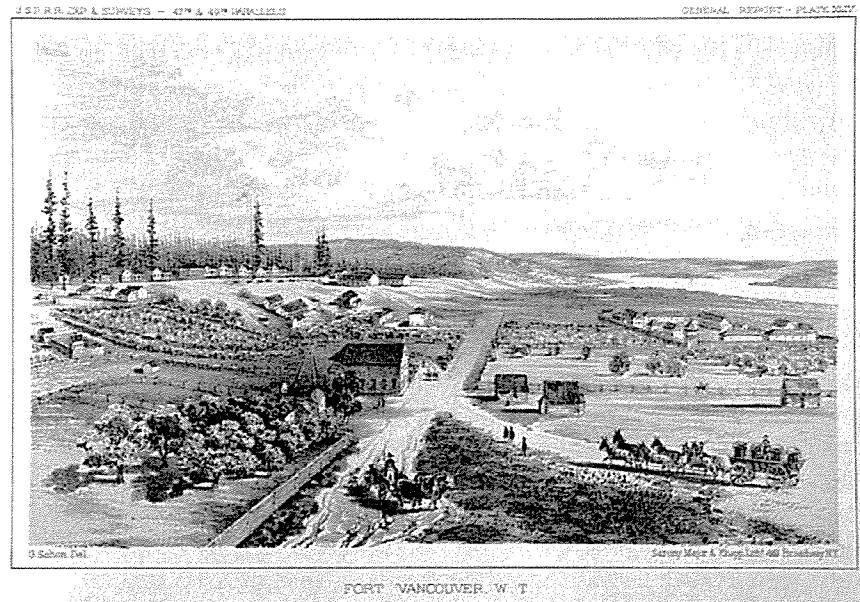
Research was conducted at the Washington DAHP to identify previously recorded archaeological sites in the CRC APE. Review of the DAHP records resulted in identification of 11 archaeological sites, including one landscape feature (with an underlying archaeological component) within the CRC APE.

These include sites associated with the early history of Fort Vancouver, first constructed in 1829 (see Exhibit 3.8-9). An extensive multicultural settlement known as the Fort Vancouver Village (“Kanaka” Village) was located along the southwest side of the Fort near the present day SR 14 interchange. In 1849, the U.S. Army established Vancouver Barracks here. Related archaeological deposits could be located in the present day Mill Plain interchange. This post expanded over the years and was one of the most important military installations in the Pacific Northwest during the late nineteenth and early twentieth centuries.



## Exhibit 3.8-9

## Early Rendering of Fort Vancouver Settlement



Source: Thomas and Hibbs, 1984.

Beginning in the 1850s, the City of Vancouver started developing west of the Fort. The earliest settlement and development occurred in the area immediately west of modern-day I-5. Recent historical archaeological investigations in the oldest portions of the city have potential to shed light on the early development of Vancouver. See the CRC Archaeology Technical Report for more information regarding these investigations.

In Washington, evidence of precontact cemeteries has not been identified, although during the 1958 construction of I-5 potential burial sites of unknown age were reportedly observed, but not documented in technical reports.<sup>29</sup>

### 3.9.3 Long-Term Effects from Project Alternatives

The following tables and associated discussion outline the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of any project alternative. A project alternative contains three physical components: 1) a river crossing and associated highway improvements, 2) a high-capacity transit mode, and 3) a transit terminus.

#### Alternative 1: No-Build

The No-Build Alternative would not result in direct effects to any NRHP-listed or eligible historic resources, although the substantial traffic congestion along the I-5 corridor expected with No-Build could affect overall community livability, and in turn, the viability of maintaining each community's historic fabric.

<sup>29</sup> Thomas and Friedenborg, 1998.

The No-Build Alternative would not have any effects to historic or pre-historic archaeological resources.

### Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.8-10 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 2, as paired with any of the possible transit terminus options.

Exhibit 3.8-10

#### Historic and Archaeological Resources Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Number of NRHP-listed or eligible historic resources potentially impacted	10 to 14	13	9 to 13	8
Total area acquired from NRHP-listed or eligible historic resources (acres)	3.12 to 4.15	3.21 to 4.21	2.64 to 3.68	2.64 to 3.64
Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources	6 to 8	8	5 to 7	5
Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation	7 to 12	12 to 13	7 to 12	5
Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated	0 to 5	1 to 8	0 to 5	0 to 4
Potential to impact archaeological historic properties	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.

Note: The impacts with the STHB option for the river crossing would be the same as shown above.

Alternative 2 could potentially affect between 8 and 14 resources listed or eligible for the NRHP, depending on the transit terminus and alignment options chosen. Of these impacts, 5 to 8 are expected to be adverse. Washington DAHP and Oregon SHPO are in the process of reviewing these preliminary findings of effect. Between 2.64 and 4.21 acres listed or eligible properties could be impacted.

Alternative 2A or 2C would result in the same number of potential impacts to historic resources as a result of noise (seven to 12 resources impacted) and access (zero to five resources impacted). Alternative 2B would result in the highest number of noise (12 to 13) and access (one to eight) impacts, while Alternative 2D would have the fewest noise and access impacts.

The left-loop SR 14 interchange option with Alternative 2 would have an adverse effect to the integrity of the aesthetic setting of some historic properties in downtown Vancouver. Because of its greater size, mass, and height, the left loop option would have a more intrusive effect to the resource's aesthetic integrity of setting than would the dual loop option. The specific interchange designs are a design detail that will be decided before the FEIS is published and after the later phases of the archaeological investigation are completed for this area.

Alternative 2 could potentially affect historic as well as potential precontact archaeological resources in Washington. All terminus options have a high potential to impact historical archaeological sites associated with downtown Vancouver as well as precontact archaeological resources adjacent to the shoreline.

Under Alternative 2A, there would be a high potential to impact 0.36 mile of high probability areas for precontact resources along the Burnt Bridge Creek drainage and 1.68 miles of medium to low probability north of downtown Vancouver. Under Alternative 2B, there would be an additional 1.24 miles of bus rapid transit line which could potentially impact archaeological resources north of downtown Vancouver. Alternative 2C, could potentially impact an additional 0.6 mile of bus rapid transit lines in medium to low probability areas north of downtown Vancouver. Alternative 2D potential impacts extend only to downtown Vancouver.

### **Alternative 3: Replacement Crossing with Light Rail**

Exhibit 3.8-11 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 3, as paired with any of the possible transit terminus options.

Exhibit 3.8-11

**Historic and Archaeological Resources Effects Summary for Alternative 3**

<b>Alternative 3: Replacement Crossing with Light Rail</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Number of NRHP-listed or eligible historic resources potentially impacted</b>	10 to 14	13	9 to 13	8
<b>Total area acquired from NRHP-listed or eligible historic resources (acres)</b>	2.77 to 3.80	3.21 to 4.21	2.64 to 3.68	2.64 to 3.64
<b>Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources</b>	6 to 8	8	5 to 7	5
<b>Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation</b>	11	10	11	5
<b>Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated</b>	0 to 6	1 to 9	0 to 6	0 to 5
<b>Potential to impact archaeological historic properties</b>	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.

Note: The impacts with the STHB option for the river crossing would be the same as shown above.

The number of NRHP-listed or eligible historic resources potential impacted and potentially adversely impacted by Alternative 3 is the same as those potentially impacted by Alternative 2. Between 2.64 and 3.80 acres listed or eligible properties could be impacted with Alternative 3.

Alternative 3A and 3C would result in the same number of potential impacts to historic resources as a result of noise (11 resources impacted) and access (zero to six resources impacted). Alternative 3B would result in slightly fewer noise impacts (11) and slightly more access impacts (one to nine), while Alternative 3D would have the fewest noise and access impacts.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Exhibit 3.8-12 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 4, as paired with any of the possible transit terminus options.



Exhibit 3.8-12

**Historic and Archaeological Resources Effects Summary for Alternative 4**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
Number of NRHP-listed or eligible historic resources potentially impacted	9 to 13	12	8 to 12	7
Total area acquired from NRHP-listed or eligible historic resources (acres)	1.46 to 1.49	1.55	0.98 to 1.02	0.98
Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources	6 to 8	8	5 to 7	6
Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation	8 to 13	13 to 14	8 to 13	6
Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated	1 to 6	2 to 9	1 to 6	1 to 5
Potential to impact archaeological historic properties	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.

Alternative 4 could potentially affect between seven and 13 NRHP-listed or eligible resources, depending on the transit alignment and chosen. Between 0.98 and 1.55 acres of listed or eligible properties could be impacted. Of these impacts, between five and eight are expected to be adverse, though Washington DAHP and Oregon SHPO are in the process of reviewing these preliminary findings of effect.

Alternative 4A and 4C would result in the same number of potential impacts to historic resources as a result of noise (eight to 13 resources impacted) and access (one to six resources impacted). Alternative 4B would result in some more noise impacts (13 to 14) and slightly more access impacts (two to nine), while Alternative 4D would have the fewest noise and access impacts.

Potential impacts to historic and potential precontact archaeological resources would be the same as Alternatives 2 and 3, because the terminus and alignment options are the same.

**Alternative 5: Supplemental Crossing with Light Rail**

Exhibit 3.8-13 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 5, as paired with any of the possible transit terminus options.

Exhibit 3.8-13

**Historic and Archaeological Resources Effects Summary for Alternative 5**

<b>Alternative 5: Supplemental Crossing with Light Rail</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Number of NRHP-listed or eligible historic resources potentially impacted</b>	9 to 13	12	8 to 12	7
<b>Total area acquired from NRHP-listed or eligible historic resources (acres)</b>	1.11 to 1.14	1.55	0.98 to 1.02	0.98
<b>Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources</b>	6 to 8	8	5 to 7	6
<b>Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation</b>	11	10	11	5
<b>Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated</b>	1 to 7	2 to 10	1 to 7	1 to 6
<b>Potential to impact archaeological historic properties</b>	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.

The number of NRHP-listed or eligible historic resources potentially impacted or potentially adversely impacted by Alternative 5 is the same as those potentially impacted by Alternative 4. Between 0.98 and 1.55 acres listed or eligible properties could be impacted with Alternative 5.

Alternative 5A and 5C would result in the same number of potential impacts to historic resources as a result of noise (11 resources impacted) and access (one to seven resources impacted). Alternative 5B would result in slightly fewer noise impacts (10) and slightly more access impacts (two to 10), while Alternative 5D would have the fewest noise and access impacts.

### 3.8.3 Long-term Effects from Project Components

This section describes the effects of the project components and various. The operational components (tolling scenarios, transit operations, and transportation demand and system management measures) would not affect cultural resources and are therefore not discussed in detail below.

### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

#### Historic Buildings, Sites, and Resources

Exhibit 3.8-14 summarizes potential effects of the river crossing and highway improvements to NRHP-listed or eligible historic resources. Maps illustrating these impacts can be found in Chapter 5, Draft Section 4(f) Evaluation.

Exhibit 3.8-14

#### Direct Impacts to NRHP-Listed and Eligible by River Crossing and Highway Improvements

Location	Description	Date	NRHP	River Crossing Option	Potential Impact	Preliminary Finding of Effect <sup>a</sup>
Marine Drive	Pier 99	1960	eligible	replacement or supplemental	Demolition/Relocation (20593 sq ft)	Adverse
Interstate 5	Northbound I-5 bridge	1917	listed	replacement or supplemental	Demolition or major seismic retrofits and compromised setting	Adverse
North Portland Harbor	Oregon Slough Levee	1916-60	eligible	replacement or supplemental	No known impact from pier placement	No Adverse
Vancouver National Historic Reserve	Historic District	2007	listed	replacement or supplemental	Impacts to the following contributing resources: Old Apple Tree Park, Pearson Field, Barracks Hospital, and Officers Row (75359 to 117612 sq ft)	Adverse
411 E Evergreen	Kiggins House	1907	listed	replacement only	Demolition/Relocation if not moved by other project prior to CRC (2424 sq ft)	Adverse
400 E Evergreen	Providence Academy	1873	listed	replacement only	Partial acquisition without displacement (11923 sq ft)	Adverse

Location	Description	Date	NRHP	River Crossing Option	Potential Impact	Preliminary Finding of Effect <sup>a</sup>
3000 K St	Residence	c. 1915	eligible	replacement	Partial without displacement (505 sq ft)	No Adverse
				supplemental	Demolition/Relocation of garage (1481 sq ft)	Adverse
3110 K St	Residence	c. 1910	eligible	supplemental	Partial acquisition w/b displacement; setting compromised (847 sq ft)	Adverse

Source: CRC Historic Built Environment Technical Report.

<sup>a</sup> Preliminary findings of effect are being reviewed by the Washington DAHP and Oregon SHPO.

The existing NRHP-listed northbound I-5 bridge would be completely removed as a result of the replacement crossing. The supplemental crossing would likely also affect the bridge's historic integrity, as seismic retrofits would enlarge the bridge piers substantially and alter the trusses and lift towers. Adding the supplemental bridge adjacent to the historic structure would visually intrude upon it. This crossing would have less harm than removing the historic bridge.

Both the supplemental and replacement river crossings would result in the displacement of Pier 99 near the Marine Drive interchange.

The parcel on which the Providence Academy is located would be affected by the widening of I-5 and the Evergreen Boulevard overpass, but this would not displace any of the buildings on the campus.

The VNHR Historic District has been preliminarily determined to be adversely affected by both river crossings. Impacts to any of the contributing resources within the District are therefore part of that preliminary determination of adverse effect. Effects to the historic built environment within the District include the construction vibration and visual setting of the Barracks Hospital (both river crossings), small acquisitions from the most western parking lot of Officer's Row (replacement river crossing), minor acquisitions or potential shading of the Old Apple Tree Park (replacement river crossing), and minor obstructions to Pearson Field's airspace (supplemental river crossing).

The impact to the Barracks Hospital would likely be considered an adverse impact because without mitigation the vibration impacts during construction may damage the unreinforced masonry structure. Additionally, the proximity of the proposed freeway would negatively impact the visual setting by removing existing and planned buffer areas. The acquisition impacts to Officers Row and the Old Apple Tree Park (Exhibit 3.8-15), and potential obstructions of Pearson Field's airspace, would be very minor and would not change the characteristics for which

Exhibit 3.8-15  
Oldest Apple Tree in the Pacific Northwest





these resources are considered contributing to the VNHR Historic District,, but these resources are included in the District and are therefore included in the adverse effect to the District.

Noise levels at the VNHR Historic District could decrease with highway sound walls potentially constructed with the highway improvements. This would likely result in a benefit to the two non-commissioned officers duplexes closest to I-5 south of the Barracks Post Hospital, as well as the Hospital itself. Noise levels at these contributing residential units currently exceed impact criteria, and would worsen with the No-Build Alternative. In addition to these benefits, these sound walls could potentially alter the historic setting of the buildings adjacent to the wall.

With both the supplemental and replacement river crossings, noise levels at the Normandy apartments (318 E Seventh Street) and the Fort Apartments (500 E 13th Street) would increase. Sound walls are proposed as a mitigation measure, but would be unable to mitigate the noise impacts on the upper floors of these buildings. The construction of new sound walls would not physically impact either structure.

The replacement crossing could displace the Kiggins House located on the west side of Interstate 5. However, the separately planned Riverwest development project, expected to begin construction in 2008, would require the removal of the Kiggins House before CRC is constructed. That relocation, occurring independent of the CRC project, is anticipated to occur in May 2008.

The highway improvements associated with the supplemental crossing could result in the demolition or relocation of the garage associated with a NRHP-eligible private residence at 3000 K Street, while replacement crossing would result in only a partial acquisition and would not impact the buildings on the property. The supplemental crossing could require a partial acquisition without the displacement of the NRHP-eligible private residence at 3110 K Street.

#### Archaeological Sites and Resources

The proposed roadway footprint for the replacement crossing would move further into the Vancouver National Historic Reserve than the current highway, with potential to affect archaeological sites there. Because it would require less new land, the supplemental crossing would be less likely to affect archaeological resources in this area. Exhibit 3.8-16 illustrates the VNHR and associated Historic Site.

The replacement crossing could have effects on archaeological resources associated with the Vancouver National Historic Reserve including the Fort Vancouver National Historic Site, Heritage Apple Tree, Fort Vancouver Village (“Kanaka” Village) and associated pond, Vancouver Barracks, Quartermaster East, and Benoit site. Ongoing and planned archaeological investigations (as summarized in Section 3.9.1) of the footprint of the proposed river crossings will help to determine the likelihood of project construction encountering these historic archaeological resources. Additionally, further design refinement will work to minimize the possibility of affecting these resources. The supplemental crossing would avoid potential effects to the HBC Pond, Quartermaster East, and Benoit sites. The supplemental crossing effects

to the Vancouver National Historic Reserve and Vancouver Barracks north of Sixth Street would be less than under the replacement crossing.

Exhibit 3.8-16

**Vancouver National Historic Reserve (VNHR)**

DIMENSIONS ARE APPROXIMATE.

Both crossings are likely to affect undiscovered archaeological sites in Vancouver, particularly those that might lie below previously disturbed soils associated with the existing I-5/SR 14 interchange area.

The potential sites for a bridge assembly/casting yard for either crossing are unknown at this time. See Chapter 2, Description of Alternatives, for more information regarding the characteristics of this potential site. However, because the yard would be located adjacent to the water, there is a potential for encountering archaeological resources. Any potential sites would be evaluated for the presence of historic structures, and investigated for potential historic and prehistoric archaeological resources. This will be done in coordination with the Section 106 consulting parties, and will follow the protocols outlined in the CRC Archaeological Research Design Report.

**Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

Light rail could potentially reestablish the early 20th century context of the historic buildings downtown, when streetcars served the area.

Bus rapid transit (BRT) would not reestablish this context and could result in a slightly greater number of potentially adverse noise impacts to NRHP-listed or eligible historic resources along the transit alignments, especially on quieter streets such as 16th, McLoughlin, or Broadway. As illustrated in Exhibit 3.8-17, bus rapid transit could potentially result in noise impacts to between two and seven NRHP-eligible historic resources, while light rail would result in zero to six impacts.

Some of these resources could be eligible for residential sound insulation through FTA, although outside noise levels could remain high, especially with BRT. Potential alterations caused by the sound insulation to the NRHP-listed or eligible historic resources would need go to the Secretary of the Interior Standards for Rehabilitation. See the Noise and Vibration section of this chapter for more information on potential noise impacts as a result of transit.

Exhibit 3.8-17

**Potential Noise Impacts to Historic Resources from Transit**

Mode Responsible for Impact	Transit Alignment Option	Address	Preliminary Finding of Effect <sup>a</sup>
Light rail or BRT	2-way Broadway	2000 Broadway St	Adverse
		2008 Broadway St	Adverse
		2214 Broadway St	Adverse
		2218 Broadway St	Adverse
		2414 Broadway St	Adverse
	McLoughlin	401 E McLoughlin	Adverse
		405 E McLoughlin	Adverse
		501 E McLoughlin	Adverse
		611 E McLoughlin	Adverse
		502 E McLoughlin	Adverse
		510 E McLoughlin	Adverse
BRT only	2-way Broadway	2221 Broadway St	Adverse
		2217 Broadway	Adverse
		111 W 29th St	Adverse
	Broadway-Main Couplet	2000 Broadway St	Adverse
		2008 Broadway St	Adverse
		2214 Broadway St	Adverse
		2218 Broadway St	Adverse
		2414 Broadway St	Adverse
		2221 Broadway St	Adverse
		111 W 29th St	Adverse
	16th Street	1605 F St	Adverse
		604 E 16th St	Adverse
	McLoughlin	700 E McLoughlin	Adverse
BRT (only with Supplemental River Crossing)	2-way Washington or Washington-Broadway Couplet	515 Washington St	Adverse

Source: CRC Noise and Vibration Technical Report.

<sup>a</sup> Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Bus rapid transit could result in a more substantial impact (an additional 0.35 acre) to Kiggins Bowl Park as compared to light rail.

The expansion of either the C-TRAN maintenance facility in East Vancouver or the TriMet Ruby Junction facility in Gresham is not expected to affect any properties that are NRHP-eligible or listed. There is no known evidence of prehistoric activity or occupation at either location. However, expansion of either maintenance facility site could potentially encounter pre-contact or historic archaeological resources.



## Transit Terminus Options (with all Alternatives)

### Historic Buildings, Sites, and Resources

The Kiggins Bowl (A) and the Lincoln (B) terminus options would result in a similar level of impacts to historic resources. As Exhibit 3.8-18 shows, the Lincoln terminus would require acquisitions from four NRHP-eligible properties, two of which could result in adverse effects, as they would require the demolition or relocation of the resource. The Kiggins Bowl terminus could result in acquisition impacts to between two and five NRHP-eligible properties, depending on the transit alignment option chosen. This total also includes a potentially adverse impact to a NRHP-eligible resource at 903 E 31st Street. Exhibit 3.8-18 summarizes potential impacts to NRHP-listed or eligible historic resources as a result of the transit alignments. Maps illustrating these impacts can be found in Chapter 5, Draft Section 4(f) Evaluation.

In addition to the full length terminus options, there are two shorter-length terminus options referred to as minimum operable segments (MOS). The Clark College MOS (C) would avoid the adverse effect to the NRHP-eligible private residence at 903 E 31st Street, as well as a portion of the acquisition impact to Kiggins Bowl Park, but would result in the same acquisition related impacts to between one (16th Street) and five (McLoughlin) NRHP-listed or eligible historic resources.

There would be no transit-related acquisition impacts to NRHP-listed or eligible historic properties by the Mill Plain MOS (D). This MOS may result in potential visual impacts associated with the transit alignment and stations through downtown Vancouver.

Exhibit 3.8-18

**Direct Impacts to NRHP-Listed and Eligible Resources by Transit Terminus Option**

Location	Description	Date	NRHP	Terminus Option	Potential Impact	Preliminary Finding of Effect <sup>a</sup>
1511 Main	Carnegie Library	1909	listed	A and C (16th Street option)	Access impact; Partial acquisition without displacement (50 sq ft)	No Adverse
401 E McLoughlin	Residence/ office	c. 1916	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (378 sq ft)	Adverse
501 E McLoughlin	Residence	c. 1927	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (55 sq ft)	No Adverse
611 E McLoughlin	Residence	c. 1910	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (149 sq ft)	Adverse
502 E McLoughlin	Residence	c. 1900	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (586 sq ft)	No Adverse
510 E McLoughlin	Residence	c. 1910	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (366 sq ft)	No Adverse
903 E 31st St	Residence	c. 1910	eligible	A	Demolition/Relocation (5461 sq ft)	Adverse
Kiggins Bowl Park	Sports Venue	Dedicated 1933	eligible	A, B, C, and D	Partial acquisition (6099 sq ft); additional 15246 sq ft for Kiggins Bowl terminus option with BRT)	No Adverse
2901 Main	Residence/ Office	c. 1915	eligible	B	Demolition/Relocation (454 sq ft)	Adverse
401 33rd St	First United Methodist	1948	eligible	B	Partial acquisition without displacement (3325 sq ft)	No Adverse
3200 Main	Office	c. 1956	eligible	B	Partial acquisition without displacement (660 sq ft)	No Adverse
3212 Main	Office	c. 1960	eligible	B	Partial acquisition without displacement (1892 sq ft)	Adverse
300 E 37th St	Office	c. 1950	eligible	B	Demolition/Relocation (18500 sq ft)	Adverse

Source: CRC Historic Built Environment Technical Report.

<sup>a</sup> Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

All transit terminus options and associated transit stations, if not designed properly, could result in visual impacts that could adversely affect the setting of historic resources. See the CRC Historic Built Environment Technical Report for more information regarding potential visual impacts.

Noise impacts could occur along these alignments which could also adversely affect the setting of historic resources along these alignments. Noise impacts are summarized in the Transit Mode discussion.

Parking and access impacts would likely occur along any of the transit alignments, especially in downtown and uptown Vancouver. These impacts could result in adverse effects to historic resources that occur along the transit alignments. These potential impacts are summarized in the Transit Alignment Options discussion, Section 3.2, and the CRC Historic Built Environment Technical Report.

#### Archaeological Sites and Resources

In Oregon, the proposed transit alignments extend within or close by the existing I-5 corridor across the Columbia River south shore floodplain and Hayden Island. Review of records on file at the Oregon SHPO indicates that no prehistoric archaeological sites have been recorded within the vicinity of the proposed transit alignments. An archaeological survey within the I-5 corridor found no evidence of prehistoric or historical archaeological sites. The project area in Oregon has been subject to substantial alteration, primarily from deposition of fill material, but the geological history suggests there is some potential for the discovery of prehistoric archaeological sites. Due to the fact that little development occurred along the I-5 corridor and vicinity until relatively recently, there appears to be little potential for encountering significant historical archaeological sites within the project area on the Oregon shore.

All areas where transit alignments are proposed in Vancouver have been occupied for more than 50 years. Therefore, there is some potential for historical archaeological remains to be found in these areas. Construction activities within city streets, where the proposed transit alignments are located, generally have not been monitored by archaeologists. Consequently, the extent to which prehistoric and historical artifacts may be found during construction excavations in the streets has not been established. Based on recent investigations by archaeologists at historic buildings sites in Vancouver, however, potential exists for encountering historical archaeological remains during construction along the proposed transit alignments.

On the north shore of the Columbia River, the proposed transit alignments begin west of the I-5 corridor, and extend across a gradually ascending flood plain that appears to have offered little inducement for settlement by prehistoric Native Americans. Review of records on file at the Washington DAHP indicates that no prehistoric archaeological sites have been recorded within or in the close vicinity of the proposed transit alignments. An archaeological survey along the proposed transit alignments found no evidence of prehistoric activity or occupation. Based on current information, there appears to be little potential for encountering prehistoric sites within the transit alignments directly on the Washington shore.

In contrast, as the proposed transit alignments extend northward from the Columbia River through the oldest portion of the City of Vancouver, the potential to encounter historical archaeological resources increases. From initial settlement in the late 1840s and 1850s, the city's business district and adjacent residential areas rapidly developed northward from the river bank into the interior.

The proposed transit alignments extend through established commercial and residential areas. An archaeological reconnaissance undertaken along the alignments confirmed the existence of paved streets and sidewalks which effectively cover any evidence of historic (and earlier prehistoric) activity or occupation. A review of archaeological site records at DAHP indicates that four historical archaeological sites have been recently recorded in the oldest portion of Vancouver, specifically where historic buildings were formerly present within a few blocks of the Columbia River on Main, Broadway, and Columbia.

The proposed transit alignments extend along some of the same streets (e.g., Washington, Broadway) where the earlier railway systems were constructed. Although the rails from the earlier systems were reportedly removed (Freece 1985:43), it is possible that some remains of these historic railway systems may be encountered during construction along the proposed transit alignments. Additionally, the first modern street pavement in Vancouver consisted of Belgian blocks, rectangular stone blocks having several square feet of top surface laid lengthwise to the street (Freece 1985:88). Intact segments of Belgian blocks underlying modern pavement may be considered historically significant and require recording as an historical archaeological resource.

Historically, the edges of city streets were often ill-defined, and foundations or other architectural and/or archaeological features associated with the front portions of former buildings may extend into the current roadways. Depending on the precise location of the transit alignments in relation to the modern streets (i.e., whether in the center or on one side or the other of the roadway), construction may encounter archaeological remains associated with historic buildings.

Before the inception of city-sponsored waste disposal, it was not uncommon for trash to be disposed of simply by being discarded into the street (creating what are known as “sheet middens”), or buried in trash pits adjacent to structures. Consequently, historical artifacts (e.g., fragmentary glass containers, broken domestic ceramics, nails and other hardware, and butchered animal remains) from these discard activities may be found below the pavement of current roadways as well as in utilities trenches (e.g., storm water, sewer, electric lines) encountered during construction excavations for the proposed transit alignments.

In general, there could be fewer overall effects to archaeological resources caused by the two MOS options than the two full length terminus options, as they have smaller construction footprints, and therefore might involve less ground disturbance. However, unlike the other terminus options, the Mill Plain MOS would include new parking facilities in the south downtown area where historic archaeological resources may be located. However, the locations of these proposed park and ride facilities have already experienced a great amount of ground disturbance associated with the construction of the I-5/SR 14 interchange. Therefore, the possibility of finding intact artifacts in this area may be diminished.

There is also a high potential for encountering pre-contact archaeological sites along the Burnt Bridge Creek drainage, which could occur with the



Kiggins Bowl terminus option, but would be avoided by all other terminus options.

### Transit Alignment Options (with all Alternatives)

#### OFFSET OR ADJACENT

Neither the offset nor the adjacent transit alignment option across Hayden Island would result in impacts to NRHP-eligible or listed historic resources. Preliminary research has not identified any archaeological sites this portion of the project area.

#### TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

Neither the two-way Washington nor the Washington-Broadway transit alignment option through downtown Vancouver would result in acquisition related impacts to NRHP-eligible or listed historic resources. Transit guideways and stations could introduce new visual elements to downtown and potentially eliminate parking and access. See Exhibits 3.8-19 and 3.8-20 for potential access impacts to historic resources from the Washington-Broadway couplet as a result alignment would be center running; and would therefore not result in any access impacts to historic resources. There may be some challenges getting to an historic property if a vehicle is traveling on the other side of the transit line. The driver would have to remain on Washington until the opportunity to make a left-hand turn. These impacts could result in an effect to the setting of these resources if not designed appropriately, or if alternate access and parking is not provided.

Exhibit 3.8-19

#### Potential Access Impacts with Washington-Broadway Couplet and LRT

Address/Description	Access(es) Lost	Alternative Access	Preliminary Finding of Effect <sup>a</sup>
801 Main St	1, to side parking lot (from Broadway)	Yes, from 8th or 9th	No Adverse
102 E Evergreen (Old Columbian Building)	1, to back parking (from Broadway)	Yes, from 11th	No Adverse
Hidden Brick Factory	1, to back parking (from Washington)	Yes, from Mill Plain Blvd	No Adverse
108 W 13th St (a Hidden House)	1, to back parking (from Washington)	Yes, from Mill Plain Blvd	No Adverse
110 W 13th (a Hidden House)	1, to back parking (from Washington)	Yes, from Mill Plain Blvd	No Adverse

Source: Historic Built Environment Technical Report.

<sup>a</sup> Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Exhibit 3.8-20

**Potential Access Impacts with Washington-Broadway Couplet and BRT**

Address/Description	Access(es) Lost	Alternative Access	Preliminary Finding of Effect
601 Broadway (Econo Lodge)	1, main entrance (from Broadway)	Yes, from 7th	No Adverse
1111 Broadway (Olson Engineering)	1, to back parking (from Broadway)	Yes, from 12th	No Adverse
1308 Washington (sm. house)	1, to a small parking lot (from Washington)	Yes, from 13th and Mill Plain	No Adverse
1300 Washington (Luepke Florist)	1, to a small parking lot (from Washington)	Yes, from 13th and Mill Plain	No Adverse

Source: Historic Built Environment Technical Report.

<sup>a</sup> Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPQ once the review of eligibility is complete.

Construction in this area has potential to result in an effect to historic archaeological features and deposits associated with early residences and businesses in the oldest portion of Vancouver.

**16TH STREET OR MCLOUGHLIN**

These alignment options apply to the Kiggins Bowl and Clark College MOS terminus options. The 16th Street alignment would result in an acquisition-related impact to the NRHP-listed Carnegie Library, now the Clark County Historical Museum. This impact has been preliminarily determined as not having an adverse effect on the property, but it would potentially block the ADA and delivery access to the museum, which could be considered an adverse effect.

The McLoughlin alignment would result in five partial acquisitions of NRHP-eligible historic properties. None of these acquisitions would result in the displacement of eligible historic buildings. Two of these acquisition impacts are estimated to be adverse, although Washington DAHP concurrence with these findings is pending.

Transit guideways and stations along 16th or McLoughlin could introduce a new visual element that could result in an effect to the setting of these resources if not designed appropriately. Parking and access could also be potentially eliminated, resulting in an adverse effect if alternate parking and access is not provided to impacted historic resources. See Exhibit 3.8-21 for the potential access impact to historic resources as a result of the 16th Street alignment. There are no access related impacts for the McLoughlin Boulevard alignment.

Exhibit 3.8-21

**Potential Access Impact with 16th Street Alignment**

Address/Description	Access Lost	Alternative Access	Preliminary Finding of Effect <sup>a</sup>
Carnegie Library 1511 Main	1, ADA and Delivery access (from 16th)	No	Adverse

Source: Historic Built Environment Technical Report.

<sup>a</sup> Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

No archaeological sites have been identified along these alignment options, but construction in this area may result in an effect to historic or archaeological features and deposits that may be in these areas.

**TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET**

These alignment options apply to the Lincoln terminus. Any acquisition-related impacts to NRHP-eligible resources would occur north of these options on Main Street. These options would only result in indirect effects. The Broadway-Main couplet could result in more access and parking related impacts to eligible and listed historic resources than the two-way Broadway alignment option (Exhibits 3.8-22 and 3.8-23).

Exhibit 3.8-22

**Potential Access Impacts with Broadway-Main Couplet Alignment**

Address/Description	Access Lost	Alternative Access	Preliminary Finding of Effect <sup>a</sup>
1920 Broadway St	1, to parking front (from Broadway)	Yes, from back alley	No Adverse
2407 Main St	1, to parking (from Main)	Yes, from back alley	No Adverse
2425 Main (Car repair)	1, to parking (from Main)	Yes, from 25th	No Adverse
2607 Main Street (Historic Safeway)	2, to parking from Main and Broadway	Yes, from Fourth Plain Blvd	No Adverse

Source: Historic Built Environment Technical Report.

<sup>a</sup> Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Exhibit 3.8-23

**Potential Access Impacts with Two-way Broadway Alignment**

Address/Description	Access Lost	Alternative Access	Preliminary Finding of Effect <sup>a</sup>
1920 Broadway St	1, to parking front (from Broadway)	Yes, from back alley	No Adverse

Source: Historic Built Environment Technical Report.

<sup>a</sup> Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Transit guideways and stations could introduce a new visual element to downtown that could result in an effect to the setting of these resources if not designed appropriately.

No archaeological sites have been identified along these alignments, but construction in this area may result in an effect to historic or archaeological features and deposits in these areas.

### **Transit Operations**

Differences in transit operations are not expected to result effects to NRHP-eligible or listed historic resources, or archaeological artifacts, or deposits.

### **Tolling Scenarios**

Different tolling scenarios are not expected to result in an effect to NRHP-eligible or listed historic resources, or archaeological artifacts, or deposits.

### **Transportation Demand and System Management**

Transportation demand and system management measures are not expected to result in any effect to NRHP-eligible or listed historic resources, or archaeological artifacts, or deposits.

### **3.8.4 Temporary Effects**

Substantial construction-related temporary impacts to historic and archaeological resources are not likely. Removal of historic and archaeological resources would be long-term effects and are discussed in the preceding text. One exception is a temporary easement (561 sq ft) for the Normandy Apartments (318 E Seventh) for the replacement crossing only and a possible additional exception is the Vancouver Barracks Post Hospital building, which would be monitored for vibration impacts during I-5 construction in this area. It is not expected that any other historic structures that remain in place near the highway (for example, the Providence Academy) would experience vibration impacts during construction.

During the construction of the transit guideway through Vancouver the economic viability of the businesses in the downtown historic buildings could diminish as a result of access and parking issues.



### 3.8.5 Potential Mitigation Measures

#### Historic Buildings, Sites, and Resources

The CRC team has attempted to avoid and minimize impacts to historic resources throughout the project development process, and will continue to do so as designs are refined. For unavoidable adverse effects to historic properties, where there is no prudent and feasible alternative, mitigation plans would be developed in consultation with Oregon SHPO, Washington DAHP, and other Consulting Parties, which include the nine participating tribal governments, the National Park Service, and FTA and FHWA. Mitigation measures could include:

- Moving rather than dismantling historic buildings.
- Providing assistance to restoration efforts, such as seismic stabilization of the Barracks Post Hospital.
- Preparing interpretive panels and placing them in locations available to the public to describe historic resources in the area.
- Supporting oral history efforts.
- Supporting, in cooperation with the NPS, historic museums and curatorial facilities.
- Where possible, returning historic properties affected by construction to their original condition.
- When possible, any residential sound insulation used to mitigate transit related noise impacts, or sound walls used to mitigate highway noise impacts, to historic resources should be done in a manner sensitive to the historic character of the building.
- Minimizing adverse effects to planned landscaping buffers in the Vancouver National Historic Reserve.
- Providing improved connections between downtown Vancouver and the Vancouver National Historic Reserve, including the construction of an expanded overpass/cover-connector between Evergreen Boulevard and 5th Street.
- Mitigating construction noise during special cultural events related to history appreciation at historic sites.
- Minimizing visual impacts to historic resources (i.e., sound walls near the Vancouver National Historic Reserve, transit stations near resources along Broadway or Main Streets) through site-specific, culturally and historically appropriate design or visual buffers.
- Minimizing parking and access impacts to businesses in historic buildings with signs to direct traffic and pedestrians to the businesses and services, and providing alternative access and parking during construction.
- Supporting the development of a facility within the Fort Vancouver National Historic Site for curating, testing, and interpreting artifacts and cultural resources information.
- Supporting the development of interpretive and educational exhibits and materials.

- Providing landscaping, sound walls, and/or other features that are capable of reducing noise and visual impacts, but would also be consistent with the cultural landscape.

### **Archaeological Sites and Resources**

Advance testing of landforms identified as having the potential for supporting archaeological remains and monitoring during project construction would help ensure that important archaeological resources would not be inadvertently damaged or destroyed during CRC project construction. Based on local geology, construction of bridge piers will require testing for archaeological sites potentially buried in the deep sediments that have accumulated along the south shore of the Columbia River. Archaeological sites are likely to be shallower in Washington except in areas covered by dredge spoils (along the riverfront) or construction fill (I-5/SR 14 interchange).

The disposition of any artifacts or samples recovered during archaeological investigations or during construction will be determined in consultation with agencies, property owners, and appropriate tribes, with consideration given to feedback from other interested parties. It is anticipated that the bulk of the artifacts recovered north of the Columbia River could be curated at the Fort Vancouver National Historic Site. Long-term curation of recovered materials is an essential element of archaeological investigations and is required as part of federal and state permitting processes. The disposition of any artifacts or samples would also occur in accordance with the process outlined in the CRC Archaeology Research Design Report.

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### 3.9 Visual and Aesthetic Qualities

Highways and major transit facilities can be highly visible public resources that can noticeably affect the visual character of the surrounding landscapes and the perception of visual resources. Such changes are of keen interest to local residents and jurisdictions.

This section describes and evaluates existing visual resources and their context in order to reasonably determine potential impacts from the project alternatives. Understanding these effects contributes to the creation of well-designed transportation facilities that fit appropriately with their settings and benefit their communities. This assessment examines the possible positive and negative effects from the alternatives upon views and visual resources. This section is based on the CRC Visual Quality and Aesthetics Technical Report.

#### 3.9.1 Existing Conditions

The existing I-5 crossing, shown in Exhibit 3.9-1, consists of two matched, steel through-truss bridges, each of which has a lift tower near the Vancouver side that supports large counterweights used to raise and lower a lift span so that tall river vessels can pass. The lift trusses and towers rise above the roadway and are highly visible, even from distant viewpoints along the river, as illustrated in Exhibit 3.9-2 on the following page.

Exhibit 3.9-1

**I-5 Bridges over the Columbia River**



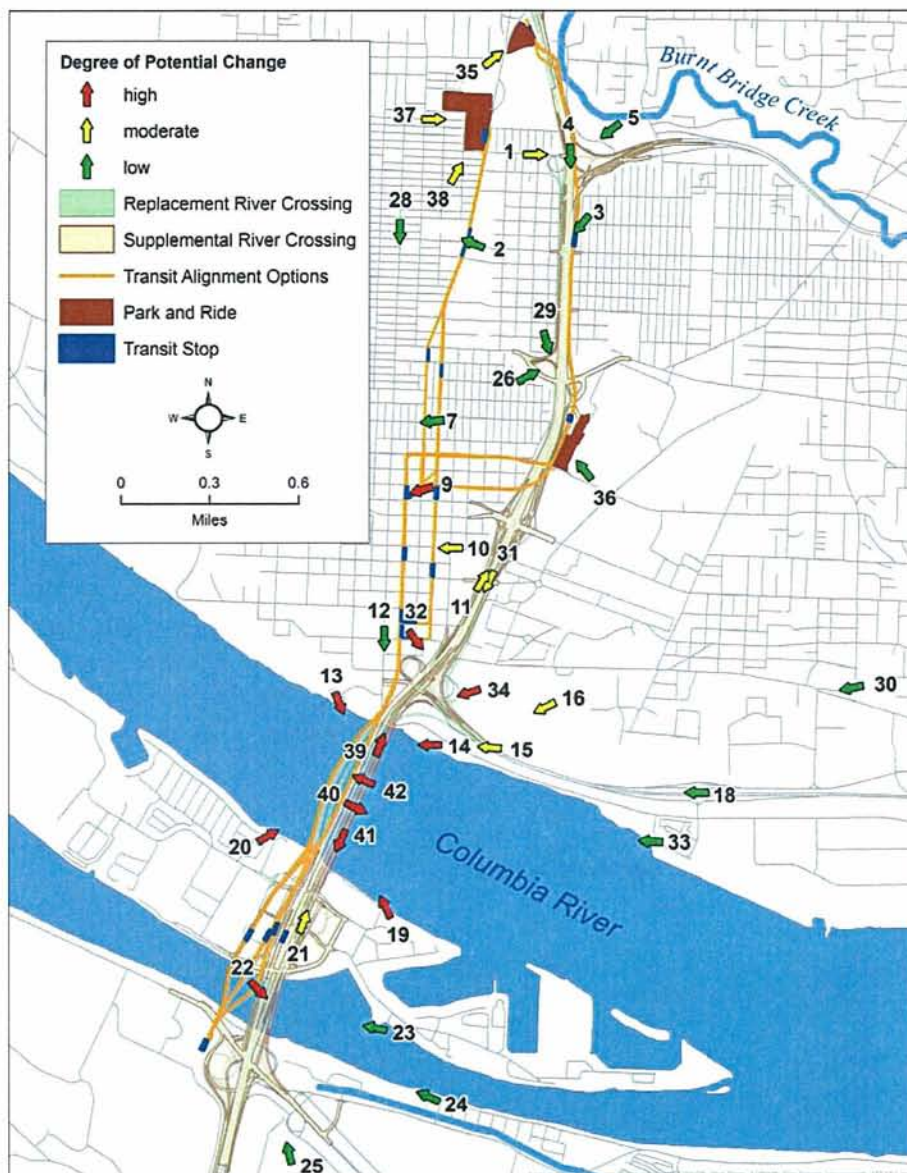
Exhibit 3.9-2 illustrates the view points from which potential changes to the visual context from project alternatives were analyzed. Evaluators employed descriptive and numeric analytical tools to assess visual quality and character of these view points, and assess the before and after conditions of selected views, using accepted, predefined numeric significance thresholds. The arrows on Exhibit 3.9-2 indicate the direction of the selected view, and the level of potential change expected from the project alternatives.



Exhibit 3.9-2  
View Points

### Degree of Potential Change

Based on methods developed by the Federal Highway Administration, visual field assessments were developed from the viewpoints shown here. The arrows indicate likelihood for high, moderate, or low potential for changes to the visual environment. The viewpoints showing potentially high degrees of change were then used for further analysis and the development of visual simulations



Source: CRC Visual and Aesthetics Technical Report.

In order to describe the existing visual environment and understand the level of visual changes that could occur with the project, the project team has defined five distinct “landscape units” in the CRC project area (see Exhibit 3.9-3). The five landscape units are the Columbia Slough in North Portland, the Columbia River, Downtown Vancouver, Greater Central Park, and Burnt Bridge Creek.

### Columbia Slough Landscape Unit

The Columbia Slough landscape unit lies between Marine Drive on the north and N Columbia Boulevard/NE Lombard Street on the south.

The visual character of this unit is defined by level open fields and industrial sites, and the interstate highway. The area is a mix of older industrial parcels, parks and recreation sites, the slough system, and small residential neighborhoods. The Scenic Views, Sites, and Drives Inventory<sup>30</sup> identifies the Columbia Slough waterway as a scenic drive, acknowledging that it is actually several unconnected segments of slough and several secondary sloughs. The highway is elevated through this section, as is the bridge of the Tri-Met Yellow MAX Line. The I-5 bridges and towers are an iconic landmark from certain viewpoints because of their historic nature and having long been part of the view. Buildings or trees block most views of the roadway from the east. Views from the highway include tree canopies and roof tops, the open areas of Delta Park and Vanport Wetlands, and the Expo Center.

Viewers in this area are a mix of motorists on I-5 and surface roads, and park and trail users, as seen in Exhibit 3.9-4. Of these, passengers in vehicles and people in the area for recreation are likely to be sensitive to aesthetic details and the quality of scenic or landscape views. This sensitivity is a combination of having time to observe views and expecting to see park-like, pleasant landscapes because they are there to enjoy recreation activities.

### Columbia River Landscape Unit

The Columbia River landscape unit lies between Marine Drive and the BNSF tracks on the north shore of the river. This unit includes North Portland Harbor, Hayden Island, and the main river channel. The overall visual character is defined by the Columbia River, the I-5 bridges, and near-continuous development along the shorelines. The river channel is broad and flanked by short, steep banks and short, flat beaches.

This area is a mix of small to medium-scale residential and marina structures, large footprint, one or two story retail box buildings surrounded by paved parking, low-rise hotels and restaurants, and heavy and light industries. As shown in Exhibit 3.9-5, the I-5 crossing is the dominant structure in this area. It can be seen from most points along the river and many viewpoints having some elevation. The industrial character of the towers and complexity of the trusses contrasts with the character of the river channel and the hills and mountain on the horizon. However, the bridges and towers are an iconic landmark from many

Exhibit 3.9-3  
**Landscape Units**



Not to scale.

Exhibit 3.9-4  
**I-5 from Delta Park**



Exhibit 3.9-5  
**Bridges from Waterfront Park**



<sup>30</sup> City of Portland, 1988.



viewpoints because of their historic nature and having long been part of the view.

The I-5 roadway is elevated through this area. Views from the roadway include scenic views of the river and distant Mount Hood. From the bridge, views are obstructed by the superstructure, but pedestrians still have panoramic views of the river. Views that include the bridge are obstructed or decreased in quality, with a larger effect for closer viewers.

Viewers in this area comprise travelers on the I-5 bridges and side streets, boaters on the river, park and trail users, people in trains crossing the river and airplanes from Pearson Airfield and the Portland International Airport. Of these groups, recreationists, air passengers, pedestrians, and vehicle passengers are likely to have high sensitivity to the views and visual character of the area because they have time to observe the environs. They are also likely to have higher expectations for a visually pleasing experience, particularly if walking across the bridge, boating, or using one of the waterfront trails or parks.

### **Vancouver Downtown Landscape Unit**

The Vancouver landscape unit includes Vancouver's downtown core of commercial and office buildings west of I-5, as well as the surrounding residential neighborhoods north toward Mill Plain Boulevard. This is an urban landscape with a mix of historic and contemporary buildings and both small and large-scale developments.

The overall visual character of this landscape unit is defined by Vancouver's urban form. Development is continuous and moderately dense and consists of single and multi-family homes, mixed use buildings and a pedestrian-friendly urban commercial and business core. There are many historic or vintage buildings and homes that contribute to a distinctive residential urban character.

The I-5 bridges are visible from several north-south streets, numerous transit stops, parks, and various locations throughout Vancouver; however, the bridges do not dominate most views (see Exhibit 3.9-6). Buildings, street signs, street trees, and the miscellaneous furnishings typical of an urban core are in the fore and middle grounds of those views. These elements obstruct views of the bridges. The exceptions are views from the conference center and hotels along the Vancouver shoreline. The highway is recessed into the grade through this section, and views of it from the surrounding area are limited by landform, buildings, and trees. Views outward from the roadway are limited by berms, sound walls, and retaining walls.

Viewers in this landscape unit are travelers on I-5 and local streets including commuters, shoppers, visitors, and tourists, residents living adjacent to I-5, and people engaged in recreation activities. Residents and visitors to the commercial and business areas may be sensitive to view quality because they are likely to expect an attractive, familiar urban or neighborhood environment.

Exhibit 3.9-6

#### **Bridge Towers from Columbia and 6th Streets in Downtown Vancouver**



### Greater Central Park Landscape Unit

This landscape unit lies east of I-5 between the BNSF railroad berm and Fourth Plain Boulevard. It includes the Vancouver National Historic Reserve (VNHR), Clark College, Pearson Air Field, various public buildings, parks, and residential neighborhoods. The Fort Vancouver area is a national tourist attraction and includes several facilities intended to recreate historic conditions. These would be especially sensitive to visual impacts from the CRC project. A new pedestrian overpass (the Confluence Land Bridge) connecting the Fort to the waterfront is a public facility and offers panoramic views of the river and bridges.

The overall visual character of this landscape unit is park-like campus and open fields. Development is primarily recreation and education-oriented with the previous military/commercial activities having evolved into historic landscapes used for recreation activities. The I-5 bridges are visible from Pearson Airfield, the Fort's plain (see Exhibit 3.9-7), and is also partially visible over the Stockade fence and from the upper floor of the bastion, a look-out tower that is part of the Stockade. Except for a few locations on hillsides, there are few unobstructed views of visual resources such as the Tualatin Hills, Mount Hood, or the Columbia River.

The I-5 bridges and SR 14 ramps are barriers to views between south Vancouver and the south Fort area. The highway is primarily recessed into the grade in this section, and views of it from the surrounding area are limited. The view of the surroundings from the roadway is blocked by berms, sound walls, and retaining walls. Existing transit as well as bicyclists and pedestrians utilize the at grade, street-system.

Viewers in this landscape unit are tourists, travelers and commuters on I-5 and its cross streets, residents living adjacent to I-5, visitors to schools and hospitals, users of Pearson Airfield, and certain residents with homes on southwest-facing hills. Tourists and residents are likely to be sensitive to views and visual quality because they expect to see scenic or familiar, pleasant landscapes and have the time to enjoy the views.

### Burnt Bridge Creek Landscape Unit

The Burnt Bridge Creek landscape unit is a riparian greenbelt surrounded by wooded hills. This landscape unit lies between the SR 500 interchange and the north limit of the project area. Visual quality is defined by the low-density, single-family residential development interspersed through the rural landscape. A Bonneville Power Administration substation and office complex adjoins I-5 on the east side. West of I-5 is the open space of the creek floodplain. The hilly, wooded terrain screens the I-5 roadway from the surrounding area. Views from the roadway are limited by trees growing along the roadway.

Viewers in this area are travelers on I-5 and residents passing through the corridor on their way to or from home. A small numbers of residents with views of the highway facilities and may be sensitive to the quality of the views. Viewers could also be sensitive to increased transit vehicle use on the roadway, and the introduction of transit supportive infrastructure.

Exhibit 3.9-7  
Bridges from Fort Vancouver





### 3.9.2 Long-term Effects from Project Alternatives

The visual impacts from the project alternatives are outlined in Exhibits 3.9-8 through 3.9-11 and summarized in the text that follows.

#### Alternative 1: No-Build

The No-Build Alternative would not result in changes to the visual quality or character of landscapes within the project area.

#### Alternative 2: Replacement Crossing with Bus Rapid Transit

A replacement river crossing would replace the existing bridges with uniformly-styled, modern bridges that would not have the prominent structures above the bridge deck, nor the tall lift towers. The new bridges would still be visible from many areas that currently can see the lift towers of the existing crossings, because the bridge decks of the new crossing would be substantially higher than the decks of the existing bridges. In general, the new crossings would likely improve views of the river from nearby areas by providing a reduced overall visual prominence. Furthermore, the views from the new structures, for transit riders, drivers, and others, would likely improve because there would not be the intricate structure over the bridge decks, like that of the existing bridges. Pedestrians and cyclists may have fewer options with build alternatives as both sides of the existing bridges currently have bike and pedestrian pathways. The replacement bridges provide the pathway only on the west side of the bridges.

Exhibit 3.9-8

**Visual Effects Summary for Alternative 2**

<b>Alternative 2: Replacement Crossing with Bus Rapid Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College Terminus (C)</b>	<b>Mill Plain Terminus (D)</b>
<b>Columbia Slough Landscape Unit</b>	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
<b>Columbia River Landscape Unit<sup>a</sup></b>	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.
	STHB may reduce visual presence with less width and fewer structures, but would have less symmetry.			
<b>Vancouver Downtown Landscape Unit</b>	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges. Could remove street trees on Main.	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges.
<b>Greater Central Park Landscape Unit</b>	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.
<b>Burnt Bridge Creek Landscape Unit</b>	SR 500 interchange tunnel could reduce prominence of highway. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce prominence of highway.	None	None

Source: CRC Visual and Aesthetics technical Report.

<sup>a</sup> In cases where values differ between these designs, the STHB values are lined in the inset box.

Views in the immediate vicinity of new transit stations could change because the stations will be introduce new fixtures and designs and because the transit vehicles must stop for short durations, adding a new dynamic quality to blocks with stations. The transit guideway and stations would be designed to integrate with the surrounding built environment, and generally would not substantially change the visual quality or character of these surroundings. The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities. In a few areas vegetation would need to be removed to accommodate the new right-of-way required by the guideway. These areas include the road widening along Main Street north of 29th Street for the Lincoln terminus (B) option, and McLoughlin Boulevard for the Kiggins Bowl terminus (A) and the Clark College MOS (C). The Kiggins Bowl terminus (A) would also remove vegetation adjoining to the highway between Mill Plain and Fourth Plain Boulevards because of the additional right-of-way required for the transit guideway.

**Alternative 3: Replacement Crossing with Light Rail**

The effects of Alternative 3 would be the same as Alternative 2 because there is little substantial visual or aesthetic difference between bus rapid

transit and light rail. With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact. The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities.

Exhibit 3.9-9

**Visual Effects Summary for Alternative 3**

<b>Alternative 3: Replacement Crossing with Light Rail Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College Terminus (C)</b>	<b>Mill Plain Terminus (D)</b>
<b>Columbia Slough Landscape Unit</b>	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
<b>Columbia River Landscape Unit<sup>a</sup></b>	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.
	STHB may reduce visual presence with less width and fewer structures, but would have less symmetry.			
<b>Vancouver Downtown Landscape Unit</b>	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges. Could remove street trees on Main.	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges.
<b>Greater Central Park Landscape Unit</b>	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.
<b>Burnt Bridge Creek Landscape Unit</b>	SR 500 interchange tunnel could reduce prominence of highway. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce prominence of highway.	None	None

Source: CRC Visual and Aesthetics Technical Report.

<sup>a</sup> In cases where values differ between these designs, the STHB values are lined in the inset box.

### Alternative 4: Supplemental Crossing with Bus Rapid Transit

Because of its differing bridge types, a supplemental river crossing would potentially cause adverse impacts to the visual quality and character for certain views in the Columbia River, Vancouver Downtown, and Greater Central Park landscape units. Retaining the existing bridges and adding a new modern-styled bridge would introduce an incoherent view. Effects from the transit guideway would be the same as Alternative 2. Pedestrians and cyclists may have fewer options with build alternatives as both sides of the existing bridges currently have bike and pedestrian pathways. The replacement bridges provide the pathway only on the west side of the bridges. Views in the immediate vicinity of new transit stations would change because the stations will be introduce new fixtures and designs and because the transit vehicles must stop for short durations, adding a new dynamic quality to blocks with stations. With The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities.

Exhibit 3.9-10

#### Visual Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Columbia Slough Landscape Unit	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
Columbia River Landscape Unit	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.
Vancouver Downtown Landscape Unit	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views. Could remove street trees on Main.	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views.
Greater Central Park Landscape Unit	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.
Burnt Bridge Creek Landscape Unit	SR 500 interchange tunnel could reduce highway prominence. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce highway prominence.	None.	None.

Source: CRC Visual and Aesthetics Technical Report.

### Alternative 5: Supplemental Crossing with Light Rail

The effects of Alternative 5 would be the same as Alternative 4 because there is no substantial visual or aesthetic difference between bus rapid



transit and light rail. With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact. The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities.

Exhibit 3.9-11

**Visual Effects Summary for Alternative 5**

<b>Alternative 5: Supplemental Crossing with Light Rail Transit</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College Terminus (C)</b>	<b>Mill Plain Terminus (D)</b>
<b>Columbia Slough Landscape Unit</b>	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
<b>Columbia River Landscape Unit</b>	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.
<b>Vancouver Downtown Landscape Unit</b>	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views. Could remove street trees on Main.	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views.
<b>Greater Central Park Landscape Unit</b>	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.
<b>Burnt Bridge Creek Landscape Unit</b>	SR 500 interchange tunnel could reduce highway prominence. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce highway prominence.	None.	None.

Source: CRC Visual and Aesthetics Technical Report.

### 3.9.3 Long-term Effects from Project Components

This section describes the effects or impacts of the components and various options that comprise the project alternatives. High-capacity transit mode, tolling scenarios, transportation demand and system management measures, and transit operations would not affect visual and aesthetic qualities, and are therefore not discussed in detail below.

#### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5) Improvements

##### COLUMBIA SLOUGH LANDSCAPE UNIT

Visual effects from either river crossing would be minor in this area for any of the build alternatives. The Marine Drive interchange ramp would be slightly taller, but the overall impact is likely to be low. The Marine

Drive Interchange Designs could change the visual character of the Expo Center parking area and the adjacent light rail station.

#### COLUMBIA RIVER LANDSCAPE UNIT

The replacement and supplemental river crossings would both create high level visual changes near the Columbia River, but differ in their visual impacts.

The replacement crossing would have high-level visual impacts in the Columbia River landscape unit from widening and reconfiguring the I-5 bridges over North Portland Harbor, adding a new transit bridge and elevated guideway, and building a new main channel crossing. A simulation of the river crossing can be seen in Exhibit 3.9-12. These impacts could be positive if the new structures are attractive and sensitive to the surrounding uses and landscapes. Effects from either transit option would be largely the same in this unit and would be an additive impact because the guideway would be part of the new bridge. Visual character and quality near the new crossing would undergo high level changes due to the removal of docks, floating homes, and other structures.

Exhibit 3.9-12

#### Visual Simulation of Replacement Crossing



Removing the truss structures and lift towers of the existing I-5 bridges would dramatically open up views from I-5. From both northbound and southbound directions on I-5, views of the Portland and Vancouver skylines would be visible, as would distant shorelines, rolling hills, and mountain profiles. Views for travelers on the crossing could be better for the replacement than for the supplemental crossing, because the latter would retain the view-blocking through-truss structure on the existing bridges. Reducing the number of supporting piers in the river, as is



planned for the replacement crossing, would open views of the river from the shore and water.

The stacked transit/highway bridge design, as illustrated in Exhibit 3.9-13, would locate high-capacity transit under the highway deck. This design would cause different visual impacts and benefits than the standard replacement crossing. This design would require two, rather than three bridges, which would reduce the prominence of the river crossing from all views. However, the bridges would be of different sizes in order to accommodate transit in one of the structures. This would reduce their symmetry, unless other design elements mitigated for such.

Exhibit 3.9-13

#### Visual Simulation of Stacked Transit/Highway Bridge Design



The footprint of the supplemental crossing would be similar to the replacement crossing, but the overall visual presence would be greater (Exhibit 3.9-14). The supplemental structure will not mimic the design of the existing bridge and it will have a higher deck and no lift span. The piers of the existing crossing will be reinforced for seismic safety, and this could add substantially to their bulk. This could also result in discordant visual styles for the combined crossing.



Exhibit 3.9-14

**Visual Simulation of Supplemental Crossing**

The supplemental crossing would also add visual complexity to the I-5 corridor on Hayden Island. The supplemental structure would be closer than the current roadway to a residential neighborhood west of I-5, and could affect visual quality there.

The view from the roadway would be similar to existing conditions for northbound motorists because they would use the existing bridges. Views for transit passengers and southbound motorists on the new supplemental structure are likely to improve over existing conditions if the design does not include a structures elevated over the deck.

Views for pedestrian and cyclists would greatly change as the existing circuitous circulation system would be replaced with a simpler one, at a higher elevation.

**VANCOUVER DOWNTOWN LANDSCAPE UNIT**

Either river crossing could replace existing highway vegetation and buffer area with a widened highway and sound walls near the SR 14 interchange, which would lessen the visual quality of the roadway for travelers.

The replacement crossing would remove the current bridge lift towers, but the new bridge deck would be higher than the existing deck and would still be visible from many locations in downtown Vancouver. The higher and wider decks of the replacement bridges are likely to degrade the quality of views that include the crossing when compared to existing conditions. For the supplemental crossing, the lift towers would remain visible and the higher roadway of the new bridge would add to the prominence of the crossing from these locations. The differing styles of the existing and supplemental bridges are likely to degrade the quality of views that include the crossing when compared to either existing conditions or the replacement crossing.



**GREATER CENTRAL PARK LANDSCAPE UNIT**

With the exception of Fort Vancouver, visual impacts would be low in this landscape for both river crossings, because visibility of the bridges and highway would not increase. With a replacement crossing, views of the bridges from Fort Vancouver could improve in quality, depending on the final design of the crossing. However, having the structure in view from the historic reserve would remain a visual impact. The supplemental crossing is likely to increase the prominence of the crossing from the Fort and degrade the quality of views that include it.

This impact would be compounded by changes to the SR 14 and Mill Plain interchanges that would bring I-5 closer to the historic Post Hospital and encroach on the HBC Village area. As illustrated in Exhibit 3.9-15, existing vegetation will likely visually block the SR 14 interchange (double-loop) from the HBC Village. With the single-loop design, this could be more visually prominent and incompatible in scale and use with the historic Village site.

Exhibit 3.9-15

**Visual Simulation from HBC (Fort) Village****BURNT BRIDGE CREEK LANDSCAPE UNIT**

The I-5/SR 500 interchange could replace existing ramps with a tunnel. This could be a visual improvement for the view of the interchange from the surrounding area, since it would have more open space. This would have an adverse visual impact on highway users, for the length of the tunnel. Highway widening through SR 500 could slightly degrade visual quality from nearby homes and for travelers on the roadway, as landscaped buffers would likely be lost.

**Transit Terminus Options (with all Alternatives)**

This section compares the Kiggins Bowl (A), Lincoln (B), Clark College MOS (C), and Mill Plain MOS (D) terminus options within each of the five landscape units. It also evaluates the impacts from the different alignment options. All of the terminus options have the same set of alignment options through the Columbia Slough and Columbia River landscape units.

**COLUMBIA SLOUGH LANDSCAPE UNIT**

Visual effects from high-capacity transit would be minor in this area. Expanding the Expo Center transit station would not change its existing character. However, the Southern or Diagonal Marine Drive Interchange designs would.

**COLUMBIA RIVER LANDSCAPE UNIT**

The new elevated transit guideway from the Expo Center to Hayden Island would increase the width of the bridge, or add a new, separate bridge, across North Portland Harbor. This would have a negative impact on views from floating homes and boats in the channel, and would block more of the distant views from nearby vantage points. Transit users would have improved views to the west, since more of the scenic surrounding area would be visible than from the current roadway. Views in the immediate vicinity of the new Hayden Island transit station could change because the station will be on an elevated structure.

**VANCOUVER DOWNTOWN LANDSCAPE UNIT**

The transit guideway through downtown Vancouver would be at street level and designed to fit in with the existing built environment. Views in the immediate vicinity of new transit stations could change because the stations will be introduce new fixtures and designs and because the transit vehicles must stop for short durations, adding a new dynamic quality to blocks with stations. With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact. The transit vehicles would not impact most views because they would not be permanent parts of any view.

North of 29th Street, the Lincoln terminus (B) could change the visual character of Main Street by widening the street from 80 to 100 feet to accommodate the transit guideway. This could result in the loss of mature street trees. For the Mill Plain MOS (D) a five-story parking structure (with ground-floor commercial use) would be inconsistent with the scale of buildings in the surrounding area, as most structures in the immediate area are one story. The parking structures around the SR 14 interchange would generally be in keeping with the scale of surrounding structures.

**GREATER CENTRAL PARK LANDSCAPE UNIT**

The Kiggins Bowl (A) and Clark College MOS (C) terminus options could require widening McLoughlin Boulevard from 80 to 100 feet. This could result in the loss of mature street trees and decrease the visual quality of the street. The 16th Street alignment option would not require street widening and would not degrade visual quality on 16th Street.

The Clark College Park and Ride, as either a three-level structure (with A and C) or a surface lot (with B and D), would be visually compatible with the existing large-footprint, mid-rise buildings and parking lots of the Clark College campus and the Veterans Administration campus to the north.

With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact.

**BURNT BRIDGE CREEK LANDSCAPE UNIT**

The Kiggins Bowl terminus (A) would cause visual impacts by adding a transit guideway in the I-5 right-of-way and shifting the highway slightly west to accommodate it. This could result in the removal of vegetation from the highway right-of-way and could make the highway corridor more noticeable from surrounding areas.

The Lincoln terminus (B) station at the Lincoln Park and Ride would be reasonably consistent with the portion of the site used as a WSDOT maintenance facility (building complex surrounded by asphalt parking), although it would also displace some single-family homes and a small business. This park and ride would be clearly visible from nearby residential units, but could be landscaped to screen it.

**TRANSIT MAINTENANCE FACILITY EXPANSIONS**

Expansion of high capacity transit systems will require expansions in regional maintenance facilities. The light rail maintenance facility expansion would require full acquisition of 14 parcels in the vicinity of NW Eleven Mile Lane in Gresham. These parcels support residential, commercial, and light industrial uses. In many cases there seems to be multiple uses occurring on a single lot. The maintenance facility expansion would be largely consistent with the building types and scales in the immediate area. The BRT maintenance facility would be located at 18th Street and 65th Avenue in Vancouver. The area now includes a business, and two residences, dispersed across a somewhat vacant property. The surrounding area includes single story commercial and warehouse facilities, including a C-Tran facility. A BRT maintenance facility would be largely consistent with the existing conditions.

**Transit Alignment Options (with all Alternatives)****OFFSET OR ADJACENT**

On Hayden Island, building the transit guideway adjacent to the highway would increase the width and bulk of the visual barrier that the elevated roadway creates. The elevated transit station would increase the visibility of the guideway over the highway, although this could benefit transit users trying to find the station.

Offsetting the transit guideway between 450 and 650 feet west of the elevated highway on Hayden Island could have slightly greater negative visual effect than the adjacent alignment option. The elevated highway barrier would still be present, and the offset guideway would create a second, though much smaller barrier to the west.

**TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET**

There would be no substantial difference in visual effects between the two-way Washington and Washington-Broadway couplet alignments.

**16TH STREET OR MCLOUGHLIN**

The 16th Street alignment option would not require street widening and would not degrade visual quality on 16th Street. In contrast, the McLoughlin alignment option would widen McLoughlin Boulevard from 80 to 100 feet, and potentially remove mature street trees and decrease the visual quality of this street.

**TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET**

There would be no substantial difference in the visual effects between the two-way Broadway and Broadway-Main couplet alignment options.

**Tolling Scenarios**

Introducing an electronic-based tolling system on the crossing could add overhead signs and electronic equipment that would be visible for motorists and other users of the bridges. These signs and equipment could result in low to moderate change in the views for users of the bridges.

**3.9.4 Temporary Effects**

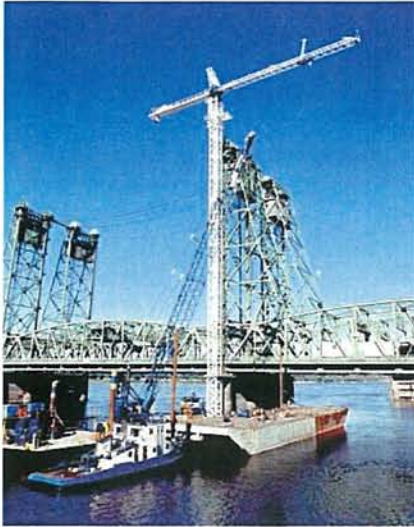
During construction the quality of views to and from the project area would be temporarily altered. Construction-related signage and heavy equipment would be visible at and near construction sites. Vegetation would be removed from some areas to accommodate construction of the bridge, new ramps, and the transit guideway. This would degrade or partially obstruct views or vistas. Short-term changes to the visual character of areas adjacent to the alignment could result from:

- Clearing and grading activities resulting in exposed soils and immature replacement plantings.
- Erosion control devices such as silt fences, plastic ground covers, or straw bales.
- Dust, exhaust, and airborne debris in areas of active construction.
- Stockpile areas of construction equipment, gravel or earth, or construction debris.

Construction outside of daylight hours would require bright temporary lighting. This could expose nearby residents and travelers to higher levels of glare from unshielded light sources or increased ambient nighttime light levels. Temporary lighting on the crossing structure could also add glare effects to river navigation and would be noticeable from wide areas of the surrounding landscape.



Exhibit 3.9-16

**Barge and Crane Performing Bridge Work**

Both the replacement and supplemental river crossing would station barges and large cranes in the Columbia River near the bridge, possibly similar to that which is illustrated in Exhibit 3.9-16. They would be highly noticeable from the roadway and surrounding landscape and would detract from the scenic quality of the area. Construction duration is expected to be shorter for the replacement river crossing.

Depending on the location of the bridge assembly/casting yard, it could result in temporary visual impacts. Any potential sites would be evaluated for the visual impacts and potential mitigation will be considered. This will be most important if the site is visible from public parks or other visually sensitive uses.

### 3.9.5 Potential Mitigation Measures

High-quality design and construction of the proposed highway and transit facilities will be important mitigation tools for visual quality and aesthetics. The following techniques could be employed for any of the alternatives to improve the visual effects of the CRC project:

- Planting vegetation, street trees, and landscaping in and around the project where appropriate,
- Giving special consideration to the design of alternatives that could result in visual impacts from public parks, open spaces, and historic or cultural resources,
- Shielding station and roadway lighting to reduce impacts from glare.
- Minimizing structural bulk where appropriate, and
- Designing the facilities to complement or blend with the surrounding landscapes and communities.

The CRC project team will coordinate with the local communities and responsible agencies to create visual design guidelines for the project. Both the replacement and supplemental crossing structures will provide opportunities to enhance community access to the scenic landscape of the Columbia River. The replacement river crossing also provides the opportunity to design a uniform crossing that does not detract from the landscapes surrounding it.

### 3.10 Air Quality

Air pollutants can affect human and environmental health. Many natural and human activities can affect air quality. Transportation system improvements, such as the CRC project, can have both beneficial and adverse effects on air quality. Two types of air emissions are evaluated in the CRC air quality analysis:

- Criteria pollutants – federal regulations have established limits for these pollutants in order to protect public health.
- Mobile source air toxics – these have potential public health concerns but have no established standards for transportation projects.

This section is based on the CRC Air Quality Technical Report and discusses how CRC alternatives would affect criteria pollutants and mobile source air toxins. In addition, carbon dioxide emissions are a concern, not for air quality, but because of their potential to contribute to global climate change. This is a potential cumulative impact and is discussed in the Cumulative Impacts section at the end of this chapter.

#### 3.10.1 Existing Conditions

##### Air Quality Pollutants and Standards

This section describes the pollutants that were studied, why they are relevant to the CRC project, and how they were analyzed.

##### CRITERIA POLLUTANTS

The U.S. Environmental Protection Agency (EPA) has developed National Ambient Air Quality Standards (NAAQS, or federal standards) for six pollutants, known as “criteria pollutants.” These include carbon monoxide (CO), lead, ozone, nitrogen dioxide, sulfur dioxide, and particulate matter (PM). Washington and Oregon also have State Ambient Air Quality Standards for these pollutants. Carbon monoxide is the only pollutant of concern for potential violations related to transportation projects in the Portland-Vancouver metropolitan area.

The CRC air quality study followed well-developed analysis methods to evaluate air quality impacts from criteria pollutants. The evaluation estimated criteria pollutant emissions for the region (Clark, Multnomah, Washington, and Clackamas counties) and for project subareas (four segments of I-5 affected by the CRC alternatives). It also performed CO hotspot analysis, estimating concentrations of CO at the most congested intersections.

The I-5 CRC project is located within the Portland CO Maintenance Area and the Vancouver CO Maintenance Area, as shown on Exhibit 3.10-1. Because of that, the Oregon Department of Environmental Quality (DEQ) and the Southwest Clean Air Agency (SWCAA) have State Implementation Plans with regulatory procedures to maintain compliance with the NAAQS. Complying with the Portland CO maintenance plan requires verifying that planned transportation projects will not cause or contribute to a violation of the federal standards for CO. This verification process is referred to as

##### Greenhouse Gases

For a discussion of greenhouse gas emissions and global climate change, please see Section 3.19.8.

demonstrating conformity. Demonstrating conformity consists of two different analyses:

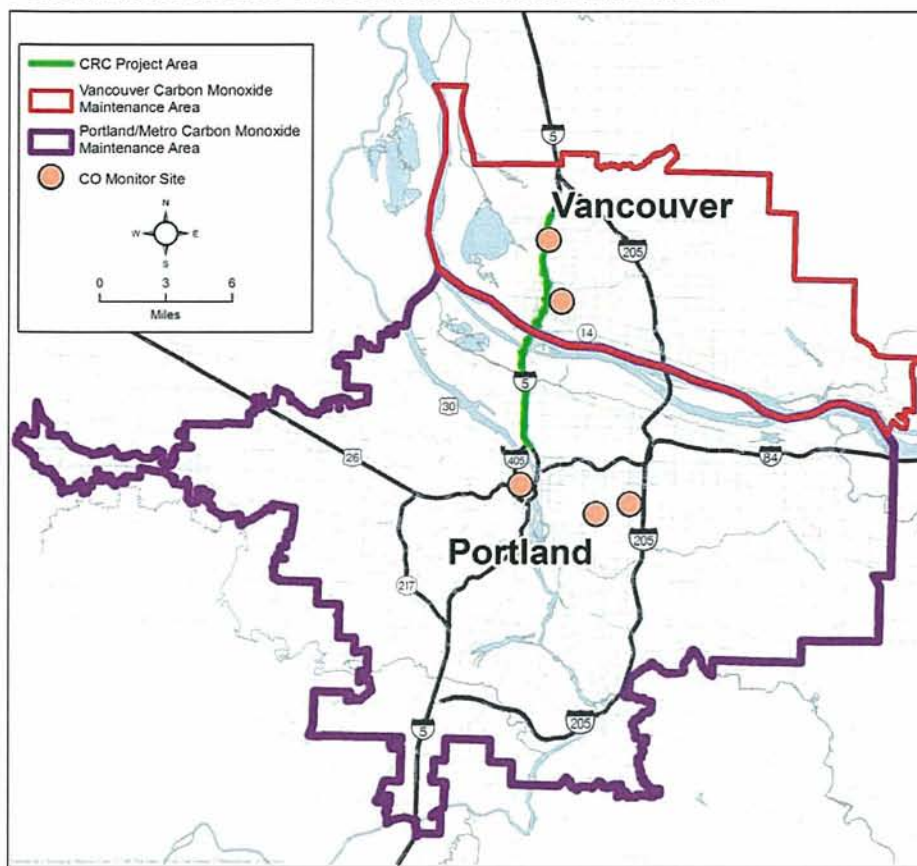
- A regional analysis – the project must be included in a conforming regional transportation plan and transportation improvement plan.
- A local analysis - the project must analyze the most congested intersections and demonstrate that CO levels, including the project, will be below the CO standards.

Metro prepared a conformity determination for the 2035 Regional Transportation Plan, and this was circulated for public and technical review and comment. After the 30 day comment period, and receiving no comments, the Metro Council approved Resolution 08-3911 and forwarded the air quality conformity determination to the USDOT (Federal Highway Administration and Federal Transit Administration.)

The USDOT (after consultation with EPA), reviewed the regional analysis and approved the air quality conformity determination on February 29, 2008. Metro included a placeholder assumption for the CRC project in the regional conformity determination they conducted. Their modeling of RTP conformity assumed a replacement bridge with LRT and tolling, with 10,000 vehicles per hour each direction, \$2 tolls, and an LRT terminus at the Lincoln Park and Ride. The project was assumed to be completed by 2017. In order to conclude that the CRC project conforms, the design and scope of the CRC preferred alternative would need to match the assumptions in Metro's RTP conformity determination. In addition, nothing could be expended before 2011 or it would need to be included in the Transportation Improvement Plan as well.

This DEIS also includes the analysis of CO levels at congested intersections in Portland and Vancouver and demonstrates compliance with Federal and State CO standards. The year of opening analysis will need to be completed before the local hot spots analysis meets the conformity requirements, and if the locally preferred alternative isn't well represented by the hot spot analysis that was completed for the DEIS, then an updated analysis would need to be completed. No regional conformity analysis is required for the Vancouver area.

Exhibit 3.10-1

**Portland and Vancouver Carbon Monoxide Maintenance Areas**

Source: SWCAA and DEQ.

**MOBILE SOURCE AIR TOXICS**

Nationally and locally, concerns have grown about several other pollutants that have a potential impact on public health but, unlike the criteria pollutants, do not have regulatory standards. These pollutants—designated as priority mobile source air toxics (MSATs) by FHWA based on EPA’s rulemaking—include benzene, 1,3 butadiene, formaldehyde, acetaldehyde, acrolein, and diesel particulates. Analyzing mobile source impacts is a challenge because there is no analysis requirement and no standardized method. The CRC project team, together with federal and state regulatory and transportation agencies, agreed upon an approach for estimating these emissions from I-5 both at the regional and sub-area level.

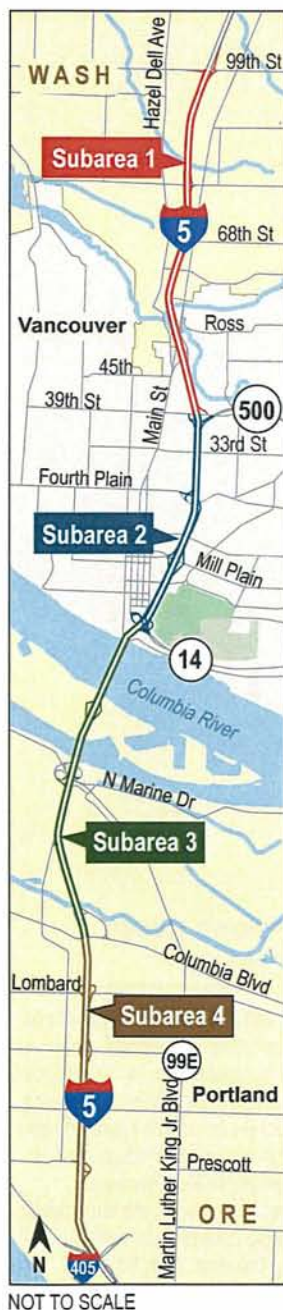
Evaluating environmental and health impacts on a proposed highway project involves emissions modeling (to estimate the amount of pollutant discharged), dispersion modeling (to estimate the resulting concentrations of the pollutant), exposure modeling (to estimate human exposure to the estimated concentrations of the pollutant), and a final determination of health impacts based on the estimated exposure. Each step is encumbered by technical shortcomings or uncertain science that prevents a complete determination of the MSAT health impacts. The Air Quality Technical Report includes a full discussion of these limitations.

### Car Emissions Keep Getting Cleaner

Starting in the early 1970s, EPA regulations controlled air pollutant emissions from motor vehicles. Recent regulations, including those for fuel formulations, help control emissions from heavy-duty diesel on-road and off-road vehicles. New gasoline reformulation rules should substantially reduce benzene emissions. These standards are expected to continue reducing pollutants in vehicle emissions over the next 25 to 30 years.



Exhibit 3.10-2  
Subareas for Air Quality



Note that the mobile source analyses for CRC and other transportation projects have forecast large declines in emissions over time. Reduced emissions have already occurred and are projected to continue due to on-going advances in cleaner fuels and emission control technologies.

### Existing Pollutant Levels

#### CRITERIA POLLUTANTS

This section describes Portland-Vancouver pollutant trends for the last 30 plus years in order to provide context for the CRC-related impacts. Monitoring stations within the Portland-Vancouver area measure concentrations of some of the criteria pollutants discussed above. The highway contributions to pollutant concentrations in the project area are developed through understanding vehicle emissions from existing and future vehicles, as well as existing and forecast future traffic volumes and speeds. The long-term effects section discusses this further.

Exhibit 3.10-3  
Carbon Monoxide Trends Since 1986 (8-hour averages)



Source: CRC Air Quality Technical Report.

During the 1970s, CO concentrations in the Portland-Vancouver area exceeded the NAAQS (referred to as federal standards) one out of every three days, and ozone levels were often as high as 50 percent over the federal standard. CO trends are illustrated in Exhibit 3.10-2. Programs and regulations were put into effect to control air pollutant emissions, and substantial improvements were made. There have been no violations of any of the federal standards in nearly ten years. Still, because of previous violations of standards, the region is a designated air quality maintenance area. This recognizes that the region is currently in compliance with the federal standards, but requires the region to develop and implement a maintenance plan to prevent backsliding.

#### MOBILE SOURCE AIR TOXICS

The Portland Air Toxics Assessment is a computer modeling project designed to estimate and assess the risk from 12 air toxics in the Portland-Vancouver area, including the six MSATs. It is based on a 1999 air emissions inventory. Its purpose is to provide more refined estimates of the most important local air toxics. Such estimates enable air quality regulators to better characterize the risks from air toxics, understand

local patterns of air toxics exposure, identify locations with elevated risk, and develop emission reduction strategies.

The results identified diesel exhaust, motor vehicles, and burning as important sources of air toxics in Portland. In general, the assessment shows widespread risks from benzene, formaldehyde, and diesel exhaust throughout the Portland-Vancouver region. Higher risks for benzene and formaldehyde appeared to align to some degree with major highway corridors.

### 3.10.2 Long-term Effects from Project Alternatives

To provide information for analyzing the trade-offs in air quality effects of the project alternatives, the project team estimated emissions for the four-county region, and for the following four segments or sub-areas of I-5 (see Exhibit 3.10-3), including on and off ramps:

- NE 99th Street to East 39th Street (Subarea 1)
- East 39th Street to State Route 14 (Subarea 2)
- State Route 14 to Columbia Boulevard (Subarea 3)
- Columbia Boulevard to the I-405 junction (Subarea 4)

The results of the emissions analysis showed that future (no-build or build) emissions of all pollutants would be substantially lower than existing emissions for the region and the subareas. Compared to existing conditions, future regional emissions for all the alternatives are expected to decline by about 30 percent for CO, 70 percent for NO<sub>x</sub>, 50 percent for volatile organic compounds (VOCs), and 90 percent for particulate matter (PM). Mobile source emissions would be about 50 percent lower for benzene, 1,3-butadiene, formaldehyde, and acrolein, and about 90 percent lower for diesel particulates. These reductions in emissions are largely due to expected improvements in vehicle emissions by 2030. Differences in the 2030 emissions among the project alternatives, including the No-Build Alternative, are extremely low—varying by one percent or less. In the context of the very large reductions (30 to 90 percent) relative to existing conditions, and given the potential error in available modeling methods, the one percent difference is unsubstantial.

To summarize, criteria pollutant and mobile source emissions for the region are expected to be substantially lower in the future than under existing conditions. On a regional basis, future differences between alternatives are small enough not to be meaningful within the accuracy of the estimation methods. All the build alternatives (with highway toll) either reduce emissions relative to No-Build, or have some tradeoffs between CO and NO<sub>x</sub> emissions relative to VOC and MSAT emissions. Without a toll, the build alternatives would increase sub-area emissions relative to the No-Build Alternative, but are still substantially lower than existing conditions. No violations of federal standards are expected.

**Alternative 1: No-Build**

Exhibit 3.10-4  
Existing and Future (2030)

Regional MSAT Emissions (Pounds Per Summer Day)	Existing	2030 No Build
Benzene	3,661	1,610
1,3-Butadiene	412	198
Formaldehyde	1,017	544
Acetaldehyde	440	382
Acrolein	50	25
Diesel PM	2,144	114

Source: CRC Air Quality Technical Report.

Under the No-Build Alternative, emissions would be substantially lower than they are today. This is largely due to projected improvements in emissions for vehicles in the future.

**Alternative 2: Replacement Crossing with Bus Rapid Transit**

Exhibit 3.10-5  
Summary of Air Quality Performance for Alternative 2

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl Terminus(A) <sup>a</sup>	Lincoln Terminus (B)	Clark College MOS (C) <sup>a</sup>	Mill Plain MOS (D) <sup>a</sup>
Benzene	1,613	1,613	1,613	1,613
1,3-Butadiene	198	198	198	198
Formaldehyde	544	544	544	544
Acetaldehyde	382	382	382	382
Acrolein	25	25	25	25
Diesel PM	115	115	115	115

Source: CRC Air Quality Technical Report.

<sup>a</sup> The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 2 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There would be no expected differences between the four terminus options.

### Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.10-6

#### Summary of Air Quality Performance for Alternative 3

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl Terminus(A) <sup>b</sup>	Lincoln Terminus (B)	Clark College MOS (C) <sup>b</sup>	Mill Plain MOS (D) <sup>b</sup>
<b>Benzene</b>	1,614 (1,620)	1,614 (1,620)	1,614 (1,620)	1,614 (1,620)
<b>1,3-Butadiene</b>	198 (199)	198 (199)	198 (199)	198 (199)
<b>Formaldehyde</b>	544 (546)	544 (546)	544 (546)	544 (546)
<b>Acetaldehyde</b>	383 (384)	383 (384)	383 (384)	383 (384)
<b>Acrolein</b>	25	25	25	25
<b>Diesel PM</b>	115	115	115	115

Source: CRC Air Quality Technical Report.

a The values in parentheses indicate estimated emissions if no toll were included with this alternative.

b The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 3 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There are no expected differences between the four terminus options. Removing the toll on the I-5 crossing slightly increases the emissions of some criteria pollutants, but these would still be substantially lower than existing conditions.

### Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.10-7

#### Summary of Air Quality Performance for Alternative 4

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl terminus(A) <sup>e</sup>	Lincoln terminus (B)	Clark College MOS (C) <sup>e</sup>	Mill Plain MOS (D) <sup>e</sup>
<b>Benzene</b>	1,613	1,613	1,613	1,613
<b>1,3-Butadiene</b>	198	198	198	198
<b>Formaldehyde</b>	544	544	544	544
<b>Acetaldehyde</b>	382	382	382	382
<b>Acrolein</b>	25	25	25	25
<b>Diesel PM</b>	115	115	115	115

Source: CRC Air Quality Technical Report.

a The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.



Alternative 4 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There are no expected differences between the four terminus options.

### Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.10-8

#### Summary of Air Quality Performance for Alternative 5

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl terminus (A) <sup>e</sup>	Lincoln terminus (B)	Clark College MOS (C) <sup>e</sup>	Mill Plain MOS (D) <sup>e</sup>
Benzene	1,613	1,613	1,613	1,613
1,3-Butadiene	198	198	198	198
Formaldehyde	544	544	544	544
Acetaldehyde	382	382	382	382
Acrolein	25	25	25	25
Diesel PM	115	115	115	115

Source: CRC Air Quality Technical Report.

a The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.

Alternative 5 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There are no expected differences between the four terminus options.

### Subarea Emissions for Criteria Pollutants and MSATs

The subareas show some variation in emissions between alternatives, although that variation is far less than the reductions that all alternatives show compared to existing conditions.

For build alternatives that include a toll (all build alternatives are packaged with a toll, but Alternative 3 was also modeled without a toll to determine the effect that tolling has on traffic volumes and patterns), emissions of VOC and MSATs are reduced relative to the No-Build in all the subareas. Emissions of CO and NO<sub>x</sub> are also reduced in all subareas except Subarea 2. The No-Build Alternative and the tolled build alternatives have the following differences:

In Subareas 3 and 4 (located between SR 14 in Vancouver and the I-405 junction in Portland) there are reductions up to 35 percent in emissions for the build alternatives relative to the No-Build Alternative. The project would have the greatest potential benefit for emissions in these areas.

Differences between alternatives are more moderate in Subarea 1 (one to four percent decrease relative to No-Build) and may not be meaningful within the accuracy of the emission estimates.

Emissions for Alternatives 2 and 3 show increases in CO and NO<sub>x</sub> in Subarea 2 relative to the No-Build. Other pollutants either show a reduction or no increase. No impact is anticipated because estimated CO concentrations are not expected to exceed the federal standards, and NO<sub>x</sub> emissions are more of a concern for regional ozone formation than for local effects. Consequently, the benefits of reduced VOC and MSAT

emissions in relation to increased CO and NO<sub>x</sub> emissions is probably still an overall benefit for this subarea.

### **Intersection-level Carbon Monoxide Concentrations**

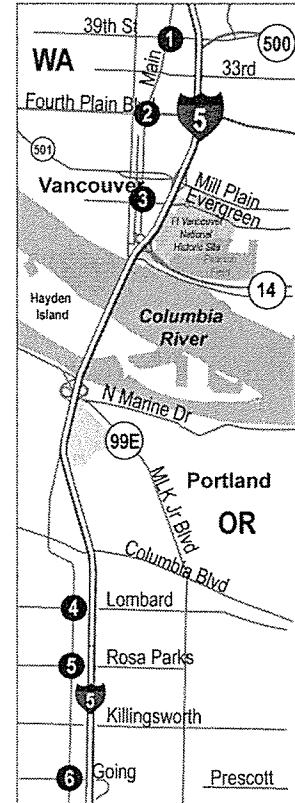
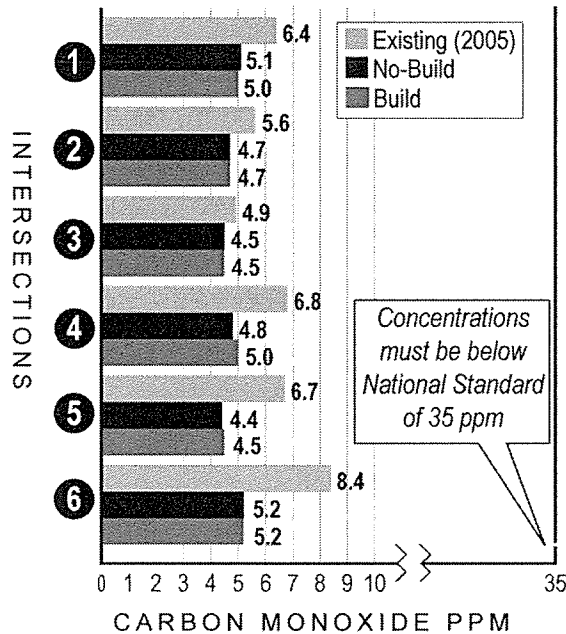
In addition to evaluating emissions at the regional and subarea level, the project team analyzed CO concentrations at the intersections that would be most affected by project alternatives. This intersection analysis is also referred to as hotspot analysis, and is part of demonstrating conformity with federal standards. The project team performed a quantitative analysis for the worst congestion conditions at three intersections in Vancouver and three intersections in Portland, as shown on Exhibit 3.10-9. The intersections were selected to represent locations where CO emissions would likely be the highest. The analysis is based on the local traffic impacts of Alternative 3 (replacement crossing and light rail) with a Lincoln terminus. The other alternatives would have similar concentrations, all well below the federal standard.

The project team followed the required methods and formulas to estimate CO concentrations based on traffic forecasts, and compared these estimated concentrations to the regulatory standards, which are:

- the maximum one-hour CO concentration cannot exceed 35 parts per million (ppm)
- the maximum eight-hour CO concentration cannot exceed 9 ppm.

The highest modeled one-hour concentration at any of the intersections was 5.2 parts per million (ppm), or about 38 percent lower than existing conditions and 85 percent below the standard. The highest modeled eight-hour concentration at any of the intersections was 4.7 ppm, or about 34 percent lower than existing conditions and 48 percent below the standard. No violations of the national standards were forecast for existing conditions, or the No-Build or build alternatives. No CO hotspot violations are anticipated.

Exhibit 3.10-9  
Air Quality Findings for Specific Intersections



Source: CRC Air Quality Technical Report. Map not to scale.

Intersection 1: East 39th Street at Main Street

Intersection 2: Fourth Plain Blvd. at Main Street

Intersection 3: Mill Plain Blvd. at Main Street

Intersection 4: Lombard Street at Interstate Avenue

Intersection 5: Rosa Parks Blvd. at Interstate Avenue

Intersection 6: Going Street at Interstate Avenue

### 3.10.3 Long-term Effects from Project Components

This section describes the effects or impacts of the components that comprise the project alternatives.

#### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

As described in the full alternatives section above, the difference in emissions between the replacement and supplemental river crossing and highway improvement options would be unsubstantial, and both would be a substantial improvement over existing and No-Build conditions.

The stacked transit/highway bridge design for the replacement crossing could have a detrimental local effect on air quality for high-capacity transit users, compared to the standard replacement design or supplemental bridge. If the bridge uses enclosed girder type construction, then ventilation systems would likely be required for transit operating inside the girders, in order to meet ventilation and safety standards. Open girder or truss design could eliminate the need for ventilation systems.

### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

Selecting bus rapid transit would result in more exhaust-emitting transit vehicles (analysis assumes diesel powered buses), whereas light rail is electric and has no street-level exhaust emissions. However, as a result of federal regulations requiring new buses (model year 2007 and later) to meet stringent exhaust emission standards that lower PM and NO<sub>x</sub> emissions by 90 and 95 percent, respectively, even the BRT emissions would likely be minimized. C-TRAN, for example, is currently using and purchasing hybrid buses that would reduce emissions relative to existing diesel buses.

Maintenance of light rail or bus rapid transit vehicles would occur at existing facilities, either the TriMet Ruby Junction maintenance base in Gresham for light rail, or the C-TRAN maintenance base in east Vancouver for bus rapid transit. Stationary sources such as maintenance facilities are subject to the permitting regulations of either DEQ or SWCAA, and no impacts are expected as a result of expanded maintenance base operations.

### **Transit Terminus and Alignment Options (with all Alternatives)**

Transit terminus and alignment options would affect different intersections in the project area at varying levels. However, based on the analysis of the most affected intersections, CO concentrations with any of the alternatives would be well below the CO standards. The terminus and alignment options would not substantially affect other criteria pollutants.

### **Tolling Scenarios**

Alternative 3 was modeled without a toll, which revealed increased emissions in the subareas relative to the No-Build. The increase for the no toll scenario relative to the No-Build Alternative is most observable in the CO, NO<sub>x</sub>, and VOC emissions. For these pollutants the difference ranges from two to 10 percent in Subareas 1, 3, and 4, and 15 to 23 percent in Subarea 2. The range in modeled results is due to variation in forecasted traffic volumes and speeds in the different subareas. Even with the no toll alternative, 2030 emissions would be substantially lower than existing levels.

### **3.10.4 Temporary Effects**

Construction for any CRC build alternative would be extensive and would involve activities that could temporarily affect air quality, such as demolishing existing structures and pavement, operating a wide variety of heavy construction equipment, on-road construction activities, and potential activities at concrete plants or staging sites where construction materials are temporarily stored or prepared. Traffic congestion will occur on some roadways during construction, and potentially along detour or construction haul routes. Construction impacts would be lowest with the No-Build Alternative and much higher for the build alternatives. Construction would cause short-term increases in air pollutant emissions and odors.

The primary direct impacts of construction will be the generation of dust from demolition, site clearing, excavating, and grading activities, direct



exhaust emissions from construction equipment, and increased congestions on the mainline highway and local streets in the project area. Traffic congestion increases idling times and reduces travel speeds, resulting in increased vehicle emission levels. Demolition may involve structures containing lead or asbestos.

Construction of concrete structures or asphalt paving will have associated pollutant-emitting sources, such as mixing operations. Stationary sources, such as concrete mix and asphalt plants, are generally required to obtain an air permit from either Oregon DEQ or the Southwest Clean Air Agency (SWCAA), and to comply with regulations for controlling dust and other pollutant emissions. Burning of debris from land clearing is prohibited in the project area. Demolition of a structure containing asbestos is regulated by DEQ (in Portland) and SWCAA (in Vancouver).

### **3.10.5 Potential Mitigation Measures**

#### **Potential Mitigation of Long-term Effects**

Long-term air quality impacts for criteria pollutants and mobile source air toxins would not be expected to occur as a result of the project. No mitigation is proposed. Elements of the CRC options that help reduce operational emissions include:

- High-capacity public transit.
- Electric-powered light rail and bio-diesel and electric-diesel hybrid buses.
- Highway capacity and safety improvements that reduce congestion and idling.
- TSM/TDM measures that reduce auto trips.
- Highway tolling that encourages the reduction of auto trips and the increase of transit mode share.

#### **Potential Mitigation of Temporary Effects**

Construction mitigation would include measures to control dust and exhaust emissions from demolition and construction activities and minimize the effects of traffic congestion. Because of the magnitude of the I-5 CRC project, the contractor would be required to develop a pollution control plan that includes documentation of operational measures that will be used to reduce emissions. Section 290 of the ODOT standard specifications and Section 1-07.5(4) of the WSDOT standard specifications outline requirements for environmental protection, including air pollution control measures. These control measures could be included in the project specifications.

Strategies to minimize the occurrence and effects of construction-related congestion will be developed throughout the design phase. This includes refining alternatives, further analyzing traffic impacts, and developing detailed construction traffic mitigation plans. Some of the strategies for reducing construction-related air quality impacts may include:

- Providing alternatives to single-occupant vehicle (SOV) trips.

- Providing incentives to reduce automobile trips and encourage mode shifts to non-SOV types.
- Managing traffic and lane closures to avoid congestion and delay.
- Providing traveler information at key junctions to encourage traffic diversion from the I-5 project area and crossing routes.
- Promoting continuous information campaigns to alert motorists of delay times within the corridor and of upcoming traffic pattern changes and detours.
- Incorporating transit priority measures where feasible.
- Working with employers whose employees must commute through the area to promote alternative work schedules.
- Instituting contractor incentives or requirements to shorten construction durations and encourage the use of lower-emitting construction equipment.

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### 3.11 Noise and Vibration

The CRC noise and vibration analysis followed the guidance of state and federal transportation agencies in order to identify the CRC alternatives' potential noise and vibration impacts and mitigation. The guidelines and standards for analyzing and mitigating highway noise are established by the Federal Highway Administration (FHWA) and state DOTs. They are different than those for transit noise, which are established by the Federal Transit Administration (FTA). These differences, and the results of the analysis, are summarized below. This information draws from the information included in the CRC Noise and Vibration Technical Report.

#### 3.11.1 Existing Conditions

##### How are sound levels measured?

Two important aspects of sound that determine its potential impacts are loudness and frequency. The unit used to measure the loudness of noise is a decibel (dB). An adjusted dB scale, referred to as the A-weighted decibel scale, accounts for humans' ability to hear only a limited range of frequencies. Decibels in the A-weighted scale are designated as dBA. This report uses the dBA unit of measurement.

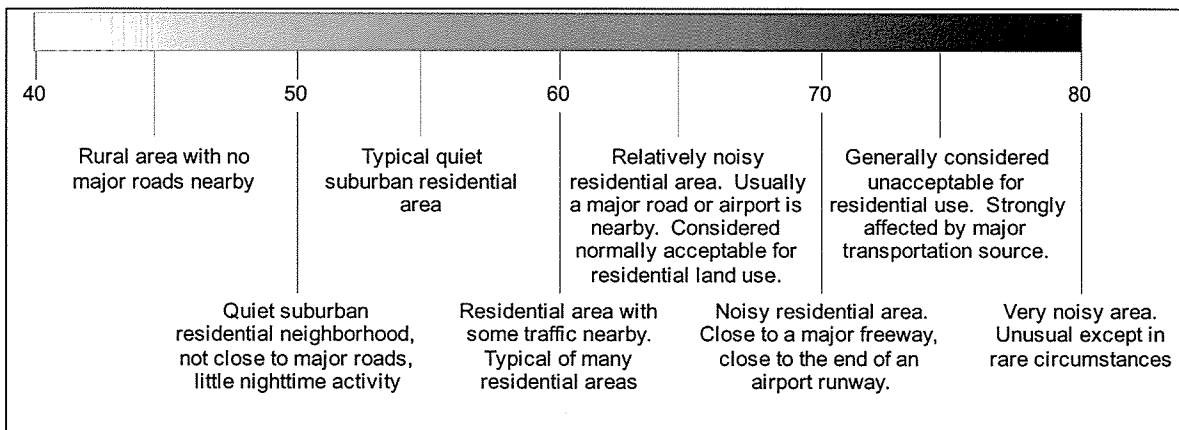
Noise levels at a given location tend to vary with time. To account for the variance in loudness over time, a common noise measurement is the equivalent sound pressure level (Leq). It is measured in dBA, for a specific time period (for example, 1 minute). This report uses Leq to describe traffic and transit noise at schools, libraries, and other sensitive institutions. This analysis also gave more weight to noise that occurs at night (10:00 p.m. to 7 a.m.), consistent with federal regulations. Calculations that use this method produce the Day-Night Equivalent Sound Level, which is abbreviated as Ldn.

##### What are typical noise levels?

Most urban and suburban neighborhoods have Ldn levels in the range of 50 to 70 dBA. Exhibit 3.11-1 shows typical community noise levels.

Exhibit 3.11-1

##### Typical Community Noise Levels in Ldn



Source: FTA, 1995.

#### How do decibels relate to loudness?

The human ear generally cannot detect very slight up or down changes in noise levels. The smallest change in noise level that a human ear can perceive is about 3 dBA, while increases of 5 dBA or more are clearly noticeable. For most people, a 10 dBA increase in noise levels is judged as a doubling of sound level.



Exhibit 3.11-2 indicates the noise levels for various noise sources and the typical human response to the noise level.

Exhibit 3.11-2  
**Typical Sound Levels**

	Noise Source of Activity	Relative Loudness (Human judgement of different sound levels)	Subjective Impression
140	Jet aircraft takeoff from carrier (50 feet)	64 times as loud	Threshold of pain
130	50-horsepower siren	32 times as loud	
120	Loud rock concert near stage Jet takeoff (200 feet)	16 times as loud	Uncomfortably loud
110	Float plan takeoff (100 feet)	8 times as loud	
100	Jet takeoff (2,000 feet)	4 times as loud	Very loud
90	Heavy truck or motorcycle (25 feet)	2 times as loud	
80	Garbage disposal (2 feet)	Reference loudness	Moderately loud
70	Typical at-grade light rail vehicle	1/2 as loud	
60	Moderately busy department store	1/4 as loud	
50	Typical television show (10 feet) Typical quiet office environment	1/8 as loud	
40	Bedroom or quiet living room	1/16 as loud	Quiet
30	Quiet library, soft whisper (15 feet)	1/32 as loud	Very quiet
20	High-quality recording studio	1/84 as loud	Just audible
10	Acoustic Test Chamber	1/128 as loud	
0			Threshold of hearing

### Noise Criteria and Analysis Methods

This section outlines how the CRC project analyzed noise impacts.

#### WHAT ARE THE HIGHWAY TRAFFIC NOISE CRITERIA?

Exhibit 3.11-3 outlines FHWA traffic noise abatement criteria. ODOT is responsible for implementing the FHWA regulations in Oregon. Under ODOT policy, a traffic noise impact occurs if predicted noise levels are within two A-weighted decibels (dBA) of the FHWA criteria. These criteria apply to the peak noise impact hour. WSDOT administers the FHWA regulations in Washington. Under WSDOT policy, a traffic noise impact occurs if predicted noise levels are within 1 dBA of the FHWA

criteria. Both agencies consider an increase of 10 dBA or more substantial.

Exhibit 3.11-3

**FHWA Traffic Noise Abatement Criteria**

Land Use Category		Hourly Leq <sup>a</sup> (dBA)
<b>Type A:</b>	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose	57 (exterior)
<b>Type B:</b>	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, (exterior) motels, hotels, schools, churches, libraries and hospitals	67 (exterior)
<b>Type C:</b>	Developed lands, properties or activities not included in the above categories	72 (exterior)
<b>Type D:</b>	Undeveloped land	—
<b>Type E:</b>	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums	52 (interior)

Source: FHWA, 1982.

<sup>a</sup> Leq = equivalent sound pressure level.

Other state regulations set allowable noise levels for individual vehicles, and for different land uses. They do not apply to highway or transit noise, but could apply to associated stationary noise sources such as park and ride lots and maintenance facilities.

**WHAT ARE THE TRANSIT NOISE CRITERIA?**

The criteria for transit impacts are taken from the FTA Transit Noise and Vibration Impact Assessment, Final Report May, 2006. The FTA noise criteria apply to noise generated by the bus rapid transit and light rail transit elements of the project. Under these criteria, the amount that the transit project is allowed to change the overall noise environment is reduced with increasing levels of existing noise. The FTA noise impact criteria identify the following noise sensitive land use categories:

**Category 1:** Buildings or parks where quiet is an essential element of their purpose.

**Category 2:** Residences and buildings where people normally sleep. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance.

**Category 3:** Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, office buildings, and other commercial and industrial land uses.

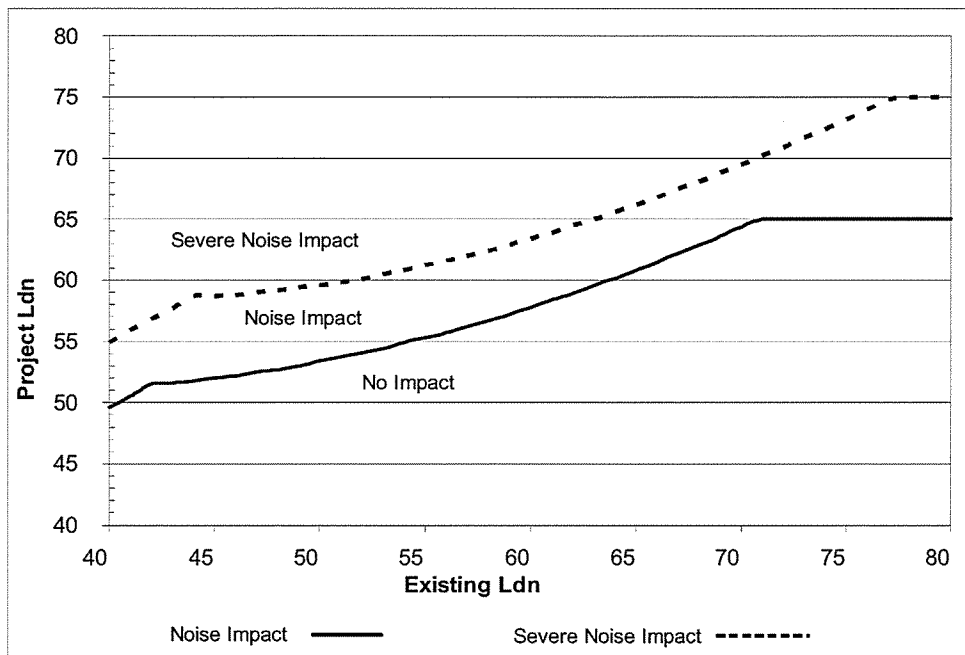
There are two levels of impact included in the FTA transit noise criteria, as shown in Exhibit 3.11-4. These two levels are:

- **Severe Impact:** Severe noise impacts are considered significant as this term is used in the National Environmental Policy Act (NEPA) and implementing regulations. Noise mitigation will normally be

specified for severe impact areas unless there is no practical method of mitigating the noise.

- **Impact:** In this range, often called a moderate impact, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These other factors can include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost effectiveness of mitigating noise to more acceptable levels.

Exhibit 3.11-4

**FTA Transit Noise Impact Criteria**

Source: FTA, 2006.

**HOW WERE FUTURE TRANSIT NOISE IMPACTS ESTIMATED?**

The transit noise analysis for the project alternatives follows the FTA's Detailed Noise Analysis methodology. This methodology provides a comprehensive assessment of project noise impacts commensurate with the level of design detail available. For bus transit/highway projects, the FTA guidance recommends following the FHWA methodology, which was followed for this analysis. Bus transit centers and other bus transit/highway transit stationary sources were analyzed following the FTA's Detailed Assessment methodology.

**WHAT ARE THE CITY NOISE STANDARDS?**

The City of Portland regulates construction noise, and virtually all major construction projects require a noise variance if they perform nighttime construction. Multnomah County, Clackamas County, and the City of Portland do not have vibration regulations.

The City of Vancouver has incorporated most state noise and vibration regulations into the Vancouver Municipal Code. It prohibits off-site

vibration impacts that are discernible without instruments at the property line, and construction activity between 8 p.m. and 7 a.m. The regulations do not apply to public streets and sidewalks, rail maintenance yards, or essential public facilities such as the interstate highway system or intercity passenger rail. This code may apply to transit stations and to park and ride lots.

## Understanding Vibration

### HOW ARE VIBRATION LEVELS MEASURED?

Vibration consists of oscillatory waves that propagate from the source through the ground to adjacent buildings, and is typically called ground-borne vibration. Two types of vibration were analyzed for the CRC alternatives—vibration from the operation of proposed light rail options, and vibration that would occur during project construction.

Vibration velocity is usually given in terms of either inches per second or decibels. This report uses the abbreviation VdB for vibration decibels to minimize confusion with sound decibels.

### WHAT ARE SOME TYPICAL VIBRATION LEVELS?

Exhibit 3.11-5 gives a general idea of human and building response to different levels of vibration in VdB. Existing background building vibration is usually in the range of 40 to 50 VdB, which is well below the range of human perception.

## Vibration Criteria and Analysis Methods

### WHAT ARE THE VIBRATION CRITERIA?

The FTA has developed impact criteria for acceptable levels of ground-borne noise and vibration that would apply to the bus rapid transit and light rail transit components of the project. These were followed for the analysis of CRC alternatives.

### HOW ARE FUTURE VIBRATION IMPACTS ESTIMATED?

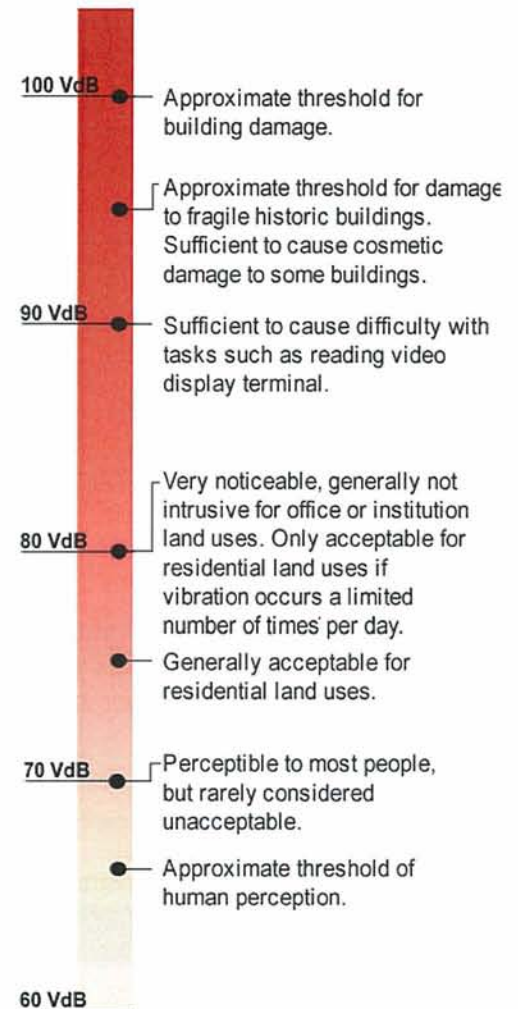
An important factor in projecting levels of vibration related to transit operations is the rate at which the vibration is reduced as it moves away from the source. The relationship between a vibration source, and the level of ground vibration at a specific distance from the source, is known as the transfer mobility. To properly determine the transfer mobility, vibration propagation measurements were conducted at four locations in the CRC corridor near the proposed transit alignments. The transit vibration analysis follows the FTA's General Vibration Assessment methodology. This methodology provides a comprehensive assessment of project vibration and ground-borne noise impacts.

## Existing Noise Levels in the CRC Project Area

Existing noise levels were measured at 68 locations from North Portland Harbor and Hayden Island to SR 500 in Vancouver. Each of these locations has one or more noise receptors at sensitive land uses such as residences, hotels, motels, or parks (see sidebar). Noise levels in the project corridor ranged from 53 to 75 dBA Leq, with 24-hour Ldn noise levels ranging from 57 to 75 dBA.

Exhibit 3.11-5

### Human and Building Response to Ground-borne Vibration Levels



SOURCE: FTA, April 1995

## What is a noise receptor?

Sensitive noise receptors are, in general, those areas of human residence or frequent use where increases in noise could potentially adversely affect the occupancy, use, or enjoyment of the location. For certain locations, such as an apartment building or hotel, there may be multiple receptors for the multiple residential units that they contain.



Currently, estimated noise levels meet or exceed the traffic noise criteria at 234 noise-sensitive receptors along I-5 and proposed transit alignments in the CRC project area. This includes single and multi-family residences along with several hotels and the residential equivalents for the parks, schools and cemetery. Of the existing impacts identified in the CRC project area, 92 are located on the Portland side, and 142 are located in Vancouver. Overall, noise levels in the project study area are dominated by traffic on I-5.

### 3.11.2 Long-term Effects of the Project Alternatives

The number of highway noise impacts would be the same for all of the build alternatives. Transit noise impacts would vary substantially by transit mode, transit operations, transit terminus option, and transit alignment options. The following tables and associated discussion summarize the potential noise and vibration impacts associated with the project alternatives.

#### Alternative 1: No-Build

Noise levels in the project area would continue to increase as traffic volumes increase. Overall, noise levels are projected to increase the most along I-5 and Main Street north of Mill Plain, where levels are projected to increase by 2 to 4 dBA with No-Build. Noise level on Hayden Island and in the downtown Vancouver core would increase by 1 dBA. Noise along most of McLoughlin and 16th Street would increase by 1 dBA except for locations close to I-5, where noise may increase by up to 4 dBA Leq. Under No-Build, the number of impacted noise receivers would increase to 268, as compared to the 234 noise receivers that are currently impacted.

#### Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.11-6 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 2.

Exhibit 3.11-6

#### Number of Receivers Impacted by Traffic and Transit Noise or Transit Vibration for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Number of Highway Noise Impacts	334	334	334	334
Number of Moderate Transit Noise Impacts	42-53	58-68	39-50	28
Number of Severe Transit Noise Impacts	19-31	7-17	12-14	7-14
Transit Vibration Impacts	0	0	0	0

Source: CRC Noise and Vibration Technical Report.

Note: The number of noise impacts with the STHB option for the river crossing would be the same as shown in the table above.

Exhibits 3.11-15, 3.11-16, and 3.11-17 at the end of this discussion illustrate locations of the projected traffic noise impacts resulting from the build alternatives, as well as the locations of potential sound walls. Exhibits 3.11-19, 3.11-20, and 3.11-21 show the location of potential transit noise impacts as a result of the four terminus options and transit mode.

Alternative 2 would result in 334 highway noise impacts. Alternative 2 would result in between 28 and 68 moderate transit noise impacts, and between seven and 31 severe noise impacts. These ranges for transit noise impacts are dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-7 for a detailed breakdown of transit noise impacts by alignment option. The replacement crossing when paired with the Kiggins Bowl terminus would result in 400 to 413 highway and transit noise impacts prior to mitigation. The Lincoln terminus option would result in 409 to 416 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS terminus options would result in 385 to 398 and 369 to 423 transit and highway noise impacts, respectively.

Exhibit 3.11-7

**Alternative 2 Noise Levels and Impacts by Transit Alignment Option (BRT with Efficient Transit Operations)**

Terminus Options	Alignment	Area	Existing		BRT L <sub>dn</sub>		Impacts		
			Min	Max	Min	Max	Mod	Sev	Total
A, B, C, or D	Adjacent	Hayden Island Floating Homes	61	69	60	68	28	7	35
A, B, C, or D	Offset	Hayden Island Floating Homes	60	68	60	68	28	14	42
A, B, C, or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	64	64	0	0	0
A or C	McLoughlin Blvd	D St to I-5	62	65	61	65	22	0	22
A or C	16th Street	C St to I-5	61	70	63	66	11	5	16
A	Kiggins Terminus	I-5 North of 33 <sup>rd</sup>	70	70	68	72	3	12	15
B	Two-way Broadway	Broadway; 19th to 29th	64	66	61	68	29	10	39
B	Broadway-Main couplet	Broadway; 19th to 29th	64	66	62	65	39	0	39
B	Lincoln Terminus	Main Street; North of 29th	70	70	64	64	1	0	1

Source: CRC Noise and Vibration Technical Report.

Alternative 2, as it includes BRT, would not result in any transit-related vibration impacts due to the operation of transit.

**Alternative 3: Replacement Crossing with Light Rail**

Exhibit 3.11-8 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 3.

Exhibit 3.11-8

**Number of Receivers Impacted by Traffic and Transit Noise or Transit Vibration for Alternative 3**

<b>Alternative 3: Replacement Crossing with Light Rail</b>				
<b>Environmental Metric</b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Number of Highway Noise Impacts</b>	334	334	334	334
<b>Number of Moderate Transit Noise Impacts</b>	17-37	7-45	17-37	7-21
<b>Number of Severe Transit Noise Impacts</b>	0	0	0	0
<b>Transit Vibration Impacts</b>	40-47	32	5-12	0

Source: CRC Noise and Vibration Technical Report.

Note: The number of impacts with the STHB option for the river crossing would be the same as shown in the table above.

Alternative 3 would result in the same number of highway noise impacts as Alternative 2. Alternative 3 would result in between seven and 45 moderate transit noise impacts, and no severe noise impacts. The range for moderate transit noise impacts is dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-9 for a detailed breakdown of transit noise impacts by alignment option. The replacement crossing when paired with the Kiggins Bowl terminus would result in 351 to 371 highway and transit noise impacts prior to mitigation. The Lincoln terminus option would result in 341 to 379 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS would result in 351 to 371 and 341 to 355 transit and highway noise impacts respectively.

Exhibit 3.11-9

**Alternative 3 Noise Levels and Impacts by Transit Alignment Option (Light Rail with Efficient Transit Operations)**

Terminus Option	Alignment Option	Area	Existing		Train L <sub>dn</sub>		Impacts		
			Min	Max	Min	Max	Mod	Sev	Total
A, B, C, or D	Adjacent	Hayden Island Floating Homes	61	69	55	63	7	0	7
A, B, C, or D	Offset	Hayden Island Floating Homes	60	68	55	64	21	0	21
A, B, C or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	56	58	0	0	0
A or C	McLoughlin Blvd	D St to I-5	62	65	56	61	16	0	16
A or C	16th Street	C St to I-5	61	70	59	62	10	0	10
A	Kiggins Bowl Terminus	Along I-5; North of 33rd	70	70	57	61	0	0	0
B	Two-way Broadway	Broadway, 19th to 29th	64	66	55	63	24	0	24
B	Broadway-Main couplet	Broadway, 19th to 29th	64	66	55	57	0	0	0
B	Lincoln Terminus	Main Street; North of 29th	70	70	60	60	0	0	0

Source: CRC Noise and Vibration Technical Report.

The Kiggins Bowl terminus (3A), with light rail on the McLoughlin alignment option, would result in vibration impacts at 12 residential locations along McLoughlin Boulevard. With the 16th Street alignment option, there are five predicted vibration impacts. The Clark College MOS (3C) would also result in these vibration impacts depending on which transit alignment option is chosen. An additional 35 vibration impacts are predicted along the Kiggins Bowl terminus (3A) where the trackway would be below the grade of the adjacent neighborhood from 26th to 33rd Streets. With the Lincoln terminus option (3B), up to 24 vibration impacts are predicted along Broadway, and eight are predicted along Main Street. No vibration impact would be expected at the Southwest Washington Medical Center on Main and 33rd Streets, but vibration levels would exceed the residential criteria at the Fire Department on Main and 37th Street. The Mill Plain MOS (3D) is not expected to result in any vibration impacts.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Exhibit 3.11-10 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 4.



Exhibit 3.11-10

**Number of Receivers Impacted by Traffic and Transit Noise or Transit Vibration for Alternative 4**

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Number of Highway Noise Impacts	329	329	329	329
Number of Moderate Transit Noise Impacts	37-49	41-70	34-46	24-31
Number of Severe Transit Noise Impacts	26-52	15-51	14-40	7-21
Transit Vibration Impacts	0	0	0	0

Source: CRC Noise and Vibration Technical Report.

Alternative 4 would result in 329 highway noise impacts. Alternative 4 would result in between 24 and 70 moderate transit noise impacts, and between seven and 52 severe noise impacts. These ranges for transit noise impacts are dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-11 for a detailed breakdown of transit noise impacts by alignment option. The supplemental crossing when paired with the Kiggins Bowl terminus would result in 399 to 423 highway and transit noise impacts prior to mitigation. The Lincoln terminus would result in 414 to 421 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS would result in 384 to 408 and 367 to 374 transit and highway noise impacts respectively.

Exhibit 3.11-11

**Alternative 4 Noise Levels and Impacts by Transit Alignment Option (BRT with Increased Transit Operations)**

Terminus Option	Alignment Option	Area	Existing		BRT L <sub>dn</sub>		Impacts		Total impacts
			Min	Max	Min	Max	Mod	Sev	
A, B, C or D	Adjacent	Hayden Island Floating Homes	61	69	62	69	28	7	35
A, B, C or D	Offset	Hayden Island Floating Homes	60	68	61	70	21	21	42
A, B, C or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	65	66	3	0	3
A or C	McLoughlin Blvd	D St to I-5	62	65	62	67	15	19	34
A or C	16th Street	C St to I-5	61	70	64	68	10	7	17
A	Kiggins Terminus	Along I-5; North of 33rd	70	70	0	0	3	12	15
B	Two-way Broadway	Broadway; 19th to 29th	64	66	63	69	9	30	39
B	Broadway-Main Couplet	Broadway; 19th to 29th	64	66	64	66	31	8	39
B	Lincoln Terminus	Main Street; North of 29th	70	70	65	66	8	0	8

Source: CRC Noise and Vibration Technical Report.

Alternative 4, as it includes BRT, would not result in any transit-related vibration impacts due to the operation of transit.

**Alternative 5: Supplemental Crossing with Light Rail**

Exhibit 3.11-12 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 5.

Exhibit 3.11-12

**Number of Receivers Impacted by Traffic and Transit Noise or Transit Vibration for Alternative 5**

Alternative 5: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Number of Highway Noise Impacts	329	329	329	329
Number of Moderate Transit Noise Impacts	17-31	7-51	17-31	7-21
Number of Severe Transit Noise Impacts	0	0	0	0
Transit Vibration Impacts	40-47	32	5-12	0

Source: CRC Noise and Vibration Technical Report.

Alternative 5 would result in the same number of highway noise impacts as Alternatives 4. Alternative 5 would result in between seven and 51 moderate transit noise impacts, and no severe noise impacts. The range for moderate transit noise impacts is dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-13 for a detailed breakdown of transit noise impacts by alignment option. The supplemental crossing when paired with the Kiggins Bowl terminus would result in 346 to 360 highway and transit noise impacts prior to mitigation. The Lincoln terminus option would result in 336 to 380 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS would result in 346 to 360 and 336 to 350 transit and highway noise impacts, respectively.

Exhibit 3.11-13

**Alternative 5 Noise Levels and Impacts by Transit Alignment Option (Light Rail with Increased Transit Operations)**

Terminus Options	Alignment Options	Area	Existing		Train L <sub>dn</sub>		Impacts		
			Min	Max	Min	Max	Mod	Sev	Total
A, B, C, or D	Adjacent	Hayden Island Floating Homes	61	69	56	63	7	0	7
A, B, C, or D	Offset	Hayden Island Floating Homes	60	68	55	64	21	0	21
A, B, C, or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	0	0	0	0	0
A or C	McLoughlin Blvd	D St to I-5	62	65	57	62	19	0	19
A or C	16th Street	C St to I-5	61	70	59	63	10	0	10
A	Kiggins Terminus	Along I-5; North of 33rd	70	70	57	61	0	0	0
B	Two-way Broadway	Broadway; 19th to 29th	64	66	55	64	30	0	30
B	Broadway-Main Couplet	Broadway; 19th to 29th	64	66	55	58	0	0	0
B	Lincoln Terminus	Main Street; north of 29th	70	70	60	61	0	0	0

Source: CRC Noise and Vibration Technical Report.

The Kiggins Bowl terminus (5A), with light rail on the McLoughlin alignment option, would result in vibration impacts at 12 residential locations along McLoughlin Boulevard. With the 16th Street alignment option, there are five predicted vibration impacts. The Clark College MOS (5C) would also result in these vibration impacts depending on which transit alignment option is chosen. An additional 35 vibration impacts are predicted along the Kiggins Bowl terminus (5A) where the trackway would be below the grade of the adjacent neighborhood, from 26th to 33rd Streets. With the Lincoln terminus option (5B), up to 24 vibration impacts are predicted along Broadway, and eight are predicted along Main Street. No vibration impact is expected at the Southwest Washington Medical Center on Main and 33rd Streets, but vibration levels would exceed the residential criteria at the Fire Department on Main and 37th Street. The Mill Plain MOS (5D) is not expected to result in any vibration impacts.

### 3.11.3 Long-term Effects from Project Components

This section describes the noise and vibration impacts of the components and options that comprise the project alternatives. This same information is presented above by alternative. Components such as tolling and transportation demand management options do not influence long-term noise and vibration effects, and so are not discussed below.

#### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

Overall noise impacts from the replacement and the supplemental river crossing and highway improvements are very similar, with minor differences in subareas of the project. Traffic noise impacts are illustrated by Alternative in Exhibit 3.11-14.

Exhibit 3.11-14

#### Summary of I-5 Traffic Noise Impacts before Mitigation (dBA)

Subarea	Existing	No-Build	Replacement crossing (Alternatives 2 and 3)	Supplemental crossing (Alternatives 4 and 5)
<b>Portland</b>				
noise levels (dBA)	47–73	48–74	51–75	51–74
receptors exceeding noise criteria	92	92	92	87 <sup>a</sup>
<b>Downtown Vancouver</b>				
noise levels	61–74	63–75	64–74	64–74
receptors exceeding noise criteria	62	62	62	62
<b>Fort Vancouver</b>				
noise levels (dBA)	61–73	62–74	60–76	62–76
receptors exceeding noise criteria	12	18	26	26
<b>Mill Plain to N Vancouver east of I-5</b>				
noise levels	55–74	57–76	58–76	58–76
receptors exceeding noise criteria	16	16	37	37
<b>Mill Plain to N Vancouver west of I-5</b>				
noise levels (dBA)	56–73	57–74	58–78	58–78
receptors exceeding noise criteria	52	80	117	117
<b>Total</b>				
Receptors exceeding noise criteria	234	268	334	329

Source: CRC Noise and Vibration Technical Report.

<sup>a</sup> The number of traffic noise impacts as a result of the supplemental river crossing are five less than with the replacement river crossing because five potentially impacted floating homes are displaced by the supplemental crossing.



**PORTLAND SUBAREA TRAFFIC NOISE**

Without the CRC highway improvements, in the year 2030 I-5 traffic noise levels in north Portland would exceed traffic noise criteria at the same 92 locations as under existing conditions. Noise levels would increase about 1 dBA (an increase typically not discernable by a person with average hearing) over existing levels at approximately 50 floating homes that currently exceed the impact criteria with existing levels of 67 to 74 dBA Leq. Noise impacts with No-Build would also occur at the Red Lion Hotel on the River (on the north shore of Hayden Island), and include all rooms facing I-5 with noise levels ranging from 68 to 72 dBA Leq.

The build alternatives would lower traffic noise levels at some receivers by up to 2 dBA and raise noise levels at other receivers by up to 5 dBA, but would not increase the number of receivers exceeding the noise impact criteria. In the case of the supplemental river crossing, the number of noise impacts is less because the river crossing displaces five of the potentially effected floating homes. Exhibit 3.11-15 illustrates traffic noise impacts in north Portland and on Hayden Island. The difference in noise levels between the replacement crossing (Alternatives 2 and 3) and supplemental crossing (Alternatives 4 and 5) is less than 2 dBA—imperceptible to a person with average hearing. In some cases, as at the floating homes in North Portland Harbor, some of these noise impacts may overlap or be in addition to transit noise impacts as a result of the offset or adjacent transit alignments across the Harbor.

**DOWNTOWN VANCOUVER SUBAREA TRAFFIC NOISE**

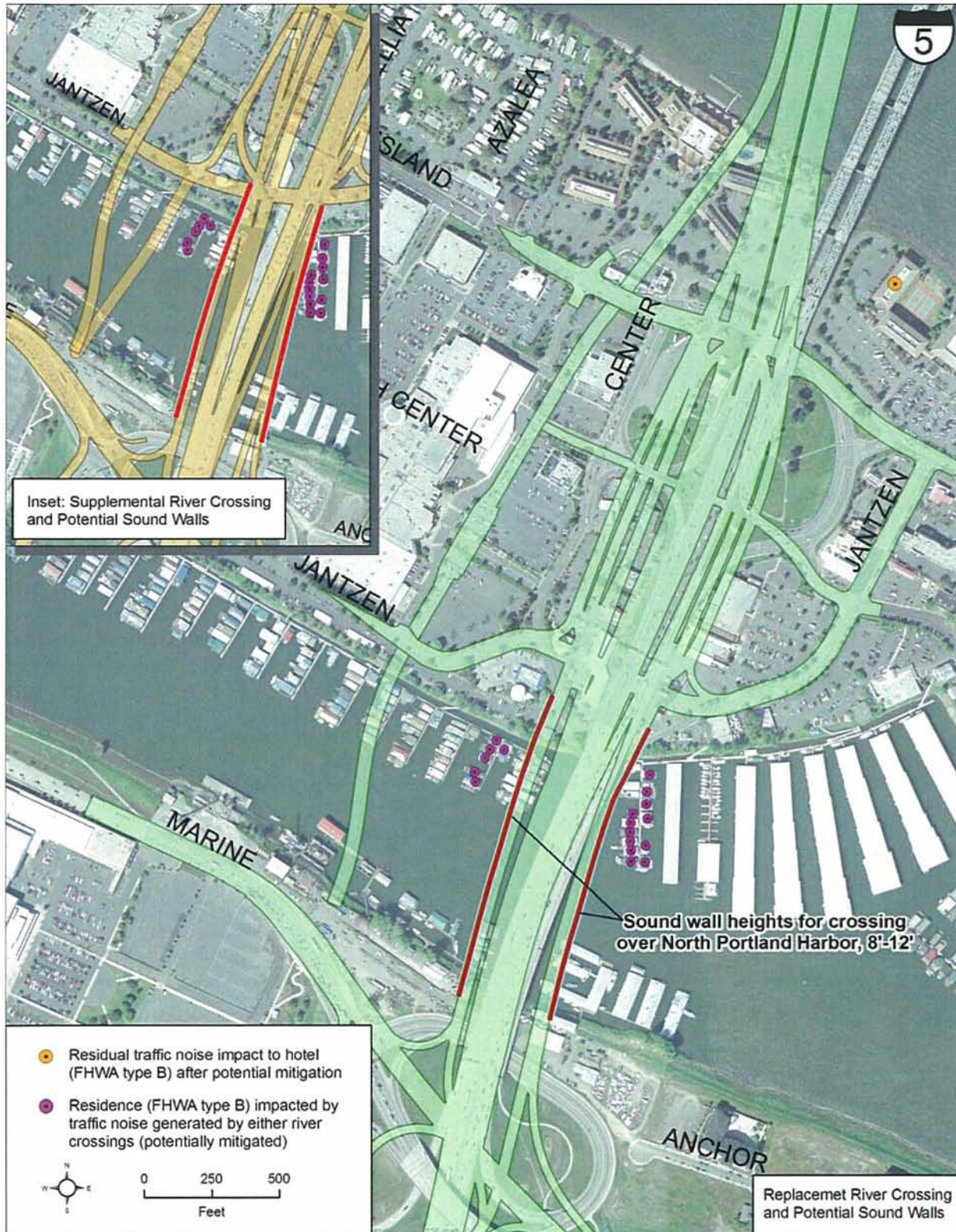
Without the CRC highway improvements, I-5 traffic noise would exceed the WSDOT traffic noise criteria at the same 62 noise-sensitive land uses as under existing conditions. Noise levels would increase by 0 to 2 dBA under the No-Build Alternative when compared to the current noise level estimates.

All the build alternatives would lower traffic noise levels at some receivers by up to 6 dBA and raise noise levels at other receivers by up to 5 dBA, but would not change the number of receivers exceeding the noise criteria. The differences in noise levels between the replacement and supplemental bridge and highway options is less than 1 to 2 dBA—imperceptible to a person with average hearing.

Traffic noise modeling shows that future traffic noise levels in downtown Vancouver would be the same at all receivers except the Red Lion Hotel Vancouver at the Quay, which is adjacent to the I-5 bridge. Exhibit 3.11-16 illustrates traffic noise impacts in south Vancouver. The shift in I-5 alignment and elevation between the replacement and supplemental alternatives would create a 3 dBA difference in future traffic noise levels at this location. However, the noise sensitive land use here would be impacted by I-5 traffic noise under the No-build or build alternatives, so there would be no change in the number of traffic noise impacts.

Exhibit 3.11-15

## Traffic Related Noise Impacts and Potential Mitigation in North Portland and Hayden Island

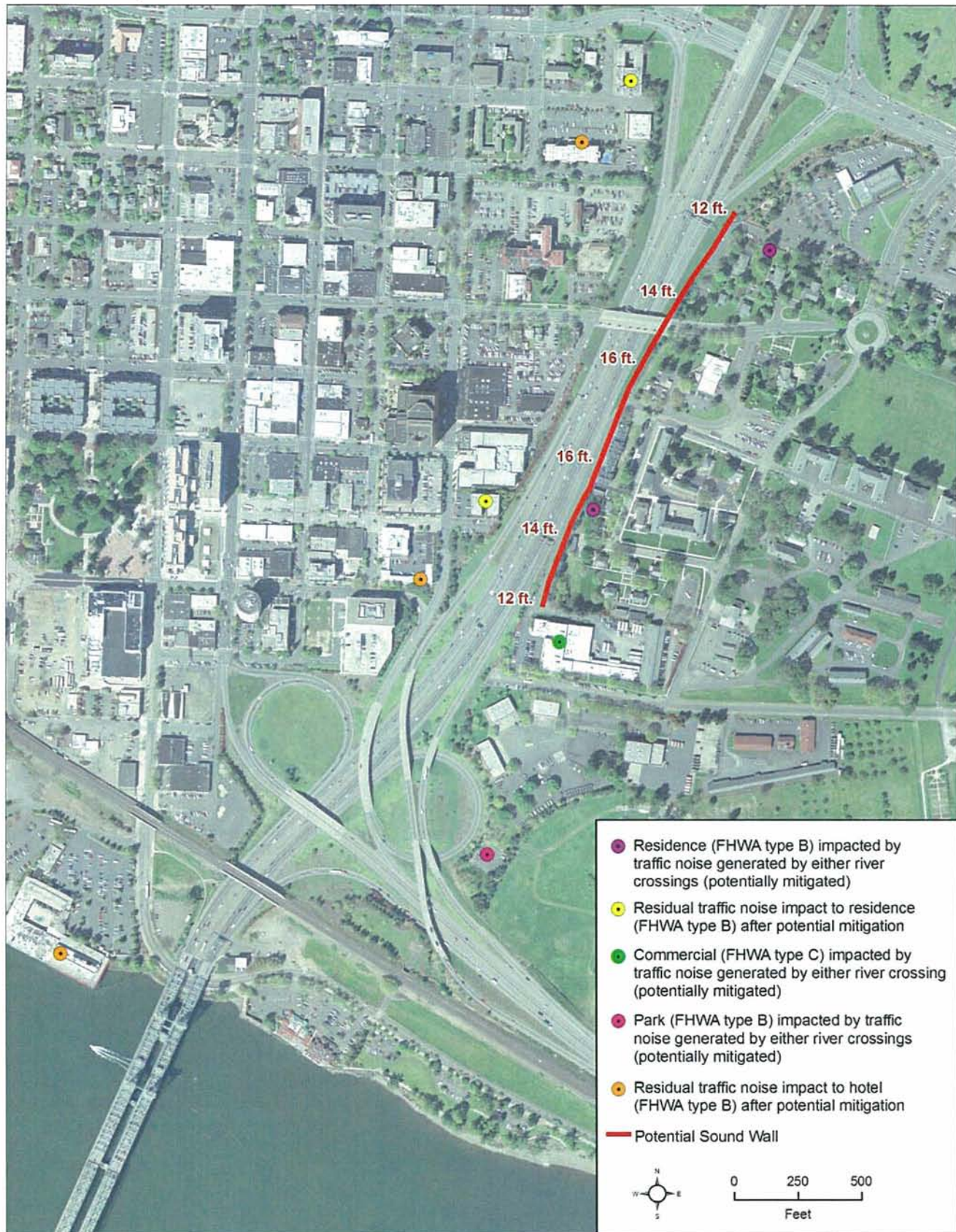


Source: CRC Noise and Vibration Technical Report.



## Exhibit 3.11-16

## Traffic Noise Impacts and Potential Mitigation in Downtown Vancouver and near Fort Vancouver



Source: CRC Noise and Vibration Technical Report.

**FORT VANCOUVER SUBAREA TRAFFIC NOISE**

By 2030, the increase in traffic on I-5 would raise traffic noise by about 1 dBA, and exceed the WSDOT traffic noise criteria at 18 noise-sensitive land uses, six more than under existing conditions. Noise levels on the Fort under the No-Build Alternative are projected to range from 62 to 74 dBA Leq with the highest levels at unshielded areas along I-5 and SR 14. The new noise impacts would be at residential receivers, one commercial use near Officers Row, and potentially one location in the park.

Compared to the No-Build Alternative, the build alternatives would increase traffic noise levels at some receivers by up to 5 dBA and reduce noise levels at other receivers by up to 3 dBA. Modeled results show that the build alternatives would impact 26 receivers, eight more than with the No-Build Alternative. Exhibit 3.11-16 illustrates traffic noise impacts in the Fort Vancouver sub-area.

**EAST OF I-5/MILL PLAIN TO NORTH VANCOUVER SUBAREA TRAFFIC NOISE**

By 2030, noise levels at the modeling locations in this area will range from 57 to 76 dBA Leq, an increase of 1 to 2 dBA over existing noise levels. The 16 locations that would meet or exceed WSDOT traffic noise criteria with the No-Build Alternative are already impacted under existing conditions. Noise levels do not exceed the criteria at the hospital, school or church, but do exceed the criteria at the VA Cemetery for areas within the cemetery near I-5.

All the build alternatives would raise traffic noise levels at some receivers by 0 to 5 dBA, and would increase the number of receivers exceeding the noise criteria by 21, to a total of 37 receivers. Exhibit 3.11-17 illustrates traffic noise impacts east of I-5 and north of Mill Plain Boulevard.

**WEST OF I-5/MILL PLAIN TO NORTH VANCOUVER SUBAREA TRAFFIC NOISE**

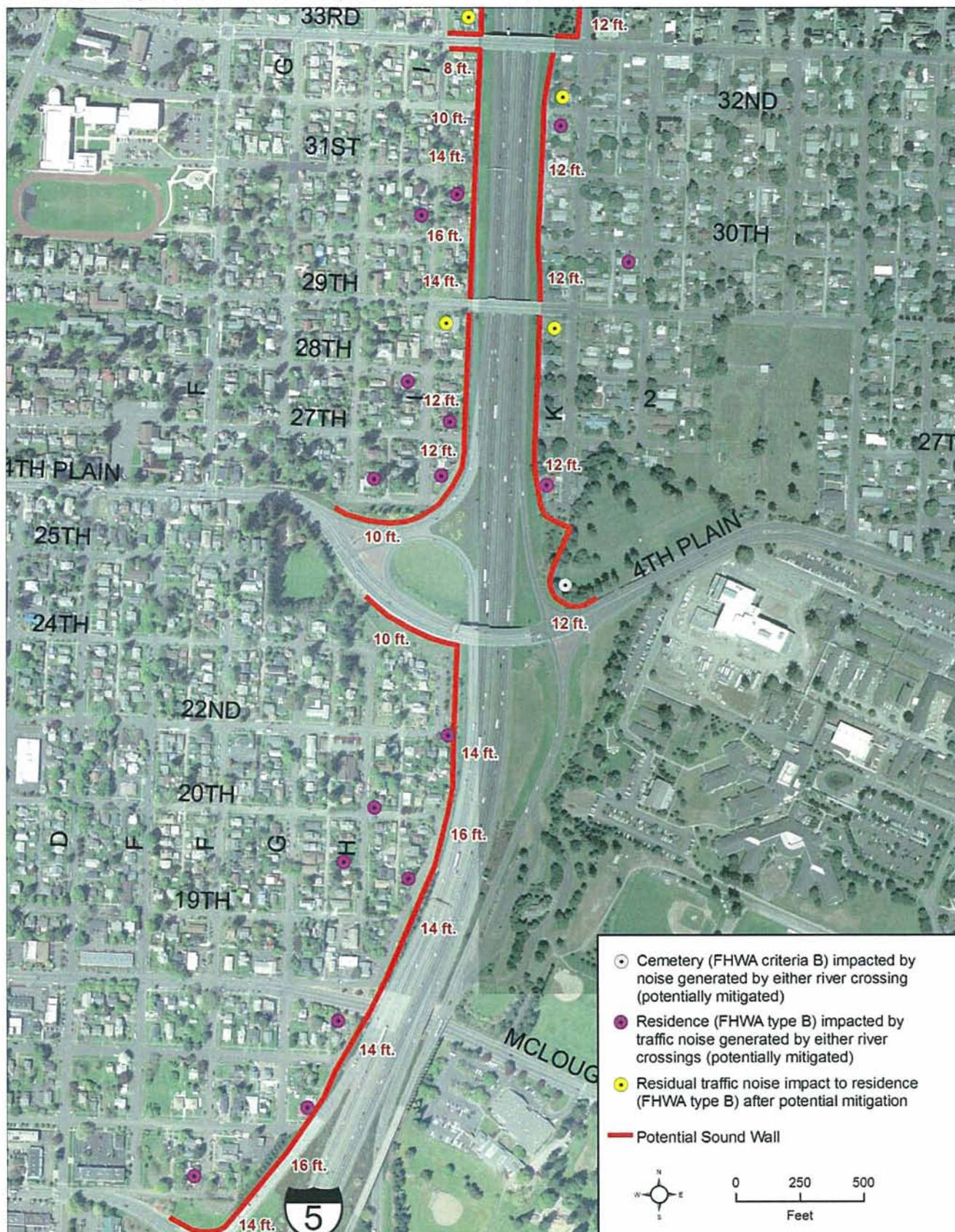
Traffic noise levels west of I-5 and north of Mill Plain are projected to range from 57 to 74 dBA Leq, a 1 to 4 dBA increase over existing conditions. Under the No-Build Alternative, 80 noise sensitive land-uses would exceed the noise impact criteria, compared to 52 noise impacts under existing conditions. The Discovery School parking area would continue to have noise levels that exceed the criteria. The eastern edge of the football field north of the school would be newly impacted under the No-Build Alternative.

The build alternatives would raise traffic noise levels by 0 to 3 dBA at some receivers, and reduce traffic noise by up to 6 dBA at others. Both options would increase the number of receivers exceeding the noise criteria by 62 compared to No-Build, to a total of 117 receivers. There is little difference between the build alternatives. Exhibit 3.11-17 illustrates traffic noise impacts west of I-5 and north of Mill Plain Boulevard. When paired with the Kiggins Bowl terminus option, the highway improvements associated with the replacement river crossing would be required to shift 25 feet West through this area. This shift would not result in any new noise impacts.



Exhibit 3.11-17 (page 1 of 2)

## Traffic Noise Impacts and Potential Mitigation in Northern Vancouver

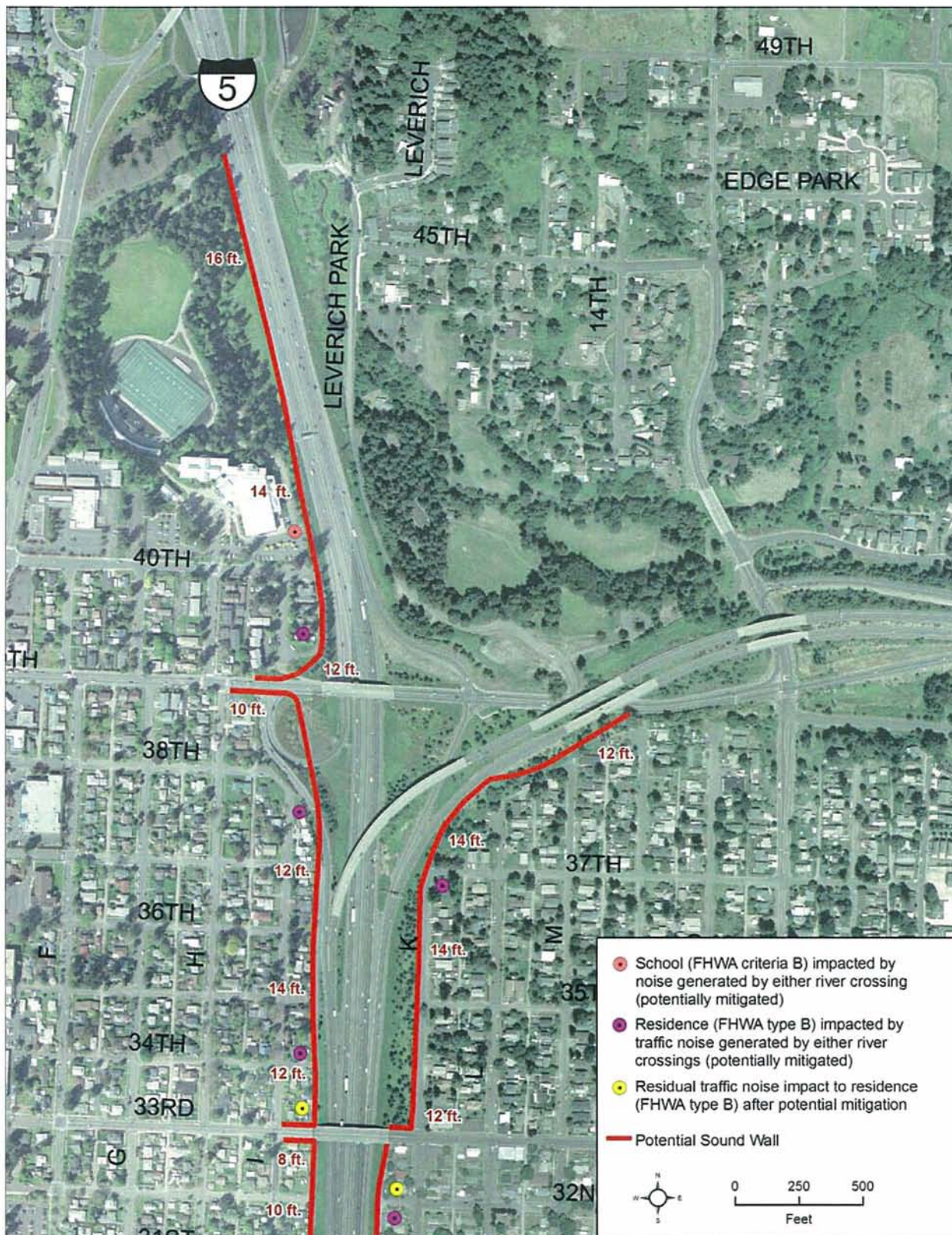


Source: CRC Noise and Vibration Technical Report.



Exhibit 3.11-17 (page 2 of 2)

## Traffic Noise Impacts and Potential Mitigation in Northern Vancouver



### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

Transit noise impacts vary substantially by transit mode because a typical diesel bus is considerably louder than an electric light rail vehicle. Bus rapid transit would result in between 24 and 70 moderate noise impacts and between seven and 52 severe noise impacts. Light rail would result in between seven and 51 moderate noise impacts and no severe noise impacts. The range of impacts for each mode is based on the range of potential transit terminus and alignments options, as discussed in the following section.

Vibration impacts would occur only with light rail, as buses rarely produce vibration levels high enough to surpass the criteria. Train systems like light rail create ground-borne vibration by the interaction of steel wheels rolling on the steel rails. Vibration and radiated noise can be intrusive and annoying to building occupants. Light rail would result in 32 to 47 vibration impacts, depending on the transit terminus and alignment options selected, as discussed in the following section.

Expansion of either the C-TRAN bus maintenance facility in eastern Vancouver or the TriMet light rail maintenance facility in Gresham would not result in any additional noise or vibration impacts

### **Transit Terminus Options (with all Alternatives)**

The Kiggins Bowl terminus option (A) would have 17 to 53 moderate noise impacts and 0 to 52 severe noise impacts. The Lincoln terminus option (B) would have seven to 70 moderate noise impacts and 0 to 51 severe noise impacts. The range reflects the variation in transit mode, design alignment options and transit operating assumptions.

The Clark College minimum operable segment (MOS) (C) would have 17 to 50 moderate noise impacts and 0 to 40 severe noise impacts. This terminus option would avoid transit noise impacts north of Clark College along the Kiggins Bowl terminus option (A) and north of Mill Plain along Main and Broadway. However, local street traffic near Clark College could increase, as drivers travel to the terminus park and ride.

The Mill Plain MOS (D) would have seven to 31 moderate noise impacts and 0 to 21 severe noise impacts. This terminus option would avoid the transit noise impacts associated with the Kiggins Bowl (A), and Lincoln (B) terminus options. Added local traffic traveling to the Mill Plain MOS park and ride and the park and rides near the SR 14/I-5 interchange, as described in Section 3.1, Transportation could increase localized traffic noise levels compared to the full length transit terminus options.

There would be no vibration impacts in Portland or downtown Vancouver. Vibration impacts with the Kiggins Bowl terminus would range from 40 to 47 receivers. With the Lincoln terminus, vibration impacts would range from 8 to 24 receivers. The Clark College MOS (C) would result in vibration impacts to 5 to 12 receivers, while the Mill Plain MOS would not impact any receivers. All of these vibration impacts can be mitigated. Exhibit 3.11-18 indicates vibration impacts by transit alignment option.



Exhibit 3.11-18

**Light Rail Vibration Impact Summary before Mitigation**

Terminus Option	Alignment option	Area	Impact Criteria (VdB)	Predicted Level (VdB)	Vibration Impacts
A, B, C, or D	Offset or Adjacent	Portland	72	<62	0
A, B, C, or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	72	69 to 71	0
A or C	McLoughlin Blvd	D St to I-5	72	72 to 73	12
A or C	16th Street	C St to I-5	72	78	5
A	Kiggins Terminus	Along I-5, 26th to 33rd	72	74 to 76	35
B	2-way Broadway or Broadway-Main Couplet	Broadway; 19 <sup>th</sup> to 29th	72	72 to 73	24
B	Lincoln Terminus	Main Street; north of 29th Street	72	72 to 73	8

Source: CRC Noise and Vibration Technical Report.

**Transit Alignment Options (with all Alternatives)****ADJACENT OR OFFSET**

On Hayden Island for light rail, the adjacent alignment option would have seven predicted noise impacts to floating homes, and the offset option would have 21. Bus rapid transit noise would affect seven more homes with the adjacent than the offset alignment. The adjacent option would have seven impacts considered severe under the FTA criteria, and the offset option would have 14. These impacts are in addition to, or overlap with, traffic noise impacts as illustrated in Exhibit 3.11-15. Additionally, some of the floating homes that would otherwise be impacted by noise are displaced by the transit guideway itself. See section 3.3, Acquisitions and Displacements for more information. These impacts are illustrated in Exhibit 3.11-19, although all could be mitigated. These are significant impacts under NEPA guidelines, and the FTA recommends avoiding severe impacts whenever possible. There would be no light rail vibration impacts in this segment.

**TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET**

Between zero and three moderate noise impacts are predicted for either alignment option in the downtown Vancouver segment. Bus rapid transit with Increased operations would result in three impacts, with all other transit modes and operation levels not resulting in impacts downtown. There would be no vibration impacts in this segment. These impacts are illustrated in Exhibit 3.11-20. All could be mitigated.

**16TH STREET OR MCLOUGHLIN**

With the Kiggins Bowl terminus option (A) or the Clark College MOS (C), the McLoughlin alignment option would have more noise impacts than the 16th Street alignment option. Tables in the Alternatives section above list the number of transit noise impacts associated with each alignment option, including how it would vary by transit mode and frequency of transit service. These impacts are illustrated in Exhibit 3.11-21. All could be mitigated.



Exhibit 3.11-19

## Transit Noise Impacts and Potential Mitigation in North Portland and Hayden Island

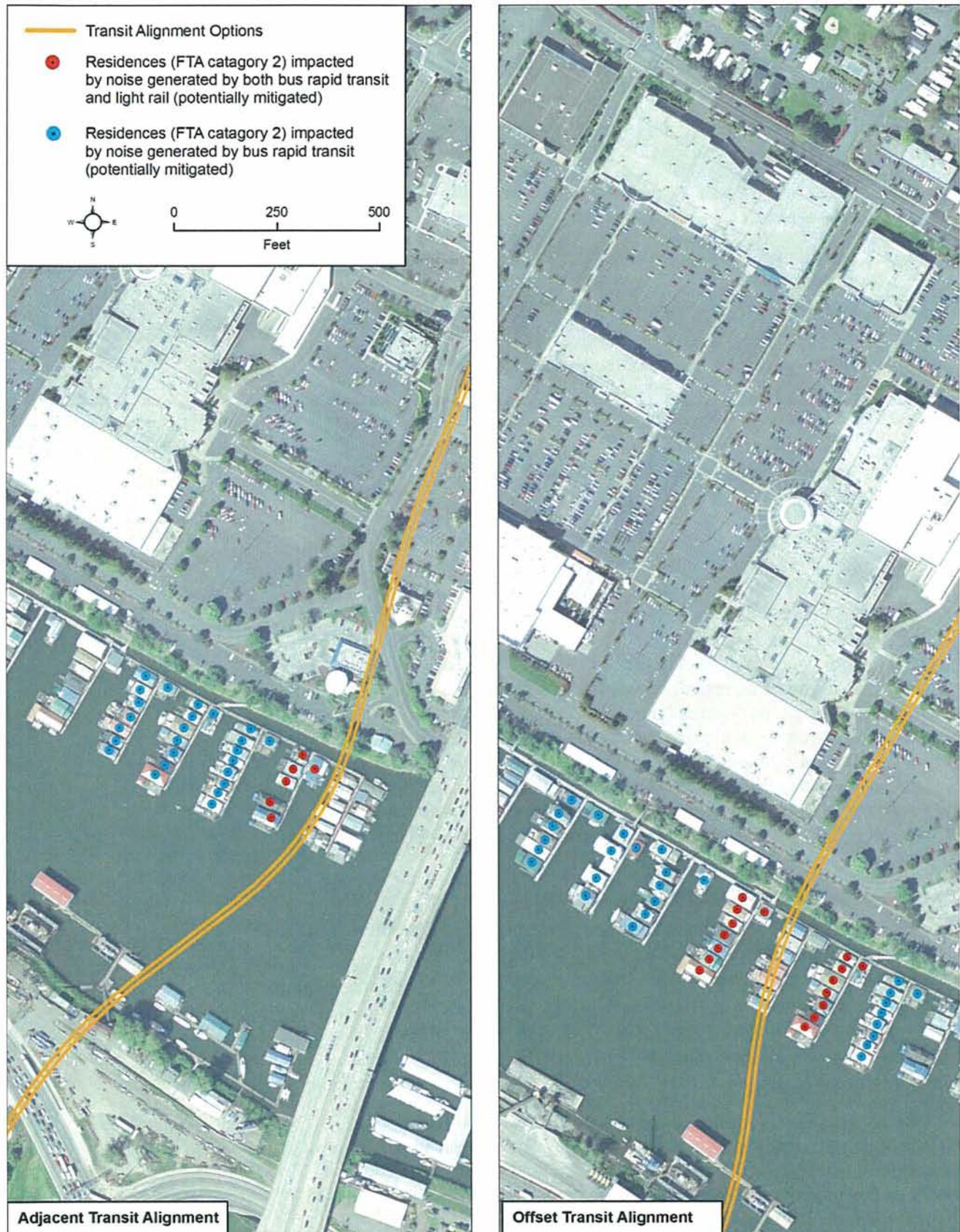




Exhibit 3.11-20  
**Transit Noise Impacts and Potential Mitigation in Downtown Vancouver**

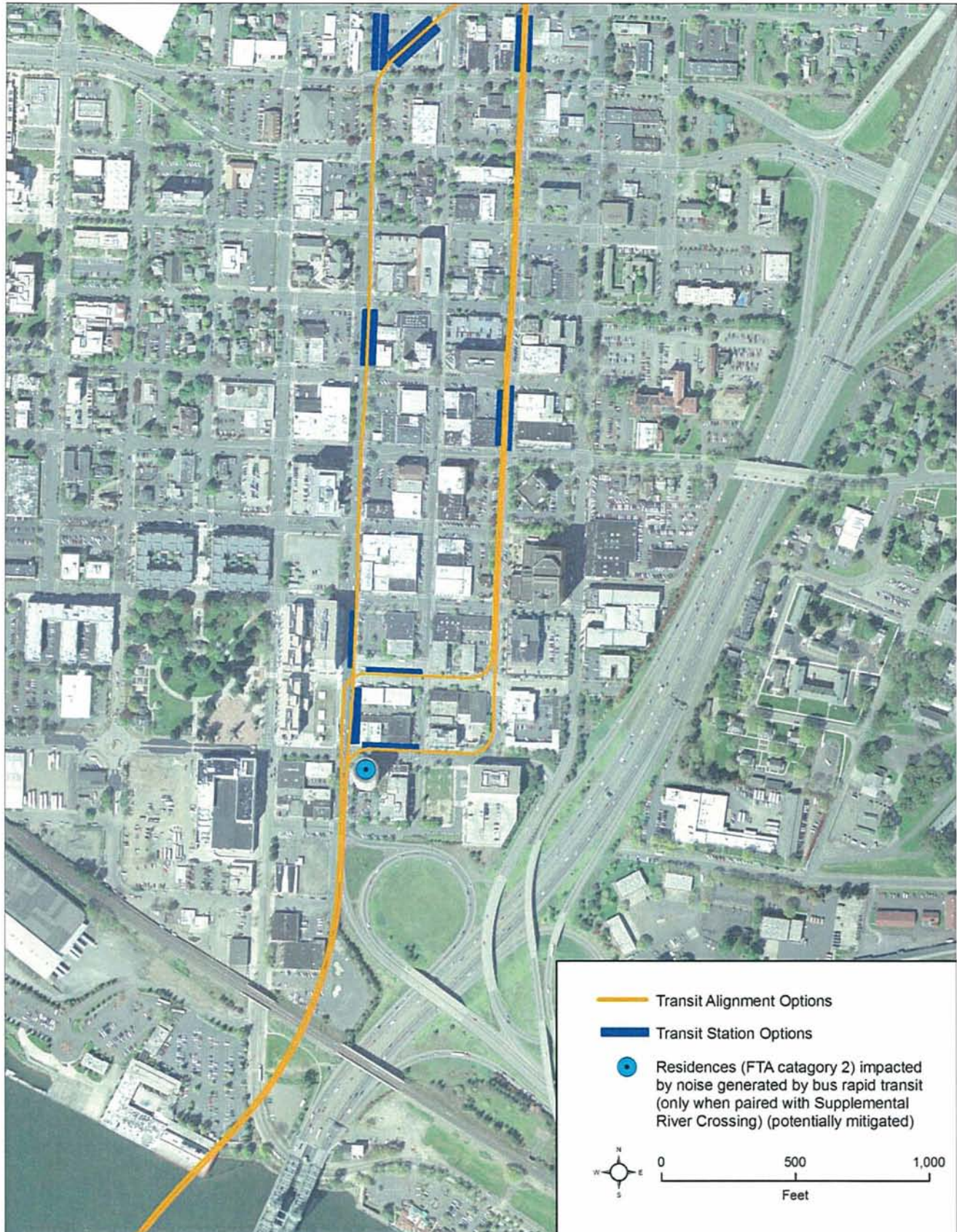




Exhibit 3.11-21 (page 1 of 2)

## Transit Noise Impacts and Potential Mitigation in Northern Vancouver





Exhibit 3.11-21 (page 2 of 2)

## Transit Noise Impacts and Potential Mitigation in Northern Vancouver





Vibration impacts would occur only with the light rail mode. With the McLoughlin alignment, there would be vibration impacts at 12 residential locations along McLoughlin Boulevard. With the 16th Street alignment, there are five predicted vibration impacts. An additional 35 vibration impacts are predicted along the Kiggins Bowl terminus where the guideway would be below the grade of the adjacent neighborhood, from 26th to 33rd Streets.

#### **TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET**

With the Lincoln terminus option (D), the two-way Broadway alignment option would have more noise impacts than the Broadway-Main couplet alignment option. Tables in the earlier full alternatives noise discussion list the number of transit noise impacts associated with each alignment option, including how noise would vary by transit mode and frequency of transit service. These impacts are illustrated in Exhibit 3.11-21.

Vibration impacts would occur only with the light rail mode. With the two-way Broadway alignment, up to 24 vibration impacts are predicted along Broadway. With the Broadway-Main couplet alignment, the same vibration impacts would occur on Broadway, and there would be eight more along Main Street. No vibration impact is expected at the Medical Center, but vibration levels would exceed the residential criteria at the Fire Department on 37th Street.

#### **Transit Operations**

For the Kiggins Bowl terminus, adding more frequent service (Increased operations) with bus rapid transit would increase the total noise impacts on McLoughlin to 34, including 19 severe impacts. Noise impacts are projected at all residences along McLoughlin Boulevard. More frequent bus rapid transit headways would also increase noise levels with the 16th Street option, impacting one more receiver and elevating two of the moderate impacts to severe impacts. Increased transit operations for light rail would increase the number of moderate noise impacts by three along McLoughlin, but would not result in any increases in noise impacts along 16th Street.

For the Lincoln terminus, adding more frequent service with bus rapid transit would result in the same number of total impacts on Broadway but would elevate 20 moderate impacts between East 18th and 29th Streets to the severe threshold. Eight additional noise impacts are expected north of 29th Street, including the Fire Department on East 37th Street. Under the Broadway-Main couplet alignment, there would be eight additional severe noise impacts with Increased versus Efficient bus rapid transit operations. Increased transit operations for light rail would increase the number of moderate noise impacts by six along Broadway.

#### **3.11.4 Temporary Effects**

Potential noise and vibration construction impacts were addressed qualitatively, based on factors such as expected construction duration, general types of construction activity, extent of construction area, and potential for traffic rerouting.

### Project Construction Phases and Noise Levels

Building the CRC alternatives would require typical roadway and structural construction equipment. The maximum noise levels of such equipment range from 60 to 80 dBA for smaller equipment such as compressors or welders, 80 to 90 dBA for large equipment such as excavators or pavers, and over 100 dBA for pile drivers.

CRC project construction would occur in several steps or phases, shown in Exhibit 3.11-22. The worst-case noise levels for each phase are shown in this table and are based on periods of maximum construction activity. The actual noise levels experienced during construction would generally be lower than those shown. In some locations, night time construction will be desirable or required in order to comply with permit conditions, manage traffic, reduce business impacts, or reduce schedule duration. Such activities would have potential impacts on residences and other noise sensitive uses. Night construction and other activities will likely require the project to obtain a variance from local noise ordinances.

Exhibit 3.11-22

#### Noise Levels for Typical Construction Phases

Scenario	Equipment	Lm <sup>a</sup>	Leq <sup>b</sup>
Construction preparation	Air compressors, backhoes, concrete pumps, cranes, excavators, forklifts, haul trucks, loaders, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment	94	87
Construction of new structures and roadway paving	Air compressors, backhoes, cement mixers, concrete pumps, cranes, forklifts, haul trucks, loaders, pavers, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment, welders	94	88
Miscellaneous activities, including striping, lighting and signs	Air compressors, backhoes, cranes, forklifts, haul trucks, loaders, pumps, service trucks, tractor trailers, utility trucks, welders	91	83
Demolition of existing structures	Air compressors, backhoes, concrete saws, crane, excavators, forklifts, haul trucks, jackhammers, loaders, power plants, pneumatic tools, pumps, service trucks, utility trucks	93	88

Source: CRC Noise and Vibration Technical Report.

<sup>a</sup> Lm (dBA) is an average maximum noise emission for the construction equipment under the given scenario.

<sup>b</sup> Leq (dBA) is an energy average noise emission for construction equipment operating under the given scenario.

Note: Combined worst-case noise levels for all equipment at a distance of 50 feet from work site.

Pile driving can generate some of the highest maximum construction sound levels. Pile driving will likely be required during bridge construction over the Columbia River and North Portland Harbor, and in the construction of interchanges, elevated transit guideways and other project elements. Noise levels during pile driving would likely be high near each of these locations. Pile driving can produce maximum short-term noise levels of 99 to 105 dBA at 50 feet. Actual levels can vary and would depend on the pile driving equipment and pile type, and the

distance and topographical conditions between the pile-driving location and the receiver location.

Noise from pile driving also has the potential to affect fish and wildlife. In deep water, pile driving has the potential to produce noise levels of 190 dB at 150 feet from the source. Noise attenuates more quickly in shallow water. Studies have shown that waterborne noise levels of 180 dB or more can injure fish and potentially cause mortality. Section 3.14, Ecosystems, discusses potential noise impacts to fish and wildlife.

The potential sites for a bridge assembly/casting yard are unknown at this time, but it is unlikely that it would be adjacent to a residential or other noise-sensitive use. However, truck traffic could increase noise levels along access and haul routes to and from the site. If the site is located adjacent to noise sensitive uses, then mitigation (discussed below) would be required to comply with local noise regulations, which will depend upon the jurisdiction in which the site is located.

### **Construction Vibration**

Vibration from construction is caused by equipment operations, and is usually highest during pile driving, soil compacting, jack-hammering, and construction related demolition activities. Although it is conceivable for ground-borne vibration from construction to cause building damage, vibration from construction is almost never of sufficient amplitude to cause even cosmetic damage to buildings. The primary concern is that the vibration can be intrusive and annoying to building occupants.

Construction activities can result in vibration effects to surrounding receivers. Major vibration-producing activities would occur primarily during demolition and preparation for the new bridges. Activities that have the potential to produce high levels of vibration include pile driving, vibratory shoring, soil compacting, and some hauling and demolition activities. Vibration effects from pile driving or vibratory sheet installations could occur within 50 to 100 feet of sensitive receivers. However, it is unlikely that vibration levels would exceed the USDOT guidelines for preventing damage to buildings.

### **3.11.5 Potential Mitigation**

#### **Potential Mitigation for Long-term Effects**

##### **POTENTIAL MITIGATION FOR TRAFFIC NOISE**

Noise walls, to the extent they are reasonable and feasible, are the most common type of highway noise mitigation. The noise walls currently along I-5 between Fourth Plain and SR 500 provide some noise reduction, but a number of residences behind the walls exceed the impact criteria. This could improve with sound walls that are higher or closer to the receivers.

Both the supplemental and replacement alternatives would include new noise walls to reduce noise substantially throughout the project corridor compared to existing and projected No-Build noise levels. Several noise-sensitive land uses, currently without noise wall mitigation, are exposed to high traffic noise levels, as shown in the maps in this section. Many of

these land uses would receive long-term noise reduction benefits with the potential mitigation. Potential mitigation measures could reduce traffic noise impact sites to 52 compared to 215 unmitigated noise impacts under the No-Build Alternative. Even so, the number of residual impacts could be higher than 52, depending on final decisions regarding sound walls. A number of factors, such as visual impacts, safety, and structural issues, in addition to noise levels, must be considered. High noise walls, for example, could reduce traffic noise impacts from the bridge over the North Portland Harbor. However, high noise walls on the bridge would also have substantial visual and structural implications.

**Portland.** For the I-5 crossing over North Portland Harbor, a noise wall on each side of the bridge structure could mitigate all noise impacts predicted to occur to the floating homes. This may not be reasonable given the visual and structural implications of installing sound walls on the bridge. Additional mitigation of transit noise impacts, as determined according to FTA criteria, could be done in coordination with traffic noise mitigation.

**Fort Vancouver.** A noise wall along the east side of I-5 near the Fort Vancouver area could mitigate all traffic noise impacts predicted at the 24 residential land uses. In addition, the noise wall would provide a noise reduction benefit for 21 residential uses where noise levels are below the impact criteria.

**East side of I-5, North of Mill Plain.** A noise wall along the east side of I-5 from Fourth Plain to about 500 feet past 37th Street could mitigate all but four of the 35 predicted residential traffic noise impacts. The areas of the Vancouver Barracks Post Cemetery expected to have noise impacts could also be mitigated with this wall. In addition, the noise wall would provide a noise reduction benefit of 3 dBA or more for 21 homes in the area that do not exceed impact guidelines.

**West side of I-5, North of Mill Plain.** A noise wall on the west side of I-5 between Mill Plain and Fourth Plain could mitigate traffic noise impacts predicted at 35 residences and would further benefit 20 homes in the area that do not exceed impact guidelines. A noise wall along the west side of I-5 from Fourth Plain to just north of the SR 500 interchange could mitigate noise impacts at 76 of 82 residences and would benefit 22 homes in the area not exceeding impact guidelines. Six residences located near required openings in the wall (for the overpasses), would receive some noise reduction benefit but it would not be feasible to achieve the required noise reduction to fully mitigate the noise impact at these homes.

#### POTENTIAL MITIGATION FOR TRANSIT NOISE AND VIBRATION

Sound insulation of residences is a potential mitigation measure for either light rail or bus rapid transit. This approach could mitigate the interior noise levels for all receivers impacted by transit. This mitigation approach could augment noise mitigation in areas also impacted by Traffic Noise such as the floating homes in North Portland Harbor. However, the exterior noise levels would remain high, especially with the bus rapid transit option.

Where light rail wheel squeal is likely to occur, at the proposed 90-degree curves at Main Street and McLoughlin or Main Street and 16th,

#### How does sound insulation work?

Residential sound insulation could include adding an extra layer of glazing to windows, sealing holes in exterior surfaces that act as sound leaks, or providing forced ventilation and air-conditioning so that windows adjacent to the sound source do not need to be opened. The extent of any building insulation measures would be determined during the final design phase of the project.



trackside lubricators could be installed if needed after project completion.

Potential vibration impacts associated with the operation of light rail could be mitigated with vibration absorbing material incorporated into the track bed. The selected vibration mitigation method would depend on the track type and level of vibration impact.

### **Potential Mitigation for Temporary Effects**

A variety of best management practices for noise mitigation could be included in construction contract specifications in order to reduce noise and vibration effects during construction. These may include:

- Require all engine-powered equipment to have mufflers installed according to the manufacturer's specifications.
- Require all equipment to comply with pertinent EPA equipment noise standards.
- Limit jackhammers, concrete breakers, saws, and other forms of demolition to daytime hours of 8:00 a.m. to 5:00 p.m. on weekdays, with more stringent restrictions on weekends.
- Minimize noise by regular inspection and replacement of defective mufflers and parts that do not meet the manufacturer's specifications.
- Install temporary or portable acoustic barriers around stationary construction noise sources and along the sides of the temporary bridge structures where feasible.
- Locate stationary construction equipment as far from nearby noise-sensitive properties as possible.
- Shut off idling equipment.
- Notify nearby residents whenever extremely noisy work would occur.
- Restrict the use of back-up beepers during evening and nighttime hours.
- Monitor any sensitive buildings where construction vibration impacts are a concern.

## 3.12 Energy

Policies at the federal, state and local levels support energy conservation for all sectors, including transportation. Transportation energy efficiency is largely regulated through requirements on vehicle manufacturers rather than transportation infrastructure. There are no established standards to determine when a transportation project has an energy “impact.” This DEIS compares the relative energy demands of the different CRC alternatives and discusses options that could reduce energy consumption during project construction and operations. This information is based on the CRC Energy Technical Report.

### 3.12.1 Existing Conditions

This section gives an overview of national and state energy supply and demand, with a focus on transportation demand and on petroleum—the primary energy source for transportation.

#### National Energy Demand

At the national level, industrial uses had the highest share of energy demand in 2005. However, the transportation sector’s energy demand is expected to grow by 1.4 percent annually—to a 29.9 percent share by 2030—and will exceed the industrial sector’s demand. Of the total energy projected to be used by transportation in 2030, 97.4 percent is expected to come from liquid fuels and other petroleum products. Even with improvements in fuel consumption rates and increasing use of alternative fuel sources, the high passenger travel demand and increasing use of trucks for freight is expected to result in a substantial increase in energy demand. The transportation sector (including aviation, marine, freight rail and roads) accounts for about 68 percent of our nation’s petroleum consumption.

#### Washington and Oregon Energy Demand

The total demand for all energy sources in Washington State has grown steadily, although the per capita consumption rate has declined several times since the early 1970s. The demand for energy from coal and natural gas in Oregon and Washington is substantially lower than the national average, but is offset by the demand for hydro-electric power. Washington is the leading hydroelectric power producer in the nation. However, as of 2004, energy derived from petroleum products accounted for the largest single share (42.0 percent) of energy consumed in Washington, slightly higher than the 2005 national demand of 40.5 percent. In 2000, approximately 47 percent of Oregon’s energy consumption came from petroleum. Since then, petroleum’s share of total demand has decreased, but still accounts for the largest share of energy consumption at 35.7 percent, notably lower than the national average. As illustrated in Exhibit 3.12-1, the transportation sectors in Washington and Oregon (including aviation, marine, freight rail and roads) account for about 71 percent and 82 percent, respectively, of each state’s total petroleum consumption. In Washington, state-wide petroleum demand in the industrial sector is nearly four times that of Oregon, increasing Washington’s non-transportation use of petroleum.

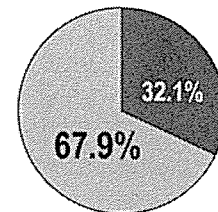
### Measuring Energy

Different energy sources (petroleum, natural gas, hydropower, wind, solar) are typically measured in different units, such as gallons of fuel or watts of electricity. To compare energy amounts for all sources, this report converts them all to **British thermal units (Btus)**. For example, the energy content of one gallon of diesel is about 130,000 Btus. One kilowatt-hour of electricity is about 3,400 Btus.

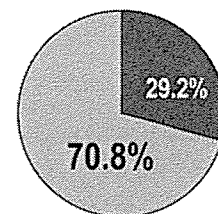
Exhibit 3.12-1

How much of our petroleum demand is consumed by transportation?

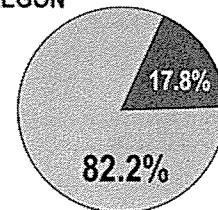
#### U.S. TOTAL



#### WASHINGTON



#### OREGON



■ Transportation ■ Other

Aviation, marine, freight rail, and roadways.  
Source: EIA, 2006.

## Peak Oil and Global Supply and Demand

Peak oil refers to the time frame in which the maximum global petroleum production rate is reached, after which the rate of production enters a terminal decline. Peak oil and its relevance to the CRC project is discussed in the Cumulative Impacts section.

The trend toward more fuel-efficient vehicles is expected to continue in the future because of recent government requirements for higher fuel-efficiency standards and rising petroleum prices. Promoting alternative fuel sources for transportation, such as ethanol, biodiesel, compressed natural gas, liquefied petroleum gas, and electricity has also been increasing. Nonetheless, petroleum demand in Washington, Oregon and the project area is projected to increase.

### Washington and Oregon Petroleum Supply

Because gasoline and diesel are the primary energy sources for the transportation sector, the analysis of energy supply focuses on petroleum-based fuel sources. Approximately 90 percent of Washington's current supply of crude oil comes from the Alaska North Slope. Five refineries in the Puget Sound area distribute refined petroleum products to Washington and adjacent states. Oregon imports 100 percent of its petroleum, of which approximately 90 percent comes from Washington refineries. Both states' future supply of petroleum is largely dependent on domestic production and reserves. Oil production from the North Slope peaked in 1988 and is projected to continue declining.

### Energy Use in the CRC Project Area

The estimated existing daily energy use for the regional transit system (including the regional MAX light rail system and all of C-TRAN's and TriMet's buses and other transit vehicles) is approximately  $2.8 \times 10^9$  Btus. For cars and trucks crossing the river on I-5 and I-205, the estimated daily energy use is about  $1.3 \times 10^9$  Btus. The estimate for existing and future highway energy use is based only on the crossing portion of highway trips. It does not estimate regional highway energy demand or even project wide demand. The reason for setting these boundaries for the highway energy estimates is twofold. First, the impact on highway energy demand outside the corridor would be minimal. Second, highway speeds and congestion have a strong influence on fuel efficiency and thus energy demand. Traffic analysis completed for the CRC project provides reliable speed and congestion estimates for the river crossing, but not elsewhere in the region. For these two reasons, highway-related energy demand is based on the estimated traffic volumes, vehicle types and travel speeds for the crossings themselves. This captures the most meaningful effects and provides a reliable comparison among alternatives, even though it does not capture all of the potential highway energy savings.

The analysis of transit-related energy demand looks more broadly, primarily because this allows the analysis to capture the effect that the CRC alternatives have on transit operations outside the immediate project area.

### 3.12.2 Long-Term Effects of Project Alternatives

By 2030, energy consumption by vehicles on regional roadways, including I-5 and I-205, will increase substantially over existing conditions. This will occur largely because population growth will increase the number of cars, trucks, and buses on the road. At the same time, average vehicle fuel efficiency is expected to improve as new,

more fuel efficient and alternative fuel vehicles replace old ones. Exhibit 3.12-2 shows predicted fuel consumption in the year 2030.

Highway energy use is projected to decrease for all of the build alternatives compared to the No-Build Alternative. Highway-related energy savings would likely be greater than shown as this table indicates only the energy reductions associated with the actual river crossing. The lower energy demand for the highway crossing is due to three primary factors:

- Increased I-5 bridge capacity decreases the duration of congestion and increases average speeds. This improves fuel efficiency. Compared to stop and go traffic, fuel efficiency improves as average speeds increase, until the speeds reach free flow conditions.
- CRC provides high-capacity transit that is expected to divert a portion of personal vehicular travel demand to transit, which uses less energy per passenger.
- Tolling the I-5 crossing is expected to deter some trips across the river, which reduces energy demand.

Total energy use would rise with Alternatives 4 and 5 primarily due to the increased level of transit operations. Total energy use would decline with Alternatives 2 and 3 compared to the No-Build Alternative.

#### Alternative 1: No-Build

Exhibit 3.12-2

#### Future 2030 Energy Consumption (Million Btu)

	Alternative 1 No Build
I-5 crossing	793.6
I-205 crossing	831.7
Highway Crossing Subtotal	1625.3
Conventional bus	3,238.1
Biodiesel bus <sup>a</sup>	0
Light rail	520.8
Transit Subtotal	3758.9
Total	5384.2

Source: CRC Energy Technical Report.

<sup>a</sup> Both transit operators have commitments to biodiesel utilization, and have begun investing in biodiesel vehicles. But for the No-Build analysis, no assumptions were made about the percentage of the vehicle fleets that may one day run on biodiesel. There is similar support for diesel/electric hybrid vehicles, though no assumptions for such were made in this analysis

The No-Build Alternative is projected to have higher energy consumption than Alternatives 2 or 3 (by about 3 percent), and lower than Alternatives 4 and 5 (by about 6 percent).



**Alternative 2: Replacement Crossing with Bus Rapid Transit**

Compared to the No-Build Alternative, Alternative 2 would decrease daily energy demand by about 3 percent in the measured area. The replacement crossing would have the greatest reduction in congestion, which would improve energy efficiency (Exhibit 3.12-3). Energy use differences between terminus options would be minimal.

Exhibit 3.12-3

**Energy Effects Summary for Alternative 2 (Million Btu)**

<b>Alternative 2: Replacement Crossing with Bus Rapid Transit</b>				
	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)<sup>b</sup></b>	<b>Mill Plain MOS (D)<sup>b</sup></b>
<b>I-5 crossing</b>	702.60	702.60	712.44	719.46
<b>I-205 crossing</b>	769.10	769.10	769.10	769.10
<b>Highway crossing subtotal</b>	1,471.70	1,471.70	1,481.54	1,488.56
<b>Conventional bus<sup>b</sup></b>	3,231.70	3,231.70	3,231.70	3,231.70
<b>Biodiesel bus</b>	24.00	23.83	23.66	23.42
<b>Light rail</b>	520.80	520.80	520.80	520.80
<b>Transit subtotal<sup>c</sup></b>	3,776.40	3,776.33	3,776.16	3,775.92
<b>Total</b>	5,248.10	5,248.03	5,257.70	5,264.49

Source: CRC Energy Technical Report.

<sup>a</sup> Transit energy use is calculated for the entire transit system, whereas highway crossing calculations are based on 0.9 mile segment of the river crossing.

<sup>b</sup> Conventional bus energy consumptions should be assumed to be slightly higher with the two MOS options, as the transit service will leave areas to be served by conventional C-TRAN fixed-routes.

<sup>c</sup> MOS energy savings are based on model results for reduced project length with light rail as the Mode.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

**Alternative 3: Replacement Crossing with Light Rail**

Alternative 3 would decrease daily energy demand by about 3 percent, compared to No-Build. The replacement crossing would have the greatest reduction in congestion, which would improve energy efficiency (Exhibit 3.12-4). Energy use differences between terminus options would be minimal.

Exhibit 3.12-4

**Energy Effects Summary for Alternative 3 (Million Btu)**

<b>Alternative 3: Replacement Crossing with Light Rail Transit</b>				
	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)<sup>b</sup></b>	<b>Mill Plain MOS (D)<sup>b</sup></b>
<b>I-5 crossing</b>	702.60	702.60	712.44	719.46
<b>I-205 crossing</b>	769.10	769.10	769.10	769.10
<b>Highway crossing subtotal</b>	1,471.70	1,471.70	1,481.54	1,488.56
<b>Conventional bus<sup>b</sup></b>	3,217.70	3,217.70	3,217.70	3,217.70
<b>Biodiesel bus</b>	0.00	0.00	0.00	0.00
<b>Light rail</b>	553.00	549.13	545.26	539.73
<b>Transit subtotal<sup>a</sup></b>	3,770.70	3,766.83	3,762.96	3,757.43
<b>Total</b>	5,242.40	5,238.53	5,244.49	5,245.99

Source: CRC Energy Technical Report.

<sup>a</sup> Transit energy use is calculated for the entire transit system, where as highway crossing calculations are based on 0.9 mile segment of the river crossing.

<sup>b</sup> Conventional bus energy consumptions should be assumed to be slightly higher with the two MOS options, as the transit service will leave areas to be served by conventional C-TRAN fixed-routes.

<sup>c</sup> MOS energy savings are based on model results for reduced project length with light rail as the Mode.

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Alternative 4 would increase daily energy demand by about 6 percent in the measured area. The supplemental crossing would not have as much reduction in congestion, although the higher toll and more frequent transit service would result in fewer auto trips across the river. Energy use differences between terminus options would be minimal (Exhibit 3.12-5).

Exhibit 3.12-5

**Energy Effects Summary for Alternative 4 (Million Btu)**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit</b>				
	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)<sup>b</sup></b>	<b>Mill Plain MOS (D)<sup>b</sup></b>
<b>I-5 crossing</b>	651.20	651.20	660.32	666.83
<b>I-205 crossing</b>	815.50	815.50	815.50	815.50
<b>Highway crossing subtotal</b>	1,466.70	1,466.70	1,475.82	1,482.33
<b>Conventional bus<sup>b</sup></b>	3,661.80	3,661.80	3,661.80	3,661.80
<b>Biodiesel bus</b>	52.60	52.23	51.86	51.34
<b>Light rail</b>	548.10	548.10	548.10	548.10
<b>Transit subtotal<sup>a</sup></b>	4,262.50	4,262.13	4,261.76	4,261.24
<b>Total</b>	5,729.20	5,728.83	5,737.58	5,743.57

Source: CRC Energy Technical Report.

<sup>a</sup> Transit energy use is calculated for the entire transit system, where as highway crossing calculations are based on 0.9 mile segment of the river crossing.

<sup>b</sup> Conventional bus energy consumptions should be assumed to be slightly higher with the two MOS options, as the HCT service will leave areas to be served by conventional C-TRAN fixed-routes.

<sup>c</sup> MOS energy savings are based on model results for reduced project length with light rail as the mode.

### Alternative 5: Supplemental Crossing with Light Rail

Alternative 5 would increase daily energy demand by about six percent in the measured area. The supplemental crossing would not have as much reduction in congestion as the replacement crossing, although the higher toll and more frequent transit service would result in fewer auto trips across the river. Energy use differences between terminus options would be minimal (Exhibit 3.12-6).

Exhibit 3.12-6

#### Energy Effects Summary for Alternative 5 (Million Btu)

Alternative 5: Supplemental Crossing with Light Rail Transit				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C) <sup>b</sup>	Mill Plain MOS (D) <sup>b</sup>
I-5 crossing	651.20	651.20	660.32	666.83
I-205 crossing	815.50	815.50	815.50	815.50
Highway crossing subtotal	1,466.70	1,466.70	1,475.82	1,482.33
Conventional bus <sup>b</sup>	3,633.30	3,633.30	3,633.30	3,633.30
Biodiesel bus	0.00	0.00	0.00	0.00
Light rail	587.00	582.89	578.78	572.91
Transit subtotal <sup>a</sup>	4,220.30	4,216.19	4,212.08	4,206.21
Total	5,687.00	5,682.89	5,687.90	5,688.54

Source: CRC Energy Technical Report.

<sup>a</sup> Transit energy use is calculated for the entire transit system, where as highway crossing calculations are based on 0.9 mile segment of the river crossing.

<sup>b</sup> Conventional bus energy consumptions should be assumed to be slightly higher with the two MOSs, as the HCT service will leave areas to be served by conventional C-TRAN fixed-routes.

<sup>c</sup> MOS energy savings are based on model results for reduced project length with LRT as the Mode.

### 3.12.3 Long-term Effects of Project Components

This section describes impacts of the components that comprise the project alternatives.

#### Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The highway improvements associated with the replacement crossing would reduce energy demand relative to the highway improvements associated with the supplemental crossing because the additional capacity would decrease the amount of time cars spend in stop and go traffic. This improves fuel efficiency.

#### Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Light rail would reduce energy demand relative to bus rapid transit, although the difference is minor. Both modes would reduce energy demand compared to providing no high-capacity transit system in the CRC corridor.

The additional electrical energy consumed by daily operations of maintenance bases would be negligible compared to the energy consumed for transportation. Expanding either the bus maintenance base in east Vancouver or the light rail maintenance base in Gresham would not measurably affect long-term energy use.

### **Transit Terminus and Alignment Options (with all Alternatives)**

The Lincoln terminus would use slightly less energy than the Kiggins Bowl terminus, because it is a more direct and shorter route to North Vancouver.

The transit component of full-length terminus options would consume more energy than the transit components of either of the minimum operable segment (MOS) terminus. The Clark College MOS would require approximately 1.4 percent less energy. The Mill Plain MOS, which represents the shortest high-capacity transit line length, would have the lowest energy use by approximately 2.4 percent compared to a full-length terminus. Construction energy demand would be lower for the minimum operable segments.

The transit alignment options would not affect the overall energy demand of the project, as summarized above for the alternatives.

### **Transit Operations**

Increased transit operations (service frequency) would increase the transit operational energy demand compared to the Efficient operations option. While the Increased transit operations would result in fewer autos crossing the river, and thus some reduction in highway energy demand, that decrease is not proportional to the added energy demand from the substantial increase in transit service associated with the Increased versus Efficient transit operations.

### **Tolling Scenarios**

Tolls on the I-5 crossing are included in all build alternatives. Other tolling scenarios were studied to analyze how tolling would affect demand on the roadway.

Under tolled scenarios, the replacement crossing would result in 178,000 daily vehicle trips across the I-5 bridges and 213,000 vehicle trips across the I-205 bridges. If no toll were collected in 2030, the I-5 crossing's daily traffic levels would increase by 32,000 vehicles (18 percent). I-205's daily traffic would decrease by 13,000 vehicles (6 percent). Without tolling, an additional 19,000 (5 percent) cross-river vehicle trips would be made in 2030.

Due to the supplemental bridge's assumed higher toll, less available highway capacity, and provision of an enhanced transit system, daily I-5 vehicle crossings would be 13,000 vehicles per day lower compared to the replacement bridge, while I-205's crossings would increase by 6,000 vehicles per day. Overall, there would be 7,000 fewer vehicle crossings of the Columbia River via I-5 and I-205.

The No Toll scenario would have the highest daily energy use. Compared to the No Toll scenario, the Standard Toll on I-5 scenario would consume approximately 1.9 percent less and the Standard Toll on



Both I-5 and I-205 would require approximately 3.6 percent less operational energy.

### 3.12.4 Temporary Effects

The method used to estimate energy use from construction is based on applying a factor to construction cost estimates. This provides a straightforward albeit relatively simplistic approach for comparing the relative energy demand of alternatives.

Based on this estimating method, Alternative 3 (replacement crossing with light rail) would require the most energy to construct (estimated at about  $7.28 \times 10^{12}$  Btus), followed by Alternative 2 (3.2 percent lower), Alternative 5 (about 19.7 percent lower), and Alternative 4 (about 23.3 percent lower). Energy to construct Alternative 4, the lowest-cost full alternative, is estimated at about  $5.90 \times 10^{12}$  Btus. The two minimum operable segments are shorter and less expensive to build, and would thus require less construction energy.

For the components that make up the alternatives, light rail construction would consume more energy than bus rapid transit; and, constructing the Kiggins Bowl terminus (A) would use more energy than the Lincoln terminus (B).

### 3.12.5 Potential Mitigation

#### Potential Mitigation for Temporary Effects

A variety of potential measures could reduce energy consumption from construction. As the project advances in design, and more detail is available on construction needs and activities, additional analysis will help identify specific measures and approaches for reducing energy consumption during construction. Potential measures include:

- Construction materials reuse and recycling.
- Encouraging workers to carpool.
- Turning off equipment when not in use to reduce energy consumed during idling.
- Maintaining equipment in good working order to maximize fuel efficiency.
- As practical, routing truck traffic through areas where the number of stops and delay would be minimized, and using off-peak travel times to maximize fuel efficiency.
- As practical, scheduling construction activities during daytime hours or during summer months when daylight hours are the longest to minimize the need for artificial light.

#### Potential Mitigation for Long-Term Effects

Energy consumption is projected to increase by 2030 under all scenarios—build or No-Build. Some of the most effective project level measures for reducing transportation energy demand are proposed among the CRC components (see list below). Other potential measures for reducing travel demand include transportation demand management and transportation system management measures outlined in Chapter 2 of this

## Estimating Construction Energy Use

The approach for estimating energy use during construction is based on a method developed by the California Department of Transportation. It estimates energy requirements for a variety of construction activities (building structures, electrical substations, site grading, etc.) by relating project costs to the amount of energy needed to manufacture, process, and install construction materials and structures.

DEIS. Improved integration of the two transit systems (C-TRAN and Tri-Met) with a single system transit pass would also improve transit ridership and reduce vehicular trip demand.

In addition to the strategies described above, the CRC alternatives include a variety of components that would help reduce energy consumption relative to the No-Build Alternative:

- Fast and reliable high-capacity transit service.
- Tolling vehicles crossing the bridge.
- Improving bike and pedestrian facilities and connections.
- Improving highway operations with auxiliary lanes and better functioning interchanges, thus reducing congestion and improving fuel efficiency.
- Eliminating bridge lifts (with Alternatives 2 and 3) and improving safety, thus reducing congestion and improving fuel efficiency.

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3.13 Electric and Magnetic Fields

Electromagnetic fields (EMF) are produced by many natural sources such as lightning, and human-made sources such as cell phones, electric appliances, and light rail transit systems. Exposure to high levels of EMF has been associated with potential effects on human health.

This section assesses the potential for human health impacts from exposure to EMF during operation of the CRC light rail options. Light rail uses an overhead electrical system (the catenary) to power the trains, and thus creates electric and magnetic fields. Bus rapid transit and roadway options generate only minor EMF emissions. The information in this section is based on the CRC Electromagnetic Fields Technical Report.

3.13.1 Existing Conditions

Effects Guidelines

There are no federal laws that limit exposure to electric or magnetic fields. Several agencies, such as the U.S. Food and Drug Administration, Department of Defense, and U.S. Environmental Protection Agency, have considered developing standards. The Federal Communications Commission (FCC) has recently adopted and enforces limits for exposure in the workplace and public areas for AM and FM radiofrequency radiation, television, and wireless sources. Schools, day care facilities, hospitals, senior living facilities, research facilities and universities are sensitive receptors to EMFs.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) in association with the American Conference of Governmental Industrial Hygienists (ACGIH) and the World Health Organization have developed voluntary occupational guidelines for EMF exposure. These guidelines are intended to prevent potential effects such as nerve stimulation or inducing currents in human cells (these effects have been shown to occur in higher frequency EMF than typically occurs in residences or occupations).

Exhibit 3.13-1 shows exposure guidelines that have been developed by ICNIRP and ACGIH. The values shown in the table may be exceeded for several minutes.

Units for Electric and Magnetic Fields

You can think of voltage as “electrical pressure” in an electrical line. It is measured in **volts (V)** or **kilovolts (kV)**. This pressure produces an electrical field that extends out from the line and is measured in **volts per meter (V/m)**. Current in an active electrical line also produces a magnetic field around the line. Magnetic fields are measured in units of **gauss (G)**. Since most magnetic field exposures involve very low levels, they are typically measured in **milligauss (mG)** or 1/1,000th of a gauss).

Electrical systems can be either **direct current (DC)** or **alternating current (AC)**. The electricity in wall sockets and power lines is alternating current. Direct current powers the MAX light rail system in Portland. The frequency of alternating current is measured in **Hertz (Hz)**.



Exhibit 3.13-1

**Exposure Guidelines for 60 Hz Electromagnetic Fields**

Exposure at 60 Hz	Electric Field (kV/m)	Magnetic Field (mG)
<b>International Commission on Non-Ionizing Radiation Protection</b>		
Occupational	8.3	4,200
General Public	4.2	833
<b>American Conference of Governmental Industrial Hygienists</b>		
Occupational Exposure Should not Exceed	25	10,000
Prudence Dictates Use of Protective Clothing Above this Level	15	–
Exposure of Workers with Cardiac Pacemakers Should not Exceed this Level	1	1,000

Source: ICNIRP, 1998.

kV/m: kilovolts per meter.

mG: milligauss.

In Oregon, the electrical field exposure standard is 9 kilovolts per meter (kV/m) within the right-of-way of an electrical transmission line.

Washington State has no standards relating to electric and magnetic field exposure.

**Existing Electric and Magnetic Field Levels**

Natural sources of electric and magnetic fields include the earth itself, which generates a weak magnetic field from currents flowing within the magma of the earth's core. Air turbulence and other atmospheric activity such as lightning can also create electric fields.<sup>31</sup>

The existing MAX light rail line uses a 750-volt direct current (DC) system to deliver power to the cars from the overhead electrical lines (catenary wires). Other elements of the light rail system—such as lighting, signals, and switches—use either alternating current (AC) or DC electricity for power. Generally, strong magnetic fields are not associated with operation of light rail. Measurements taken of the TriMet MAX system in Portland at distances of 10, 20, and 30 meters (about 32, 65, and 98 feet, respectively) from the MAX light rail track gave the results shown in Exhibit 3.13-2.

Exhibit 3.13-2

**Magnetic Field Strength at Distance from MAX Light Rail Tracks (mG)**

	10 Meters	20 Meters	30 Meters
Horizontal	167.0	44.6	13.3
Vertical	17.8	8.22	3.43

Source: Edelson and Holmstrom, 1998.

The highest measured values (167 milligauss [mG]) are well below the ICNIRP standard of 833 mG for general public exposure to magnetic

<sup>31</sup> WHO, 2005.

fields. The magnetic field strengths become less with increasing distance from the track.

Magnetic fields were measured on the MAX light rail system in 2007 and ranged from 107 to 601 mG at electrical substations, and from 47 to 551 mG at light rail stations. These field intensities are also below the general public exposure standards. Measurements at other light rail systems have produced similar results.

The existing light rail system exposes the general public and train operators to electric and magnetic fields at stations and inside the light rail cars. Magnetic field measurements taken inside the cars (between the Delta Park and Killingsworth stations) fluctuated between approximately 0.38 to 8.13 mG when measured at approximate seat height, indicating that EMF emissions are extremely low within the light rail vehicles.

### **3.13.2 Long-term Effects from Project Alternatives**

The CRC alternatives with light rail (Alternatives 3 and 5) would be expected to have similar EMF levels to those measured on the existing MAX light rail system. Where people could be exposed (within and near the light rail right-of-way, near power substations, or in the light rail vehicles) EMF emissions would be below occupational exposure guidelines. While light rail transit would generate higher EMF intensities than bus rapid transit, none of the options or alternatives would pose substantial EMF exposure risks to human health. There would be lower exposure with the MOS options (C and D) than with the full length transit terminus options (A and B). However, because emissions would be below occupational exposure guidelines, these differences would not be substantial.

### **3.13.3 Long-term Effects from Project Components**

None of the project components or various options that make up the project alternatives would be expected to pose substantial EMF exposure risks to human health. Where people would be exposed, EMF emissions would be expected to be below occupational exposure guidelines.

### **3.13.4 Potential Mitigation of Adverse Effects**

The levels of anticipated EMF are below exposure standards for both the workplace and general public. Thus, mitigation would not be necessary. However, because MAX electric power substations tend to generate the highest EMF intensities in the field measurements, it may be prudent to locate these facilities away from sensitive receivers.

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### 3.14 Ecosystems

This section discusses how the project could affect plants and animals in the project area. It considers endangered and other protected species, common species, and nuisance species, such as invasive weeds. The discussion includes effects to the habitats that these species depend on, as well as potential direct effects to the fish, animals, or plants, including aspects of water quality and fill and construction activities within waters that relate directly to aquatic species. The information presented in this section is based on the Ecosystems Technical Report.

Section 3.16, Hydrology and Water Quality, focuses on issues such as how the project could affect stormwater, surface water, jurisdictional waters, temperature, and flooding. Section 3.15, Wetlands and Jurisdictional Waters, addresses how the project could affect wetlands as a result of altering the soil, hydrology, or plants in the wetlands and their buffers. It also addresses the direct effects of removing and adding materials, such as bridge piers or fill, to waterways such as the Columbia River.

Many federal, state, and local laws and regulations govern and protect terrestrial and aquatic habitats and the plants and animals that inhabit them. Although water quality, wetlands, and fish habitats are functionally linked, this DEIS separates their discussion into different sections of the document, because different laws, agencies, and permits must be addressed for each of these issues. Among those laws and regulations protecting species and their habitats are the federal and states' Endangered Species Acts (ESA), Magnuson-Stevens Fishery Conservation Management Act (MSFCMA), and local land use permitting. Compliance with the federal ESA and MSFCMA occurs through consultation with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS).

This project team has discussed potential impacts with these agencies based on current designs. Once a locally preferred alternative is selected, this project will continue coordination, and prepare a Biological Assessment for review by NMFS and USFWS. Approval of the project, including impact avoidance and minimization measures, would occur through the issuance of a Biological Opinion for those species and habitats that may be affected by the project. Both NMFS and USFWS may require that certain conservation measures and terms and conditions are met in order to provide clearance of the project. Compliance with the federal ESA suffices for compliance with the Oregon ESA. The Washington ESA has no formal ESA consultation process.

State and federal water quality standards and removal and fill activities within wetlands and waters are also regulated. Among these regulations that relate to plants and animals are the states' Section 401 Clean Water Act water quality certifications and Washington Department of Fish and

#### How can I learn more?

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The Ecosystems Technical Report provides a detailed, technical discussion on the potential impacts of the project to habitats, plants, and animals.

#### What laws apply to different species?

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Federal, state and local laws and regulations that apply to various animals, plants and their habitats include:

- Federal and State Endangered Species Acts
- Magnuson-Stevens Fishery Conservation Management Act
- Bald Eagle and Golden Eagle Protection Act
- Marine Mammal Protection Act
- Migratory Bird Treaty Act
- Oregon Fish Passage Statute
- Washington Hydraulic Project Approval
- Sections 401 and 404 Clean Water Act
- Washington Priority Habitat and Species
- Washington Shoreline Management Act
- City of Portland Environmental Zones
- City of Vancouver Critical Areas Ordinance

Key laws and regulations are discussed in Sections 3.14 through 3.16 of this DEIS. For more detail, see the CRC Ecosystems Technical Report, Chapters 4 and 10.



Exhibit 3.14-1  
**Natural Resource Features  
 in the Project Area**



DIMENSIONS ARE APPROXIMATE.

#### TERMS & DEFINITIONS

##### Fish Habitat Terms

**Riffle** – a shallow, fast-moving stream section with water broken by rocks and boulders

**Glide** – a section of stream with little or no turbulence

**Pool** – a deep, slow moving area with smooth water surface

Exhibit 3.14-2  
**I-5 Crossing the Columbia Slough**



Wildlife's hydraulic project approval. Further discussions of these regulatory processes are located in their respective sections of this document.

### 3.14.1 Existing Conditions

Plants and animals depend on certain habitat conditions in order to survive. When discussing the effects that the project could have on fish, wildlife, and plants, it is important to consider the habitat where these species live. The CRC project includes proposed improvements along five miles of roadway, and crosses large and small bodies of water as well as densely-developed land and open space (Exhibit 3.14-1). This means that the potential habitats in the project area and the project's effects on them could vary widely. This section discusses the important habitat features on land and in the water in the project area, and then describes the protected, common, and nuisance species that live there.

#### Aquatic and Riparian Habitats

Major aquatic resources in the project area include (from south to north) the Columbia Slough, the Columbia River (both the North Portland Harbor channel on the south side of Hayden Island and the main channel on the north), and Burnt Bridge Creek. These aquatic habitats could be directly affected by the project from in-water construction work, construction near riparian areas, re-routing of stormwater drainage from the roadway and bridges, or permanent structures placed into or removed from these waterways.

This section describes the habitat found in these waterways and what aspects of that habitat are important to fish and wildlife. The Water Quality and Hydrology section of the DEIS provides more detailed information on the condition of the water in these rivers and streams, and the Wetlands section describes fill or removal activities that could take place in streams and rivers.

#### COLUMBIA SLOUGH

The Columbia Slough is located south of the project area. A portion of the slough can be seen in Exhibit 3.14-2. Habitat quality is compromised by high water temperature, high chemical and heavy metal levels, low oxygen levels, and presence of fecal coliform. Historic and modern land uses around the waterway have contributed to these issues, as industrial and stormwater discharges have increased pollutant and turbidity levels and decreased the oxygen available for fish. Vegetation clearing and lack of shading have increased temperatures above those preferred by native fish, and channel alterations and upstream dams have reduced the rate of flow, which has led to excess sedimentation.

Although still impaired, this waterway has shown improvement over the last ten years as habitat restoration, flow management, and source control measures have been implemented along its length. In the project area, levees with limited tree cover line the banks, resulting in low-quality riparian habitat. Near the project, the Columbia Slough provides glide habitat for fish. The City of Portland and the Metro regional government have designated the slough, its riparian zones, and associated remnant sloughs and ponds (including Vanport Wetlands) as special habitat areas, as discussed further in the Terrestrial Habitats section below. There are



no fish passage barriers between I-5 and the slough's outlet to the Willamette River. Its flow and surface level is affected by tides and upstream dams, pumps, and outfalls. The existing roadway and transit overpasses provide a small area of shading in the slough.

#### COLUMBIA RIVER

The Columbia River and its tributaries are the dominant aquatic system in the Pacific Northwest. In the project area, river height and flow rate are influenced by tides and upstream dams. Developed uses of the river include commercial transport, power generation, irrigation, and recreation. Washington, Vancouver, Portland, and Metro have all designated the Columbia River and its shoreline as special environmental zones.

Because the project is within a developed area, riparian habitat quality along both the north and south banks of the Columbia River is poor (see Exhibit 3.14-3). Dikes and levees, particularly when reinforced with rip rap or concrete as is the case near the crossing, make poor quality riparian habitat. The river in this area offers glide habitat for fish, with primarily sandy substrate. Water quality is limited by elevated temperatures, industrial and agricultural chemicals, arsenic, and dissolved copper. The average depth near the project is about 27 feet. The main channel is dredged to a depth of about 40 feet to allow ships to pass, and levees or dikes have been built along the banks in many areas to provide flood control. Hydroelectric dams upstream impound water, raising its temperature, making fish passage more difficult, and creating bottlenecks where predators have access to migrating salmon.

The North Portland Harbor channel, on the south side of Hayden Island, supports several floating home communities and commercial and recreational moorages (see Exhibit 3.14-4). Average depth in this channel is about 14 feet, with deeper water on the south side. The south shore supports active industrial uses. Piers and moorages line the shore, providing very low quality riparian habitat. Piers and floating homes provide shade and refuge for both predatory fish and juvenile salmon. Utility lines on the piers and a large number of parked vessels increase the likelihood that hazardous materials could leak or spill into the aquatic habitats here. Glide habitat is available in North Portland Harbor. The City of Portland and Metro have designated North Portland Harbor as an environmental protection zone and high-value riparian habitat area, respectively.

The I-5 crossing influences aquatic habitat conditions in the main channel and North Portland Harbor. Bridge piers in the river provide refuge from the current for both predatory fish and juvenile salmon. Fish are attracted by shading under the pile caps and interruptions in the current provided by the in-water structures. Attractants such as bridge piers may increase predation rates on juvenile salmon.<sup>33</sup> The bridge decks also provide some shading to the water, although it is not measurable in terms of habitat quality. Untreated stormwater runoff

Exhibit 3.14-3  
**Columbia River Main Channel and I-5 Bridges**

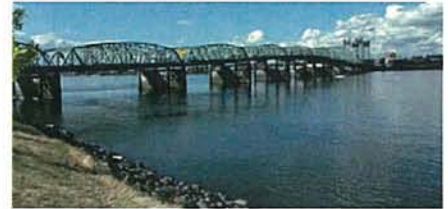


Exhibit 3.14-4  
**North Portland Harbor Channel and I-5**



<sup>33</sup> Pribyl et al., 2004.

Exhibit 3.14-5  
**Burnt Bridge Creek**



discharges to the river from the bridge, incrementally impacting its water quality.

#### **BURNT BRIDGE CREEK**

At the northern end of the project area, Burnt Bridge Creek provides glide, riffle, and pool habitat for fish, accommodating most of their lifecycle habitat needs. Depths range between several inches and several feet. There are no barriers to fish passage in the creek. In-water habitat is warmer than recommended for native fish. A recreational trail provides access to many parts of the stream.

Just north of the project area, Burnt Bridge Creek crosses under I-5 in a large culvert, interrupting the generally good quality riparian habitat in this section. Near I-5, the creek occupies a narrow forested ravine (see Exhibit 3.14-5) which has been designated as a Riparian Habitat Conservation Area by the Washington Department of Fish and Wildlife and City of Vancouver. This habitat is likely to support species of interest such as various migratory birds, songbirds, and native turtles.

#### **Terrestrial Habitats**

Historically, the project area was forested, with forested wetlands on the Oregon shore and Hayden Island, and forested uplands on the Washington side. The Oregon shore was part of a large floodplain wetland system and included many sloughs, back channels, and small or seasonal lakes. In the immediate project area, land was converted to agricultural use such as pasturage, and more recently to commercial, recreational, and residential uses. Urban development began in the Vancouver area in the mid-19th century, and supports commercial, industrial, residential, and recreational development today. Urban development has substantially degraded habitat in all parts of the project area, particularly for land-based species.

Exhibit 3.14-6 shows the amount of different habitat types within the project area.<sup>34</sup> As shown, by far the largest amount of land is occupied by urban habitats. Open water also makes up a substantial amount of habitat in the project area, as this classification includes the Columbia River and North Portland Harbor. Less than five percent of the project area is classified as either wetland or forest habitat, with most of this occurring as small patches isolated from other natural areas.

<sup>34</sup> Habitat classifications are based on Johnson and O'Neil, 2001.



Exhibit 3.14-6

**Habitat Types in the Project Area**

Habitat Classifications	Acres in the Project Area
Urban and Mixed Environs	1059.4
Lakes, Rivers, Ponds, and Reservoirs	251.4
Westside Riparian Wetlands	29.2
Westside Lowland Conifer-Hardwood Forest	20.8
Herbaceous Wetlands	15.5
<b>Total</b>	<b>1376.3</b>

Source: CRC Ecosystems Technical Report

Exhibit 3.14-7

**Locally Designated Priority Habitats**

Habitat Classifications <sup>a</sup>	Acres in the Project Area
Washington Priority Habitats	188.1
Vancouver Critical Areas	242.1
Metro Goal 5	483.04
City of Portland Environmental Zones ( E-zones)	242.52

Source: CRC Ecosystems Technical Report.

<sup>a</sup> These habitats overlap and cannot be totaled.

Both state and local jurisdictions have designated certain habitats as being of high priority for their habitat or ecological value, requiring land use permitting processes if impacted. Exhibit 3.14-7 shows the amount of land of each priority type within the project area. Note that these amounts overlap. For example, the open water habitat of the Columbia River is located within a Washington priority habitat, a Portland environmental zone (E-zone), and a Goal 5 habitat for Metro. The Ecosystems Technical Report, included as an electronic appendix to this DEIS, provides more detail on each habitat classification.

Terrestrial wildlife habitat occurs in the project area in city parks, managed wetlands, riparian areas, and small pockets of woodland. However, urban industrial, commercial, recreational, and residential development occupies most of the land around the CRC project. The north and south ends of the project come closest to relatively large or intact habitat areas, adjoining Vanport Wetlands on the south and the Burnt Bridge Creek Greenway on the north.

**URBAN AND MIXED ENVIRONS**

A densely developed urban environment does not necessarily exclude wildlife from the area. Bridges are used as habitats by some species such as raptors and swallows. These species typically prefer nesting/denning sites on tall structures (or trees and cliffs, where available) near open water and can nest and breed successfully on bridges or other structures. The superstructure of the existing bridge is good breeding habitat for certain raptors, and the bridge underside and piers provide good potential habitat for swallows.



Interstate 5 serves as an important barrier to wildlife passage for land-based species. Underpasses and stream crossings provide for some connectivity, but these are not well-suited to wildlife. Although there are some natural areas near I-5 (Vanport Wetlands to the south, Burnt Bridge Creek to the north), the existing corridor does not cross or divide these habitats in the project area.

#### **WETLANDS**

The Wetlands and Jurisdictional Waters section of this DEIS discusses wetland habitats in the project area in detail. This section focuses on their value to fish, wildlife, and rare plants.

Several wetlands are located in the project area in Oregon. In the project area, Walker Slough, Schmeer Slough, a small wetland between Expo Road and the MAX rail line, and several roadside drainage ditches offer small patches of wetland habitat. They are connected by culverts to other wetlands or streams, but have barriers to fish passage. Noxious weeds are pervasive in each, making them of low-quality habitat for rare or protected plant species. These ditches and swales could offer habitat for waterfowl and other migratory birds.

The Vanport Wetlands supports a variety of habitats appealing to birds and terrestrial species. Culverts, pipes, and pump stations present barriers to fish passage. West of the project area, a wildlife corridor with few developed interruptions connects this wetland to other large remnants of the floodplain wetland system, increasing its value to wildlife that need larger areas of habitat. Large numbers of ducks, geese, swallows, and other migrating birds use this habitat. Although noxious weeds are present in the wetland, it is actively managed for habitat value and has the potential to support rare plant species, although none have been documented there.

In Washington, a wetland complex adjoins Burnt Bridge Creek. Although much smaller than the Vanport site, these offer relatively high value habitat because they are connected to a forested riparian corridor, contain open water, grassland, and forested sections that appeal to many birds and bats, and connect with Burnt Bridge Creek during high water, providing backwater habitat for fish.

#### **FOREST**

Small patches of forested area can be found near the Interstate, totaling less than 21 acres between Victory Avenue and SR 500. The largest patches are located at the north end of the project area near Kiggins Bowl and Burnt Bridge Creek, where they have grown on steep slopes that were never developed. Because they are small and isolated from each other, they do not provide good habitat for larger terrestrial species, but many birds utilize forested patches in urban areas for nesting.

#### **Plants and Animals**

This section describes the protected, common, and nuisance species that can be found in the project area, and how the project could affect them and the habitats they depend on. Lists of species described here are not intended to be exhaustive; other protected, common, and nuisance species could occur in the project area.

Many different laws and regulations concern the treatment of certain fish, wildlife, and plant species. At a national level, the Endangered Species Act lists endangered and threatened species that receive special protection both for individual animals or plants and for their critical habitats. Both Oregon and Washington also maintain similar lists of endangered or threatened species that carry protections at a state level.

Other laws protect certain species even when they may not be endangered or threatened. For example, migratory birds cannot have their nests disturbed when eggs or nestling birds may be present. States track populations of rare plants and discourage activities that could harm them. The project examined the possible effects the alternatives could have on these protected species and the habitats they depend on.

The CRC team solicited input from regional Native American tribes on several occasions to determine which plants and animals are of important cultural significance as traditional food, craft, and medicinal sources. The species identified include wapato, cattail, camas, salmon, smelt (eulachon), lamprey, and others. These species are found in some of the aquatic and wetland habitats in the project area.

Many common animals have adapted to urban and suburban settings like the project area. They may not be specifically protected by conservation laws, but project staff looked for their presence in the project area and analyzed the effects the alternatives could have on them.

State and local regulations actively discourage the presence or introduction of certain species. These are often termed nuisance species, and plants may be considered invasive or noxious weeds. These species generally aggressively harm or replace native plants, animals, or crops and can be very difficult to remove once they establish a foothold. Studies for this DEIS examined how the project might affect the presence or spread of noxious species in the project area.

#### **PROTECTED SPECIES**

Certain animal or plant species have special legal protection because their populations have declined substantially from historic levels, and their survival as a species may be at risk. These species may be listed under the federal or states' Endangered Species Acts (ESA). In addition, species may be listed as sensitive or as species of concern, which offers limited protective regulations above those in place from other laws and regulations.

Bald eagles were taken off the federal ESA list in August 2007, but are still listed as threatened under Oregon and Washington state ESAs. Bald eagles use the Columbia River and environs to forage for fish and duck, but no nesting or breeding sites are known within one mile of the project. They are protected under the Bald Eagle and Golden Eagle Protection Act and Migratory Bird Treaty Act. Peregrine falcons were taken off the federal ESA list in 1999, but were listed as threatened under the Oregon ESA until March 2007. They are protected under the Migratory Bird Treaty Act. Peregrine falcons utilize the existing bridge structure year-round.

The project area is located in the Pacific flyway, the major north-south route for migratory birds that extends from Patagonia to Alaska. Many migratory birds such as geese, ducks, and swallows use the area for resting, feeding, and breeding.

Protected fish and habitats that they depend on are present or potentially present in all aquatic resources in the project area. The Columbia River and North Portland Harbor are known to support listed anadromous salmonids, including Chinook salmon, chum salmon (*O. keta*), sockeye salmon, steelhead trout, and coho salmon. Habitat use for these species is primarily migration, holding, and rearing. Chum salmon are known to spawn in the Columbia River upstream of the project area, near the mouth of Camas Creek.<sup>35</sup>

Bull trout are federally threatened and have been documented overwintering and feeding in the Lower Columbia River at very low abundance. The Bull Trout Lower Columbia Recovery Team considers the mainstem Columbia to contain core habitat necessary for full recovery of the species.<sup>36</sup>

The National Marine Fisheries Service (NMFS) has determined that the southern distinct population segment (DPS) of green sturgeon may occur in Washington coastal waters.<sup>37</sup> Northern and southern DPSs were delineated in 2003; in 2006, the southern DPS was listed as threatened, while the northern DPS was classified as a species of concern. Southern green sturgeon spawn in the Sacramento River, California, while northern green sturgeon spawn in the Klamath and Rogue Rivers. Genetic and tagging data indicate that the stocks commingle in the Columbia River estuary during the summer as sub-adults and adults.

Northern (Steller) sea lions are listed as threatened under the federal ESA as well as by both Oregon and Washington. California sea lions are not listed under the ESA, but like the Steller sea lions, they are protected under the Marine Mammal Protection Act (MMPA).

Species of concern that occur in the project area include cutthroat trout, Pacific and river lamprey, and the northern DPS of green sturgeon.

Exhibit 3.14-8 summarizes the protected aquatic species known to use or potentially be using waterways in the CRC project area, including Northern sea lions, as well as fish.

During 2005 and 2006, the CRC project team conducted field surveys for rare plants where construction might occur. No state or federally listed or proposed plants were found. In Oregon two rare plants (bristly sedge and Columbian watermeal) are reported historically within two miles of the project. In Washington, the rare plants tall bugbane and small-flowered trillium are reported to occur within two miles of the project. Five other rare plants (Torrey's peavine, diffuse montia, western yellow oxalis, Idaho gooseberry, and snapdragon skullcap) occurred historically in the

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<sup>35</sup> B. Meyer, NMFS, personal communication.

<sup>36</sup> USFWS, 2002.

<sup>37</sup> NMFS, 2007.

project area in Washington, although no current populations have been found. None of the historic rare plant populations occurred in the project construction footprint where direct impacts are likely to occur.

Coordination with the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), Washington (WDFW) and Oregon Departments of Fish and Wildlife (ODFW), among others, has been occurring through the regular meetings of the CRC Interstate Collaborative Environmental Process (InterCEP) group. Presence of and effects to the species and habitats in the project area are regularly discussed at these meetings. Potential effects to these species, based on current project designs, are discussed below. They will be further addressed as project planning continues and through other regulatory processes such as Section 7 ESA consultations, the Fish and Wildlife Coordination Act, and WDFW's hydraulic project approval.



Exhibit 3.14-8

**Protected Aquatic Species Found in the CRC Project Area**

Common Name <i>Scientific Name</i> ESU/DPS <sup>a</sup> (Where Appropriate)	Federal Status	OR Status	WA Status	Presence Confirmed	Habitat Used
<b>Chinook salmon</b> <i>Oncorhynchus tshawytscha</i>					
Lower Columbia River ESU <sup>b,c</sup>	threatened	sensitive critical	candidate	yes	migrating/holding
Upper Columbia River-Spring Run <sup>b,c</sup>	endangered	N/A	candidate	yes	migrating/holding
Snake River Fall-Run <sup>c</sup>	threatened	threatened	candidate	yes	migrating/holding
Snake River Spring/Summer-Run <sup>c</sup>	threatened	threatened	candidate	yes	migrating/holding
<b>Steelhead trout</b> <i>Oncorhynchus mykiss</i>					
Lower Columbia River DPS <sup>b</sup>	threatened	sensitive critical	candidate	yes	migrating/holding
Middle Columbia River <sup>b</sup>	threatened	sensitive critical	candidate	yes	migrating/holding
Upper Columbia River <sup>b</sup>	endangered	N/A	candidate	yes	migrating/holding
Snake River Basin <sup>b</sup>	threatened	sensitive vulnerable	candidate	yes	migrating/holding
<b>Sockeye salmon</b> <i>Oncorhynchus nerka</i> Snake River	endangered	none	candidate	yes	migrating/holding
<b>Coho salmon</b> <i>Oncorhynchus kisutch</i> Lower Columbia River <sup>c</sup>	threatened	endangered	none	yes	migrating/holding
<b>Chum salmon</b> <i>Oncorhynchus keta</i> Columbia River ESU <sup>b</sup>	threatened	sensitive critical	candidate	yes	migrating/holding
<b>Coastal cutthroat trout</b> <i>Oncorhynchus clarki clarki</i> Southwestern Washington/Columbia River	species of concern	sensitive critical	N/A	yes	unknown
<b>Bull trout</b> <i>Salvelinus confluentus</i> Columbia River DPS	threatened	sensitive critical	candidate	yes	unknown; potentially overwintering and feeding
<b>Pacific lamprey</b> <i>Lampetra tridentata</i>	species of concern	sensitive vulnerable	N/A	yes	unknown
<b>River lamprey</b> <i>Lampetra ayresi</i>	species of concern	none	candidate	no	unknown
<b>Green sturgeon</b> <i>Acipenser medirostris</i> Northern DPS	species of concern	none	N/A	no	unknown
Southern DPS	threatened	none	N/A	no	unknown
<b>Northern (Steller) sea lion</b> <i>Eumetopias jubatus</i>	threatened	threatened	threatened	yes	feeding, resting
<b>California sea lion</b> <i>Zalophus californianus</i>	protected (MMPA) <sup>d</sup>	none	none	yes	feeding, resting

Source: Streamnet 2008, USFWS 2008.

<sup>a</sup> ESU: Evolutionarily Significant Unit DPS: Distinct Population Segment.<sup>b</sup> Critical Habitat present.<sup>c</sup> Essential Fish Habitat present.<sup>d</sup> MMPA: Marine Mammal Protection Act.

## COMMON SPECIES

Common animals found in the project area include rock doves, crows, European starlings, sparrows, Canada geese, wood ducks, and other urban-adapted birds; deer, raccoons, rabbits, nutria, coyotes, and garter snakes; and trout, sculpin, minnows, shellfish, great blue herons, toads, turtles, and frogs in waterways and wetlands. Salmon and other aquatic species eat smaller aquatic organisms in the project area such as adult and larval insects, sand shrimp, crabs, and zooplankton.

Wapato and cattail, herbaceous wetland plants with important cultural significance as traditional food and medicinal sources for several Native American tribes, occur in wetlands in the project area, including Vanport Wetlands, Schmeer Slough, and Burnt Bridge Creek Wetlands. Smelt and other important traditional fish resources are found in the Columbia Slough and Columbia River, and may occur in Burnt Bridge Creek, although their presence has not been documented.

## NUISANCE SPECIES

Noxious weeds grow throughout the project area within most vegetated areas that are not regularly maintained. Exhibit 3.14-9 lists plants that can overrun native species and degrade habitat in the CRC project area.

Exhibit 3.14-9

### Noxious Weeds Found in the Project Area

Botanical Name	Common Name	OR Status <sup>a</sup>	WA Status <sup>b</sup>
<i>Agropyron repens</i>	Quackgrass	B	N/A
<i>Centaurea pratensis</i>	Meadow knapweed	B	B
<i>Cirsium arvense</i>	Canada thistle	B	C
<i>Cirsium vulgare</i>	Bull thistle	B	C
<i>Clematis vitalba</i>	Old man's beard	B	C
<i>Conium maculatum</i>	Poison hemlock	B	C
<i>Convolvulus arvensis</i>	Field bindweed	B	C
<i>Cytisus scoparius</i>	Scot's broom	B	B
<i>Daucus carota</i>	Wild carrot	N/A	B
<i>Geranium robertianum</i>	Herb-Robert's	N/A	B
<i>Hedera helix</i>	English ivy	B	C
<i>Hypericum perforatum</i>	St. John's wort	B	C
<i>Phalaris arundinacea</i>	Reed canarygrass	N/A	C
<i>Polygonum cuspidatum</i>	Japanese knotweed	B	B
<i>Rubus discolor</i>	Himalayan blackberry	B	N/A
<i>Verbascum thapsis</i>	Common mullein	N/A	Monitor

Source: CRC Ecosystems Technical Report.

<sup>a</sup> In Oregon, Class B weeds are non-native plants that have economic impacts and are known to have established footholds within the state.

<sup>b</sup> In Washington, Class B weeds have limited footholds in the state and control is required where possible. Class C weeds are widely established and control requirements may vary by local jurisdiction.

States do not generally keep lists of nuisance animal species, but several non-native animals that harm native species and tend to proliferate are present near the bridge. These include European starlings, which can compete for food and destroy the nests of native songbirds; bullfrogs and carp, which prey on young amphibians and fish; and nutria, a water-dwelling South American rodent that competes with native beaver and otters.

### **3.14.2 Long-term Effects of the Project Alternatives**

Long-term effects to aquatic habitats would occur from bridge piers in the water and pollutants from the roadway or transit facilities entering aquatic habitats. The effects from each alternative are described below.

The project alternatives are not likely to have adverse effects on plant species of cultural importance to Native Americans. None of the wetlands containing traditional plant resources would be impacted, as described in Section 3.15, Wetlands and Jurisdictional Waters. None of the alternatives are likely to have long-term effects on rare plants or nuisance plant and animal species.

Long-term effects to terrestrial habitats from the project could include vegetation removal, grading, filling, or paving land, or building structures on land. The differences between the alternatives would be very small.

#### **Alternative 1: No-Build**

Existing conditions include the release of untreated stormwater runoff from I-5 and the I-5 crossing to the Columbia River. This would continue under the No-Build Alternative, and the pollutant load in the stormwater would likely increase. The existing bridge and roadway alignment overlays locally and regionally designated habitats. For example, the current condition encroaches upon 35.4 acres of Washington Priority Habitats, 79.8 acres of City of Vancouver Critical Areas, 72.1 acres of Metro-designated Goal 5 habitat, and 30.4 acres of City of Portland E-zone. The bridge structure used by peregrine falcons would remain. Traffic congestion is likely to worsen, adding to noise and water quality concerns. Lift-span operation and congestion have been linked to a high rate of vehicle collisions, as described in the Traffic section of this DEIS. Collisions can increase the risk of leaks or spills of hazardous materials reaching aquatic habitats. In the long term, these effects could negatively affect fish, wildlife, and their habitats.

The No-Build Alternative could have benefits over the build alternatives for habitats in the Columbia Slough and Burnt Bridge Creek. Interchange and transit construction would increase paved area and runoff loads for Burnt Bridge Creek. In addition, new roadway runoff from the I-5 crossing would not be sent to the Columbia Slough drainage, which is one of the stormwater management options being considered with the build alternatives.

#### **Alternative 2: Replacement Crossing with Bus Rapid Transit**

Long-term ecosystem impacts are summarized in Exhibit 3.14-10, and shows both overall impacts and net increases in impact area for locally and regionally designated habitats.

Exhibit 3.14-10

## Summary of Ecosystem Impacts for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric <sup>a</sup>	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Columbia River aquatic habitat	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.
	STHB has most improvement – slightly less fill in Columbia River. Same treatment as three-bridge option			
Columbia Slough aquatic habitat	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
Burnt Bridge Creek aquatic habitat	<200 sq. ft of buffer directly impacted.	<200 sq. ft of buffer directly impacted.	<200 sq. ft of buffer directly impacted.	<200 sq. ft of buffer directly impacted.
Fish predation	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.
	Benefit. STHB design would have fewest piers in the water.			
Peregrine Habitat	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.
Washington Priority Habitat impacted (total acres [net acres]) <sup>b</sup>	45.8 [10.4]	45.7 [10.3]	45.7 [10.3]	45.7 [10.3]
	44.0 [8.6]	43.9 [8.5]	43.9 [8.5]	43.9 [8.5]
City of Vancouver Critical Areas impacted (total acres [net acres]) <sup>b</sup>	90.2 [10.4]	89.3 [9.5]	89.3 [9.5]	89.3 [9.5]
	85.8 [6.0]	84.9 [5.1]	84.9 [5.1]	84.9 [5.1]
Metro Goal 5 lands impacted (total acres [net acres]) <sup>b</sup>	112.2 [40.1]	112.2 [40.1]	112.2 [40.1]	112.2 [40.1]
	109.2 [37.1]	109.2 [37.1]	109.2 [37.1]	109.2 [37.1]
City of Portland E-zone impacted (total acres [net acres]) <sup>b</sup>	43.5 [10.1]	43.5 [10.1]	43.5 [10.1]	43.5 [10.1]
	41.9 [8.5]	41.9 [8.5]	41.9 [8.5]	41.9 [8.5]

Source: CRC Ecosystems Technical Report.

<sup>a</sup> Values for the replacement design and the stacked transit/highway bridge (STHB) design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

<sup>b</sup> Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

Alternative 2 would have six piers for each bridge (totaling 18 piers), in the Columbia River. The stacked transit/highway bridge (STHB) would also have six piers per bridge in the Columbia River (totaling 12 piers), and slightly less volume and area in the river. Piers, particularly in water less than 20 feet deep, attract fish and may lead to an increase in predation rates on juvenile salmon.<sup>38</sup> Fewer piers would result in less shading and water flow interruptions, which could result in less predation on juvenile salmon (many of which are protected under the federal ESA and are of cultural importance to Native Americans).

<sup>38</sup> Pribyl et al., 2004.



on juvenile salmon (many of which are protected under the federal ESA and are of cultural importance to Native Americans).

Although the Columbia Slough would not be directly impacted by the build alternatives, additional treated stormwater is proposed to drain to this waterway. The overall pollutant loading for the project area is likely to decrease. Further discussion of pollutant loading is discussed in the Hydrology and Water Quality section of this document. The STHB design may result in slightly less pollutant loading in the Columbia Slough and the project overall due to the decrease in new surfaces that would need to be treated.

Impacts to Burnt Bridge Creek are anticipated to occur as a result of construction activities within the Priority Habitat overlay. The Lincoln terminus and MOS designs would impact approximately 1.25 acres within this area, due primarily to existing infrastructure already present in the overlay. The Kiggins Bowl terminus option would have approximately 1.3 acres of impact in this area (a net increase of 0.05 acre) as a result of the new guideway to Kiggins Bowl.

Project design, construction, and conservation measures will be part of the ESA consultation with NMFS and USFWS as project planning continues. Adverse effects to protected plants and terrestrial wildlife species are not anticipated at this time, with the exception of peregrine falcons that utilize the existing bridge. The new bridge design will likely not include towers or other large structures above the roadway deck and may not provide suitable habitat for these birds. Without suitable mitigation, the falcons could leave the area.

City of Portland E-zones, City of Vancouver Critical Areas, Washington Priority Habitats, and Metro-identified Goal 5 areas would be impacted by Alternative 2. Total impacts vary depending on terminus option, Marine Drive interchange design, and whether STHB is proposed. Impacts occur near Burnt Bridge Creek, the Columbia River and North Portland Harbor, and near the Expo Center. Overall, net impacts (those impacts from proposed designs relative to existing impacts) show a relatively slight increase. For example, the Kiggins Bowl terminus would impact a total of 45.8 acres of Priority Habitat, resulting in a net increase of 10.4 acres of impacted habitat. The majority of this impact is related to the bridges over the Columbia River. The implementation of the STHB would decrease the total impact to Priority Habitats for the Kiggins Bowl terminus to 44.0 acres, and net increase of 8.6 acres. The other terminus options with STHB show similar reductions in total and net impacts for the locally designated habitats. In addition, the Lincoln terminus and MOS designs would impact approximately 0.05 acre less Priority Habitat near Burnt Bridge Creek because the guideway east of the highway would not be constructed.

### Alternative 3: Replacement Crossing with Light Rail

Alternative 3 would have the same impacts for ecosystem resources as Alternative 2 (Exhibit 3.14-11), with the exception that light rail would require approximately 1 acre less new paved surface at the Expo Center transit station, resulting in approximately 0.5 acre less impact to a City of Portland E-zone.

Exhibit 3.14-11

#### Summary of Ecosystem Impacts for Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric <sup>a</sup>	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Columbia River aquatic habitat	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.
	Most improvement – STHB has slightly less fill in Columbia River. Same treatment as three-bridge option.			
Columbia Slough aquatic habitat	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
Burnt Bridge Creek aquatic habitat	<200 sq. ft of buffer directly impacted.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.
Peregrine Habitat	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.
Fish predation	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.
	Benefit. STHB design would have fewest piers in the water.			
Washington Priority Habitat impacted (total acres [net acres]) <sup>b</sup>	45.8 [10.4]	45.7 [10.3]	45.7 [10.3]	45.7 [10.3]
	44.0 [8.6]	43.9 [8.5]	43.9 [8.5]	43.9 [8.5]
City of Vancouver Critical Areas impacted (total acres [net acres]) <sup>b</sup>	90.2 [10.4]	89.3 [9.5]	89.3 [9.5]	89.3 [9.5]
	85.8 [6.0]	84.9 [5.1]	84.9 [5.1]	84.9 [5.1]
Metro Goal 5 lands impacted (total acres [net acres]) <sup>b</sup>	112.2 [40.1]	112.2 [40.1]	112.2 [40.1]	112.2 [40.1]
	109.2 [37.1]	109.2 [37.1]	109.2 [37.1]	109.2 [37.1]
City of Portland E-zone impacted (total acres [net acres]) <sup>b</sup>	43.0 [9.6]	43.0 [9.6]	43.0 [9.6]	43.0 [9.6]
	41.4 [8.0]	41.4 [8.0]	41.4 [8.0]	41.4 [8.0]

Source: CRC Ecosystems Technical Report.

<sup>a</sup> Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

<sup>b</sup> Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Long-term ecosystem impacts for Alternative 4 are summarized in Exhibit 3.14-12.

Exhibit 3.14-12

**Summary of Ecosystem Impacts for Alternative 4**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit</b>				
<b>Environmental Metric<sup>a</sup></b>	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College MOS (C)</b>	<b>Mill Plain MOS (D)</b>
<b>Columbia River aquatic habitat</b>	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.
<b>Columbia Slough aquatic habitat</b>	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
<b>Burnt Bridge Creek aquatic habitat</b>	<200 sq. ft of buffer directly impacted.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.
<b>Peregrine Habitat</b>	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.
<b>Fish predation</b>	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.
<b>Washington Priority Habitat impacted (total acres [net acres])<sup>b</sup></b>	41.0 [5.6]	40.8 [5.4]	40.8 [5.4]	40.8 [5.4]
<b>City of Vancouver Critical 1 Areas impacted (total acres [net acres])<sup>b</sup></b>	85.4 [5.8]	85.0 [5.4]	85.0 [5.4]	85.0 [5.4]
<b>Metro Goal 5 lands impacted (total acres [net acres])<sup>b</sup></b>	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]
<b>City of Portland E-zone impacted (total acres [net acres])<sup>b</sup></b>	42.0 [11.6]	42.0 [11.6]	42.0 [11.6]	42.0 [11.6]

Source: CRC Ecosystems Technical Report.

<sup>a</sup> Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

<sup>b</sup> Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

Alternative 4 would have the same impacts as Alternative 2, with a few exceptions. Alternative 4 would include retrofitting the ten piers of the existing bridges, increasing their area by a total of 0.5 acre and their volume by a total of approximately 3,800 cubic yards. In addition, the supplemental bridge would consist of six additional piers, adding approximately 1.14 acres in area and approximately 33,000 cubic yards in volume.

The overall pollutant loading for the project area is likely to decrease, but the ability to treat all the stormwater from the existing bridges is limited.

Further discussion of pollutant loading is discussed in the Hydrology and Water Quality section of this document.

With all the build alternatives, project design, construction, and conservation measures will be part of the formal ESA/EFH consultation and MMPA permitting with NMFS and USFWS as project planning continues. Adverse effects to protected plants and terrestrial wildlife species are not anticipated at this time, with the exception of peregrine falcons that utilize the existing bridge. The supplemental bridge design would retain the towers and other large structures, but disturbance from construction would likely occur.

City of Portland environmental overlay zones, City of Vancouver Critical Areas, Washington Priority Habitats, and Metro-identified Goal 5 areas would be impacted by Alternative 4. Total impacts vary slightly depending on terminus option. Impacts occur near Burnt Bridge Creek, the Columbia River and North Portland Harbor, and near the Expo Center. Overall, net impacts (those impacts from proposed designs relative to existing impacts) show a relatively slight increase. For example, the Kiggins Bowl terminus option would impact a total of 41.0 acres of Priority Habitat, resulting in a net increase of 5.6 acres of impacted habitat. The majority of this impact is related to the bridges over the Columbia River. The other terminus options would impact approximately 0.2 acre less Priority Habitat and 0.4 acres of Critical Area near Burnt Bridge Creek because the guideway east of the highway would not be constructed.



### Alternative 5: Supplemental Crossing with Light Rail

Long-term ecosystem impacts for Alternative 5 are summarized in Exhibit 3.14-13.

Exhibit 3.14-13

#### Summary of Ecosystem Impacts for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit				
Environmental Metric <sup>a</sup>	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Columbia River aquatic habitat	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.
Columbia Slough aquatic habitat	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
Burnt Bridge Creek aquatic habitat	<200 sq. ft of buffer directly impacted.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.
Peregrine Habitat	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.
Fish predation	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.
Washington Priority Habitat impacted (total acres [net acres]) <sup>b</sup>	41.0 [5.6]	40.8 [5.4]	40.8 [5.4]	40.8 [5.4]
City of Vancouver Critical 1 Areas impacted (total acres [net acres]) <sup>b</sup>	85.4 [5.8]	85.0 [5.4]	85.0 [5.4]	85.0 [5.4]
Metro Goal 5 lands impacted (total acres [net acres]) <sup>b</sup>	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]
City of Portland E-zone impacted (total acres [net acres]) <sup>b</sup>	41.5 [11.5]	41.5 [11.1]	41.5 [11.1]	41.5 [11.1]

Source: CRC Ecosystems Technical Report.

<sup>a</sup> Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

<sup>b</sup> Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

Alternative 5 would have the same impacts for ecosystem resources as Alternative 4, with the exception that light rail would require approximately 1 acre less new paved surface at the Expo Center transit station, resulting in approximately 0.5 acre less impact to a City of Portland E-zone.

### 3.14.3 Long-term Effects of Project Components

Certain project components differ only slightly in their effects on ecosystem resources, and are not considered here. These include interchange options, pedestrian and bicycle facilities, transit operations options, tolling scenarios, and transportation system/demand management options.

#### **Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)**

The replacement crossing would have six piers per bridge in the Columbia River, and the supplemental crossing would have six piers for the supplemental bridge and retain the ten piers from the existing bridges. More of the piers for the supplemental crossing would be located in water less than 20 feet deep, where fish are more likely to congregate and piers can contribute to increased predation on juvenile salmon. Reduction in total and shallow-water piers for the replacement crossing would be an improvement over existing, No-Build, and supplemental crossing conditions.

The stacked transit/highway bridge option for the replacement crossing would further reduce the number of piers in the river over existing, supplemental, or standard-design replacement crossings. This option would put approximately 18 percent less structure in the water, assuming 96-inch vertical piles are used to support the piers. It may, however, result in additional smaller piers in shallow-water habitat near the south shore of the Columbia River main channel, which could negatively impact fish.

Realigning Marine Drive south of the Expo Center would impact the Vanport wetland, which is a mitigation site owned and maintained by the Port of Portland. Construction would impact approximately 0.48 acres of wetland and 1.58 acres of E-zone. Two piers would be placed in the wetland, both approximately 10 ft in diameter, causing a direct impact of 0.003 acre. Long-term effects on vegetation (mature cottonwood trees) below the alignment in the Vanport and Expo Center wetlands cannot be quantified due to the preliminary design of this option. The diagonal realignment of Marine Drive would not impact the Vanport wetland or its associated E-zone, and would impact approximately the same area of the Expo Center wetland and its E-zone as the standard Marine Drive alignment.

#### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

Light rail is likely to generate slightly lower pollutant loads to stormwater runoff than bus rapid transit, which would benefit aquatic habitats and sensitive aquatic species. Light rail vehicles do not carry fuel on board, lessening the potential for spills and leaks of petroleum related to transit vehicles. The light rail braking system does not use copper brake pads, which would reduce the transit contribution of copper in stormwater runoff.

Bus rapid transit would require adding approximately 1 acre more new paved surface at the Expo Center transit station for a turn-around area.

This could have an adverse effect on habitat and water quality in this area, compared to light rail.

Bus rapid transit could potentially require expanding the C-TRAN bus maintenance facility in east Vancouver at 65th Avenue. Vegetative cover at this facility consists of residential/commercial lawn and trees, and agriculture. No threatened, endangered, or sensitive species or species of interest likely occur in the area. Expansion of the facility would result in the removal of lawn, approximately fifty immature broadleaf trees, and approximately ten mature broadleaf trees. In addition, expansion would convert pervious surfaces to impervious, requiring integration of stormwater controls.

Likewise, light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Vegetative cover at the Ruby Junction maintenance facility consists of developed land (no vegetation), with small portions of residential lawn and mature trees. No threatened, endangered, or sensitive species or species of interest likely occur in the area. Expansion of the facility would result in the removal of lawn and approximately two dozen conifers and broadleaf trees. In addition, the expansion would convert pervious surfaces to impervious, requiring integration of stormwater controls.

#### **Transit Terminus Options (with all Alternatives)**

With the exception of the riparian buffer of Burnt Bridge Creek, the Kiggins Bowl and Lincoln terminus options would have no other appreciable differences in impacts to ecosystems resources, as the same routes and options are allowable for either south of the Mill Plain area. Therefore this section addresses the differences in Northern Vancouver, where the two options would diverge. The Kiggins Bowl terminus would have a greater effect in this area than the Lincoln terminus, impacting approximately 1.3 acres of Washington Priority Habitat near Burnt Bridge Creek, while The Lincoln terminus would affect approximately 1.25 acres of Priority Habitat in this area.

Either minimum operable segment would avoid the Kiggins Bowl Terminus option's impact to the Burnt Bridge Creek riparian buffer and Kiggins Bowl habitat area zone, but they would have the other impacts associated with the full-length terminus options near the Columbia River and in Oregon.

#### **Transit Alignment Options (with all Alternatives)**

The transit alignment options (adjacent vs. offset; two-way Washington vs. Broadway-Washington; two-way Broadway vs. Broadway-Main; or 16th Street vs. McLoughlin) would have no measurable differences in long-term ecosystems effects.

### **3.14.4 Temporary Effects**

#### **Aquatic Habitats**

No construction would occur in or adjoining the Columbia Slough, so no temporary effects to its aquatic and riparian habitats would occur from the CRC project.

In-water construction would occur in the Columbia River under all build alternatives. If used, coffer dams around bridge piers would disrupt stream flow during construction and pile driving. Disrupted stream flow would make it more difficult for fish to travel through the construction area. In-water work would increase turbidity, making it difficult for fish to see or absorb oxygen from the water. Underwater noise from pile driving and heavy machinery could injure or kill nearby fish. In addition, construction activities could limit recreational fishing activities due to access and safety concerns. Construction-related contaminants could enter the water during this work. In-water construction duration would likely be shorter for the stacked transit/highway bridge replacement crossing design. This would reduce the duration of negative temporary effects.

No construction would occur in Burnt Bridge Creek. Construction within the creek's adjoining riparian habitat would occur with the Kiggins Bowl Terminus option and the I-5/SR 500 interchange improvements. This could cause temporary increases in erosion, which could increase creek turbidity and lower the quality of fish habitat during construction.

The potential sites for a bridge assembly/casting yard are unknown at this time. However, they are likely to be adjacent to the Columbia River, Willamette River, or other water body in the region. The existing conditions on the assembly/casting yard could range from a developed and paved port terminal to a currently undeveloped site. Because the site will be adjacent to the water, it would have the potential to impact the same species identified for constructing the bridge, as well as other species that may be unique to the particular sites. The development and operations of the assembly/casting yard would be subject to the same federal and state environmental regulations that apply to other aspects of project construction, as well as any other federal, state or local regulations that may apply to the particular site. Before any site is selected, a thorough, site-specific environmental impact analysis will be conducted. All necessary permits will be secured prior to site development and operations.

### **Terrestrial Habitats**

Habitat provided by the existing bridges would be disturbed during construction of any of the build alternatives. Construction noise, lights, and other effects could degrade nesting, roosting, and feeding habitat for birds and bats. Disruptive activity could occur during migration or nesting seasons, and could lower reproductive success or prevent the use of the bridge habitat for several years.

Vegetation adjoining the highway and interchanges that may serve as food, cover, or breeding habitat for terrestrial species may be removed during construction. These areas will be replanted when the project is finished, but species utilizing these areas would be temporarily impacted.



### Plants and Animals

Both adult and juvenile migrating salmon and other aquatic species, such as smelt and lamprey, would pass through in-water construction areas. Disturbance from this could kill fish, delay migration, or lower reproductive success. Invertebrates could be displaced from the river bed during in-water construction work, but are likely to return rapidly once that work is over.

Construction could substantially disturb the peregrine falcons using the existing bridge structure. All of the build alternatives would include several years of noise, vibration, and crane lifting. The No-Build Alternative would avoid these impacts.

Noise, lights, vegetation removal, and other disturbance from roadway and transit construction could negatively affect breeding, foraging, and dispersal of both common and protected terrestrial species such as rabbits and other small mammals, birds that may avoid loud machinery, and migratory birds that may no longer rest or feed near the construction areas. Lights used for night work could disturb nocturnal animals such as owls or bats, or disrupt night-migrating birds.

Vegetation removal is likely along the existing roadway, especially near interchanges where alterations are planned. No rare or protected plant species have been identified that would be affected, although some areas contain mature trees. Exposed soil during construction could temporarily increase the presence of noxious weeds along the roadway, as these plants frequently colonize disturbed areas.

### 3.14.5 Potential Mitigation for Adverse Effects

The CRC project team has considered adverse effects to ecosystems while developing the alternatives. The project avoided certain adverse impacts by deciding not to pursue options such as a trenched tunnel crossing, substantial use of coffer dams during construction, or placement of a park and ride facility in Cold Canyon. The project team has designed construction footprints to avoid and minimize potential adverse effects to wetlands in the Delta Park area, and waterway effects from in-water piers. Throughout the project, the project team will continue to work with the appropriate regulatory agencies to avoid ecosystems impacts, and to minimize and mitigate ecosystems impacts that cannot be avoided.

The project will use best management practices during construction to first avoid and then minimize unavoidable impacts to ecosystems, fish, and wildlife. Both WSDOT and ODOT utilize standard specifications and special provisions to direct contractors to avoid and minimize impacts. In addition, standard terms and conditions of approvals from regulatory agencies have been incorporated into the preliminary designs analyzed in this document. The project could reduce impacts associated with in-water work by avoiding the most critical fish migration seasons, and by using coffer dams and bubble curtains to reduce noise and turbidity effects. Mitigation for effects to aquatic habitat could include shallow water habitat restoration.

Replanting riparian areas will help limit long-term effects of ground disturbance to habitat. These measures include removing noxious weeds and replanting native plants that are more likely to support sensitive wildlife species. Current riparian habitat along the Columbia Slough, North Portland Harbor, and the Columbia River is of low quality, with low vegetation cover and rip-rap or concrete surface in many areas. This presents an opportunity to enhance local habitat to mitigate for adverse ecosystems effects from the project. The Wetlands and Jurisdictional Waters section of this DEIS presents more detail on mitigation measures for potential impacts to wetland habitats.

The project team could schedule disruptive activities, such as vegetation or structure removal, outside of bird nesting seasons. The project team could install exclusionary devices on the bridge to prevent nests from being established when demolition or disruptive activities are scheduled.

Platforms could be built to mitigate for the replacement crossing's removal of the peregrine falcon habitat.

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### 3.15 Wetlands and Jurisdictional Waters

This section describes the existing wetlands and jurisdictional waters that could be affected by the project and discusses the functions that they currently provide. It also analyzes the effects that each alternative could have on wetlands and jurisdictional waters, and what steps will be taken to avoid, minimize, or compensate for any adverse effects. The Ecosystems and Water Quality sections of this DEIS provide more information on the effects that wetlands impacts have on fish, wildlife, and water quality. The information presented in this section is based on the CRC Wetlands and Jurisdictional Waters Technical Report, which is included as an electronic appendix to this DEIS.

The federal Clean Water Act gives environmental oversight to the U.S. Army Corps of Engineers for waterways and their associated wetlands. State governments generally share this jurisdiction. Wetlands and waterways regulated by this law are called “jurisdictional” waters and wetlands. Adding or removing bridge piers or other structures in a river, or filling, excavating, or building in a jurisdictional wetland require joint federal, state, and local permitting.

In addition, Executive Order 11990 – Protection of Wetlands requires federal agencies to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Each agency shall avoid undertaking or providing assistance for new construction located in wetlands unless the agency finds that there is no practicable alternative to such construction, and that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use. In making this finding, the head of the agency may take into account economic, environmental, and other pertinent factors.

Wetlands perform functions that are valuable to fish, wildlife, environmental quality, and surrounding communities. Wetlands provide flood protection, improve water quality in rivers and streams, recharge groundwater, and provide breeding and rearing habitat for many birds, fish, and other wildlife. Because these functions are very difficult and expensive to successfully replicate, federal and state laws require that any project with the potential to impact wetlands must try to avoid and minimize impacts wherever possible, and if impacts are not avoidable, must compensate for these impacts by restoring or creating new wetland areas to ensure that the overall environmental functions provided to the area are not diminished.

In Oregon, the ratio of replaced wetland area to affected wetland area reflects the likelihood of mitigation project success and the need to maintain wetland acreage and functions. Typical ratios include 1:1 for restoration, 1.5:1 for creation, 3:1 for enhancement, and 2:1 for enhancement of cropped wetlands (ORS 141-085-0136). Within its borders, the City of Portland (COP) regulates wetland buffers when the wetland is within a mapped environmental zone overlay. If the CRC project is not exempt from environmental zone regulations (COP Code Section 33.430.080) and the project does not meet the City’s development standards (COP Code Section 33.430.140 through .190), environmental review and mitigation will be required by the City. The

#### Are all wetlands and streams “jurisdictional”?

Very complex regulations determine which wetlands and waterways are jurisdictional. For the purposes of this DEIS summary, all wetlands and waterways that are potentially jurisdictional were considered, and this section refers to them all as simply wetlands or waterways. Final determinations of the boundaries and legal status of each would be made by the appropriate agencies.



mitigation site plan must demonstrate that the mitigation will replace all of the resources and functions affected, will be within the same watershed as the affected environmental zone, and that a suitable mitigation site is owned by the applicant.

In Washington, the mitigation ratio is based on the type of compensation, the affected wetland's category, and/or any special characteristics of the affected wetland. A wetland is classified into one of four categories based on its Washington State Wetland Rating System score. Category 1 wetlands are those that receive a score greater than 70 (out of 100 possible points), Category 2 wetlands are those that receive a score between 51 and 69, Category 3 wetlands are those that receive a score between 30 and 50, and Category 4 wetlands are those that receive a score lower than 30. Consideration beyond the rating score is given to wetlands containing special characteristics. Typical ratios range from 1:1 for re-establishment or creation and rehabilitation of Category 4 wetlands to 24:1 for enhancement only of Category 1 forested wetlands.<sup>38</sup> In the project area in Washington, wetland buffers are regulated by the City of Vancouver under its critical areas protection ordinance. Compensatory mitigation is required to address affected functions by achieving a functional equivalency or improvement and providing a similar wetland or buffer function. Approval criteria require no net loss of functions or values for any activity impacting a critical area.

Different jurisdictions use various ways of measuring the environmental functions provided by wetlands. All wetlands identified in both Oregon and Washington were compared using both states' assessment methods to allow for an equal comparison of existing qualities and potential impacts. For comparative purposes, this section describes wetland functions based on the Washington State wetland rating system, which consolidates ratings of many individual functions into water quality (removing pollutants), hydrological (providing flood control), and habitat (supporting fish and wildlife) values. The CRC Wetlands Technical Report, provided as an electronic appendix to this DEIS, provides detailed information on the scoring of each wetland in both Oregon and Washington rating systems.

Many jurisdictions also restrict activities within a certain distance of wetlands, known as buffer zones. This analysis considers effects to wetlands, waters, and designated buffers.

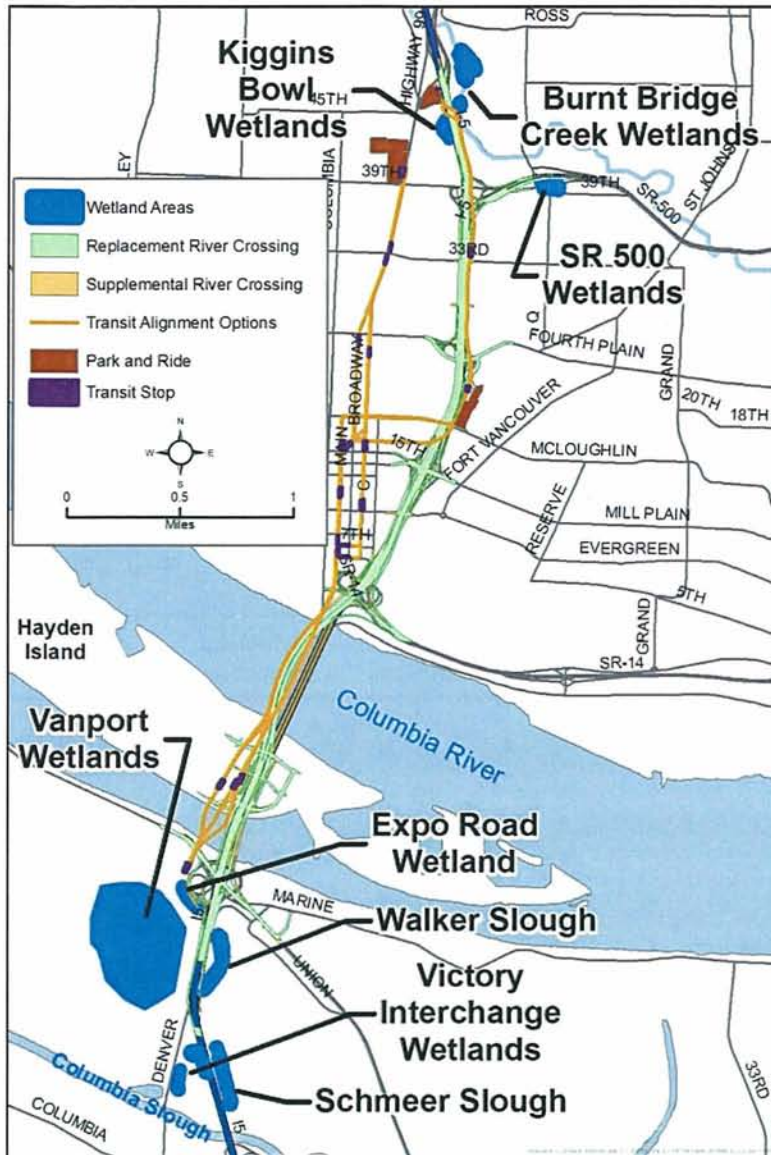
### 3.15.1 Existing Conditions

This section describes the location, size, and functional values of wetlands and jurisdictional waters that have been field-identified in the project area. Exhibit 3.15-1 shows the locations of these wetlands relative to the project area. More detailed maps of each wetland and buffer area follow.

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<sup>38</sup> Hruby, 2004.

**Exhibit 3.15-1**  
**Identified Wetlands in the CRC Project Area**



Source: CRC Wetlands and Jurisdictional Waters Technical Report.

In Oregon, as discussed below, there are large wetlands west of the project area, remnants of the extensive wetland system that historically existed on the floodplain of the Columbia River prior to development. Large portions of this system, including the project area, were altered by building dikes and levees, draining land, and adding fill material to low spots; first for agricultural purposes and then for urban development. Despite the reduction in area from historic size, the remaining wetlands in the project area perform important functions and have high value due to their relative rarity in the urban area.

In Washington, as described below, wetlands are localized near Burnt Bridge Creek and the SR 500 interchange at the northernmost extent of the project. Topographic position, historic aerial photos, and early descriptions of the area indicate that wetlands were not present in the remainder of the project area in Washington prior to development.

Several constructed wetlands, built to manage stormwater runoff, are located near the roadway in the project area in both Oregon and Washington. Creating wetlands is an improved technique to manage stormwater runoff compared to traditional drainage pipes, because wetlands store water and allow it to infiltrate into the ground, providing better flood control; wetlands slow down the speed of the water, allowing sediment and many pollutants to settle out; and wetlands allow water to percolate into the ground, where it eventually recharges underground aquifers used for water supply.

Exhibit 3.15-2 summarizes the size and functional assessments of the surveyed wetlands in the project area. The scale used ranges from 0 to 32 for water quality and hydrologic functions and 0 to 36 for habitat function. Higher numerical values denote higher functions. The CRC Wetlands and Jurisdictional Waters Technical Report provides more detail on how the functions are assessed and includes field data sheets for each wetland.

Exhibit 3.15-2  
**Existing Wetland Conditions**

Wetland	Size (acres)	Water Quality Function	Hydrologic Function	Habitat Function
Victory Interchange wetlands	0.5	14	12	7
Schmeer Slough	2.5	14	10	10
Walker Slough	2.7	10	16	15
Expo Road	0.3	14	16	8
Vanport Wetlands	88.7	26	24	22
SR 500 Wetlands	0.5	16	14	3
Kiggins Bowl Wetlands	0.9	8	4	14
Burnt Bridge Creek Wetlands	1.9	14	16	22

Source: Data compiled from the CRC Wetlands Technical Report and Wetland Delineation Report.

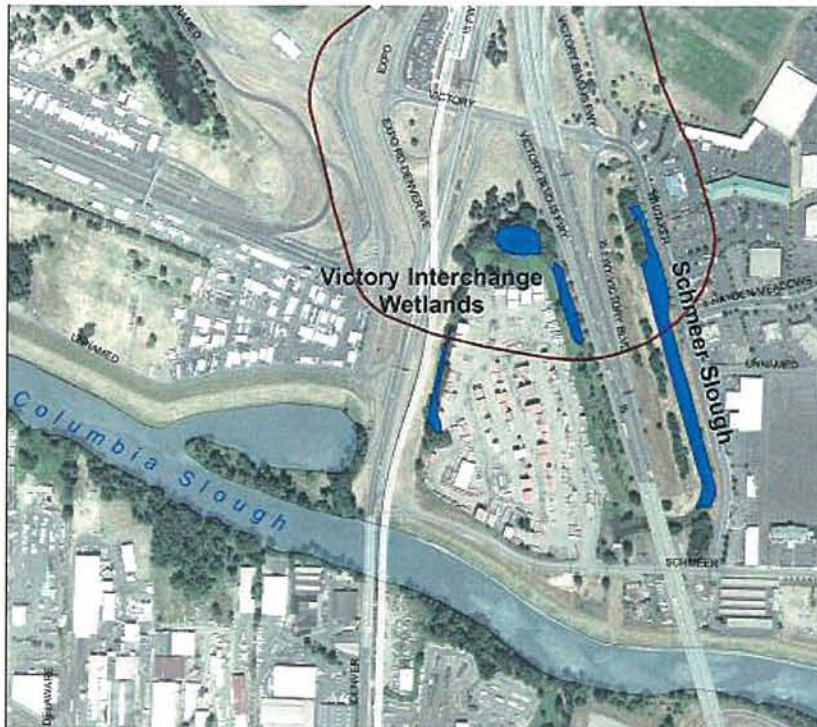
### Wetlands in Oregon (North Portland and Hayden Island)

This area includes a complex of small wetland systems, some of which are connected by culverts near the I-5 roadway. These wetlands are remnants of the former slough system that have been modified to increase drainage and convey stormwater from the surrounding area to the Columbia Slough.

The Victory interchange wetlands consist of three distinct wetland areas located south of Victory Boulevard, between the existing light rail tracks and the I-5 roadway (see Exhibit 3.15-3). None of the project alternatives would directly impact these wetlands. The northern and eastern portions are flooded during the wet season, and the southwestern part is flooded most of the year. They support reed canarygrass, blackberry, willows, cottonwood, poplars, horsetail, and common rush. This wetland complex has a medium functional value for water quality and flood control and a low value for habitat.



Exhibit 3.15-3

**Wetlands near Victory Boulevard**

Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.

Schmeer Slough is located on the east side of I-5 and connects (by pipes) Expo Road wetland and Walker Slough to the north with the Columbia Slough to the south. Water levels are typically between 2 and 2.5 feet in depth. This wetland supports cottonwood, Pacific willow, native blackberry, several species of grass, and horsetail. It has medium functional value for water quality, and low values for flood control and habitat.

Walker Slough, shown in Exhibit 3.15-4, is a year-round flooded wetland on the east side of I-5 in Delta Park. It supports wooded, shrub, and seasonal grassland areas. It has two stretches of open water connected by a culvert beneath an access road, and connects to Schmeer Slough to the south via underground pipes. Stormwater from the surrounding area is conducted to Walker Slough via several underground pipes. Walker Slough supports Oregon Ash, cottonwood, willows, slough sedge, nodding beggarstick, and reed canarygrass. It has a low value for water quality, and moderate values for flood control and habitat.

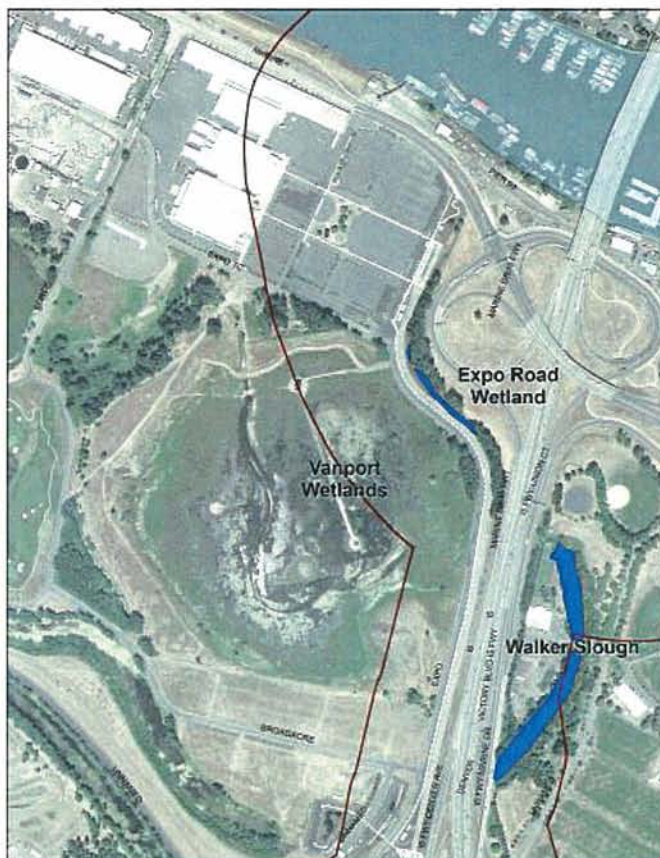
The Expo Road wetland is located between the MAX tracks and the Marine Drive interchange. It connects by culvert to Walker and Schmeer sloughs to the southeast and ditches within the Peninsula Drainage District No. 1 to the northwest. It is forested, and supports plants such as willow, cottonwood, Himalayan blackberry, and reed canarygrass. It has moderate values for water quality and flood control functions, and a low value for habitat.

Vanport Wetlands is a large (about 90 acres) wetland area managed by the Port of Portland as a mitigation site. It includes areas of forest, shrubs, grassland and seasonal open water. Because of its relatively large



size and diversity of habitats, it has the highest values for functions of any of the wetlands in the project area. It has high value for water quality and flood control functions, and moderate value for habitat.

Exhibit 3.15-4

**Wetlands near Marine Drive**

Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.

Based on mapped soils and aerial photographs, there may be one other wetland near this part of the project area, between Vancouver Way and Marine Drive. As project staff did not have permission to enter this property, the presence of a wetland could not be verified.

**Wetlands in Washington**

No wetlands were identified in the south Vancouver portion of the project area. There are several natural, constructed, and potential wetland sites around the northern portion of the project area near Burnt Bridge Creek and SR 500.

The SR 500 wetlands are on the east side of the project area, as shown in Exhibit 3.15-5. They are part of a stormwater system that eventually discharges to Burnt Bridge Creek. The SR 500 wetlands are within an area classified as Critical Lands.<sup>39</sup> They support eastern cottonwood,

<sup>39</sup> Clark County, 2007.

common rush, and several types of grass. They have moderate functional values for water quality and flood control, and a low value for habitat.

Exhibit 3.15-5

**Wetlands near SR 500**



Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.



Exhibit 3.15-6

**Wetlands near Burnt Bridge Creek**

Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.

Kiggins Bowl wetland is located at the base of steep slopes separating I-5 from Kiggins Bowl (see Exhibit 3.15-6). The Kiggins Bowl wetland is located in an area classified as Critical Lands and as a Non-Riparian Habitat Conservation Area.<sup>40</sup> It supports cottonwood, willow, and reed canarygrass. It has low functional values for water quality and flood control, and moderate habitat value.

The Burnt Bridge Creek wetland complex comprises a series of wetlands between Burnt Bridge Creek and I-5 (see Exhibit 3.15-6). The wetland areas nearest the highway are stormwater detention ponds and a mitigation site managed by WSDOT, which receive stormwater from I-5. The Burnt Bridge Creek wetlands are located in an area classified as Critical Lands and as a Riparian Habitat Conservation Area.<sup>41</sup> They are seasonally flooded, and support shrubby plants like Pacific ninebark, blackberry, red osier dogwood, and understory species like reed canarygrass, meadow foxtail, and knotweeds. As a group, they have moderate values for water quality, flood control, and habitat.

<sup>40</sup> Clark County, 2007.

<sup>41</sup> Clark County, 2007.

## Waterways

The project team analyzed potential structural work, fill, and excavation that could affect waterways near the CRC project. No project construction would occur in the Columbia Slough or Burnt Bridge Creek waterways. See the Ecosystems and Water Quality and Hydrology sections of this DEIS for detail on the watersheds, habitat values, and water quality issues pertaining to the waterways in the CRC project area. Potential effects to waterways by the project are discussed in the section below.

Construction activity would occur in the Columbia River and North Portland Harbor for any of the build alternatives, and is described in the Temporary Effects discussion later in this section. The existing bridge is supported by piers in both the Columbia River main channel and the North Portland Harbor channel.

### 3.15.2 Long-Term Effects of the Project Alternatives

Both direct and indirect effects to wetlands are possible from the CRC alternatives. Direct effects result from filling or dredging in surface water bodies, wetlands, or their buffers. These impacts can be quantified in terms of area or volume affected. Indirect effects can impact wetland functions even when the wetland or waterway itself is not altered. These effects can result from removing vegetation or disturbing soil near the wetland or waterway, increasing impervious surface nearby, or changing surface and subsurface water flow patterns.

In accordance with relevant state and federal regulations and Executive Order 11990, impacts to wetlands and jurisdictional waters were avoided and minimized to the extent practicable. The tables in each Alternative section below summarize the likely direct impacts of the project alternatives to waterways, wetlands, and adjoining buffer zones, including filling or excavation. Indirect long-term effects to wetland and waterway functions are discussed in Section 3.14, Ecosystems, and Section 3.16, Hydrology and Water Quality.

The following exhibits illustrate how the combined roadway and transit construction footprints would intersect with the identified jurisdictional waters, wetlands, and buffer areas. Likely impacts are discussed in detail in each alternative section, below.



Exhibit 3.15-7

Potential Impacts of Project Alternatives to Wetlands in Oregon

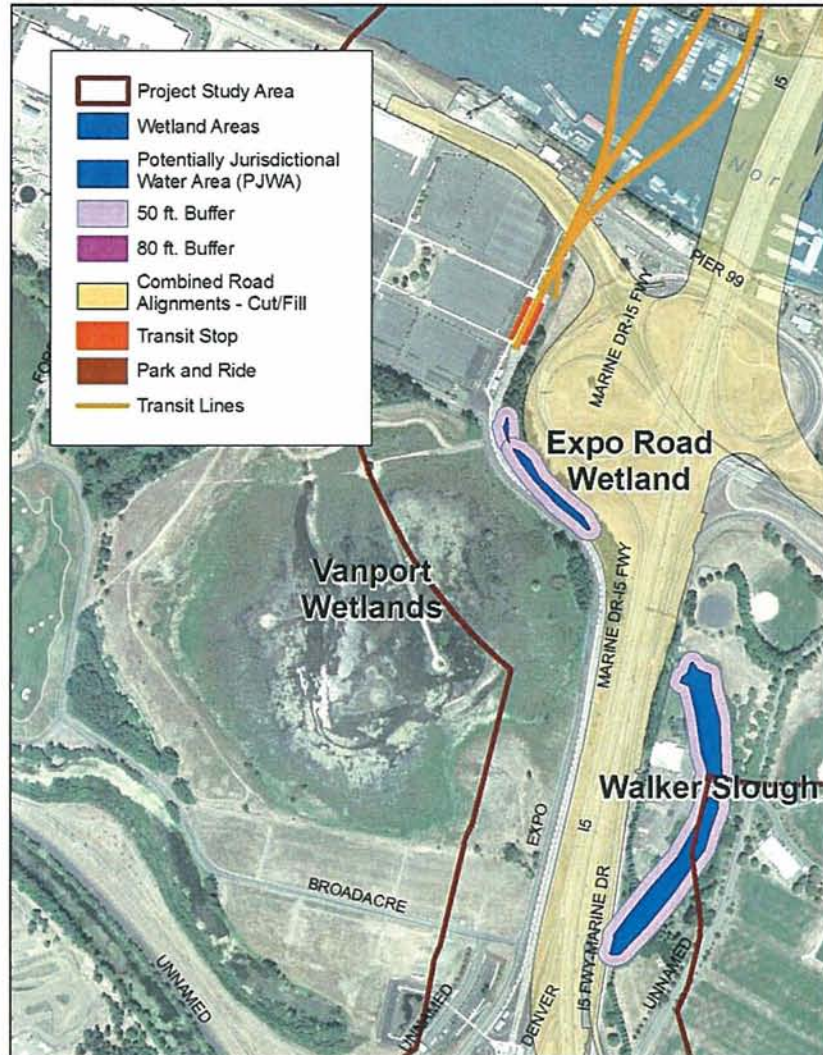
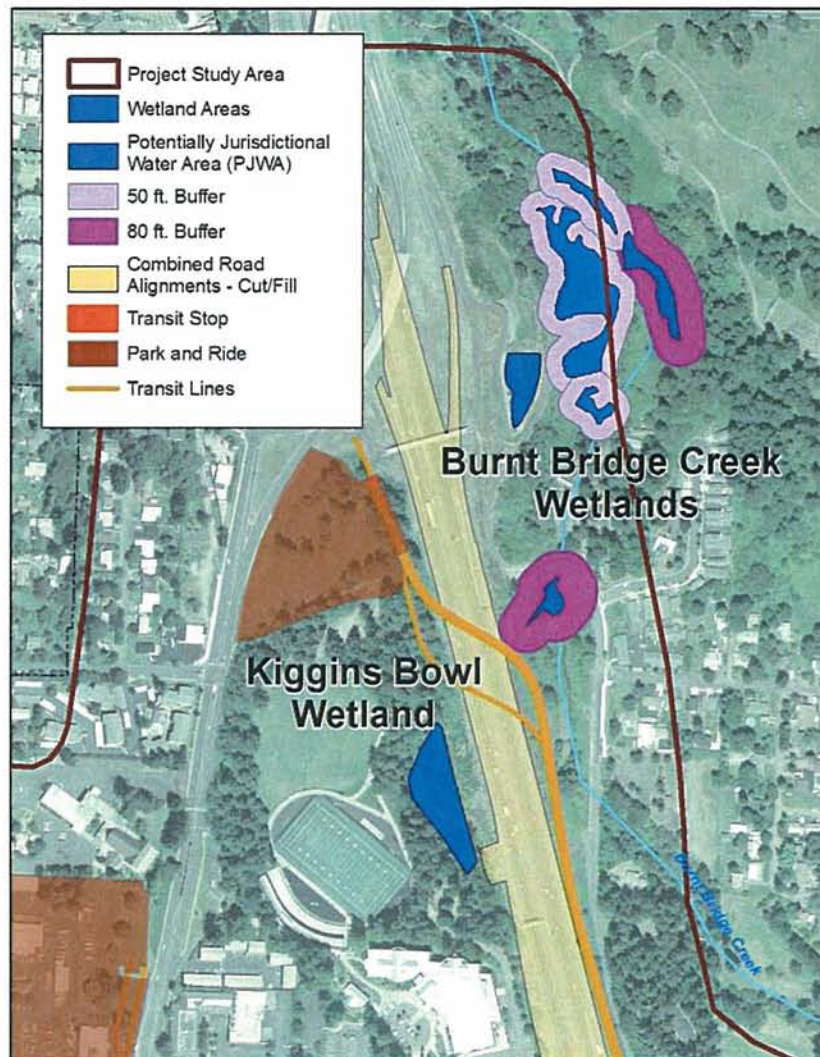


Exhibit 3.15-8

**Potential Impacts of Project Alternatives to Wetlands near SR 500**



Exhibit 3.15-9

**Potential Impacts of Project Alternatives to Wetlands near Burnt Bridge Creek****Alternative 1: No-Build**

The No-Build Alternative would avoid direct impacts to wetlands or other waters of the States and U.S. The existing bridge piers in the Columbia River would remain.

**Alternative 2: Replacement Crossing with Bus Rapid Transit**

Exhibit 3.15-10

**Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters**

<b>Alternative 2: Replacement Crossing with Bus Rapid Transit<sup>a</sup></b>				
	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College Terminus (C)</b>	<b>Mill Plain Terminus (D)</b>
<b>Expo Road wetland (acres)</b>	0.09	0.09	0.09	0.09
<b>SR 500 wetlands (acres)</b>	0.02	0.02	0.02	0.02
<b>Kiggins Bowl wetland (acres)</b>	< 0.01	<0.01	<0.01	<0.01
<b>Total wetland impact (acres)</b>	<b>0.11</b>	<b>0.11</b>	<b>0.11</b>	<b>0.11</b>
<b>Expo Road buffer (acres)</b>	0.98	0.98	0.98	0.98
<b>Walker Slough buffer (acres)</b>	0.13	0.13	0.13	0.13
<b>Burnt Bridge Creek wetlands buffer (acres)</b>	< 0.01	< 0.01	< 0.01	< 0.01
<b>Total wetland buffer impact (acres)</b>	<b>1.11</b>	<b>1.11</b>	<b>1.11</b>	<b>1.11</b>
<b>Columbia River fill (acres)</b>	3.04 2.81	3.04 2.81	3.04 2.81	3.04 2.81
<b>Columbia River remove (acres)</b>	0.75	0.75	0.75	0.75
<b>Columbia River bridge piers (net cubic yards)</b>	50,600 44,200	50,600 44,200	50,600 44,200	50,600 44,200

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

<sup>a</sup> Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

As shown above for Alternative 2 with all terminus options, long-term direct impacts from the replacement crossing with bus rapid transit would include about 1.11 acres of buffer and about 0.11 acre of wetland. This total would be higher with the Marine Drive interchange southern realignment option due to impacts to Vanport Wetlands, which is discussed further in Section 3.15.3. The totals above include impacts to 0.09 acre of the Expo Road wetlands, 0.98 acre of the Expo Road wetlands buffer, and 0.13 acre of the Walker Slough buffer. Impacts to the SR 500 wetlands (which appear to be stormwater features unlikely to require a buffer) total 0.02 acre.

Direct impacts to waterways would occur from bridge piers in the Columbia River, including both the main channel and the North Portland Harbor channel. No in-water impacts will occur in other waterways.

Permanent bridge piers in the Columbia River (including North Portland Harbor) for Alternative 2 would cover an area of 3.04 acres and displace



a volume of 86,900 cubic yards. Demolition of the existing bridges in the Columbia River and North Portland Harbor would result in removal activity in approximately 0.75 acre of waterway and 36,300 cubic yards of material for a net displacement of 50,600 cubic yards. The stacked transit highway bridge design would cover an area of 2.81 acres and displace a net volume of 44,200 cubic yards.

In addition to the waterways impacts shown above, constructing the transit alternatives could temporarily impact approximately 300 square feet of a potentially jurisdictional ditch associated with the Expo Road wetland. Both the highway footprint and transit alignments intersect this feature. Project construction would occur in and around the stormwater ditch associated with the Kiggins Bowl wetlands. The Kiggins Bowl terminus option would impact a small portion of this ditch, while the other terminus options would not.

Bus rapid transit vehicles carry fuel on board, which increases the risk (over light rail) of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality. This is a potential indirect effect of Alternative 2. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

**Alternative 3: Replacement Crossing with Light Rail**

Exhibit 3.15-11

**Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters**

<b>Alternative 3: Replacement Crossing with Light Rail Transit<sup>a</sup></b>				
	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College Terminus (C)</b>	<b>Mill Plain Terminus (D)</b>
<b>Expo Road wetland (acres)</b>	0.04	0.04	0.04	0.04
<b>SR 500 wetlands (acres)</b>	0.02	0.02	0.02	0.02
<b>Kiggins Bowl wetland (acres)</b>	< 0.01	<0.01	<0.01	<0.01
<b>Total wetland impact (acres)</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>
<b>Expo Road buffer (acres)</b>	0.43	0.43	0.43	0.43
<b>Walker Slough buffer (acres)</b>	0.13	0.13	0.13	0.13
<b>Burnt Bridge Creek wetlands buffer (acres)</b>	< 0.01	< 0.01	< 0.01	< 0.01
<b>Total wetland buffer impact (acres)</b>	<b>0.56</b>	<b>0.56</b>	<b>0.56</b>	<b>0.56</b>
<b>Columbia River fill (acres)</b>	3.04 2.81	3.04 2.81	3.04 2.81	3.04 2.81
<b>Columbia River remove (acres)</b>	0.75	0.75	0.75	0.75
<b>Columbia River bridge piers (net cubic yards)</b>	50,600 44,200	50,600 44,200	50,600 44,200	50,600 44,200

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

<sup>a</sup> Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

Impacts to the Columbia River (including North Portland Harbor), Vanport Wetlands, the SR 500 wetlands, Walker Slough buffer, and Burnt Bridge Creek wetlands buffer would be the same as for Alternative 2. All terminus options would result in the same impacts.

Utilizing light rail transit vehicles would eliminate the need for a bus/rail transfer and turn-around facility, and would result in impacts to the Expo Road wetland and its buffer of 0.04 acre and 0.43 acre, respectively.

Light rail vehicles are electric powered, which reduces the risk of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality. This is a potential indirect impact of Alternative 3. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

**Alternative 4: Supplemental Crossing with Bus Rapid Transit**

Exhibit 3.15-12

**Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters**

<b>Alternative 4: Supplemental Crossing with Bus Rapid Transit<sup>a</sup></b>				
	<b>Kiggins Bowl Terminus (A)</b>	<b>Lincoln Terminus (B)</b>	<b>Clark College Terminus (C)</b>	<b>Mill Plain Terminus (D)</b>
<b>Expo Road wetland (acres)</b>	0.13	0.13	0.13	0.13
<b>SR 500 wetlands (acres)</b>	0.03	0.03	0.03	0.03
<b>Kiggins Bowl wetland (acres)</b>	< 0.01	<0.01	<0.01	<0.01
<b>Total wetland impact (acres)</b>	<b>0.16</b>	<b>0.16</b>	<b>0.16</b>	<b>0.16</b>
<b>Expo Road buffer (acres)</b>	1.18	1.18	1.18	1.18
<b>Walker Slough buffer (acres)</b>	0.13	0.13	0.13	0.13
<b>Total wetland buffer impact (acres)</b>	<b>1.31</b>	<b>1.31</b>	<b>1.31</b>	<b>1.31</b>
<b>Columbia River fill (acres)</b>	1.93	1.93	1.93	1.93
<b>Columbia River remove (acres)</b>	0.25	0.25	0.25	0.25
<b>Columbia River bridge piers (net cubic yards)</b>	101,400	101,400	101,400	101,400

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

Long-term direct impacts from the supplemental crossing with bus rapid transit (all terminus options) would include about 1.31 acres of buffer and about 0.16 acre of wetland. This total would be higher with the Marine Drive interchange southern realignment option due to impacts to Vanport Wetlands, which is discussed further in Section 3.15.3. The totals above include impacts to the Expo Road wetland of 0.13 acre, to the Expo Road wetland buffer of 1.18 acres, and to the Walker Slough buffer of 0.13 acre. Impacts to the SR 500 wetlands total 0.03 acre.

Additional permanent bridge piers in the Columbia River (including North Portland Harbor) over existing conditions for the supplemental crossing would cover an area of 1.93 acres and displace a net volume of 101,400 cubic yards. Demolition of the existing bridges in North Portland Harbor would result in removal activity of approximately 0.25 acre in area.

Bus rapid transit vehicles carry fuel on board, which increases the risk of leaks or spills of petroleum from transit vehicles, a potential indirect impact.

## Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.15-13

### Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters

Alternative 5: Supplemental Crossing with Light Rail Transit <sup>a</sup>				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Expo Road wetland (acres)	0.08	0.08	0.08	0.08
SR 500 wetlands (acres)	0.03	0.03	0.03	0.03
Kiggins Bowl wetland (acres)	< 0.01	< 0.01	< 0.01	< 0.01
Total wetland impact (acres)	0.11	0.11	0.11	0.11
Expo Road buffer (acres)	0.63	0.63	0.63	0.63
Walker Slough buffer (acres)	0.13	0.13	0.13	0.13
Total wetland buffer impact (acres)	0.96	0.96	0.96	0.96
Columbia River fill (acres)	1.93	1.93	1.93	1.93
Columbia River remove (acres)	0.25	0.25	0.25	0.25
Columbia River bridge piers (net cubic yards)	101,400	101,400	101,400	101,400

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

For Alternative 5 with all terminus options, impacts to the Columbia River (including North Portland Harbor), Vanport Wetlands, the SR 500 wetlands, Walker Slough buffer, and Burnt Bridge Creek wetlands buffer would be the same as for Alternative 4.

Utilizing light rail transit vehicles would eliminate the need for a bus/rail transfer and turn-around facility, and would result in impacts to the Expo Road wetland and its buffer of 0.08 acre and 0.63 acre, respectively.

As with Alternative 4, light rail vehicles are electric powered, which reduces the risk of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality, a potential indirect impact of this project. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

### 3.15.3 Long-Term Effects of Project Components

Certain project components do not affect the wetlands or waters impacts analysis, and are not considered here. These include transit operations options, tolling scenarios, and transportation system/demand management options.



### **Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)**

Between 0.04 (light rail) and 0.09 (bus rapid transit) acre of the Expo Road wetland would be impacted with a replacement crossing. This is slightly less area of impact than the supplemental crossing, which would impact between 0.08 (light rail) and 0.13 (bus rapid transit) acre of this wetland. Highway interchange improvements associated with the replacement crossing would impact less than 0.02 acre of the SR 500 wetlands, while improvements associated with the supplemental crossing would impact less than 0.03 acre.

The replacement crossing would impact between 0.43 (light rail) and 0.98 (bus rapid transit) acre of the buffer zone in a 50-foot radius from the Expo Road wetland. This is slightly less of an impact than the supplemental crossing, which would impact between 0.63 (light rail) and 1.18 (bus rapid transit) acres of the buffer zone.

The replacement crossing would entail removal of 0.75 acre of existing structure or fill from the river. It would add 2.62 acres, resulting in a displaced volume of approximately 66,700 cubic yards from the river. The supplemental crossing would require 0.25 acre of removal and 1.93 acres of fill. A volume of approximately 101,400 cubic yards of the river would be displaced by the in-water structures.

The stacked transit/highway bridge design with the replacement crossing would put approximately 18 percent less structure in the water than the standard replacement crossing, assuming 96-inch vertical piles are used to support the piers. It may, however, result in additional smaller piers in shallow-water habitat near the south shore of the Columbia River main channel.

A Marine Drive southern realignment option, south of the Expo Center would impact the E-zone associated with Vanport Wetland, which is a mitigation site owned and maintained by the Port of Portland. Construction impacts within the wetland would be about 0.48 acre. Two piers would be placed in the wetland, both approximately 10 ft in diameter, causing a direct impact of 0.003 acre. Mitigation for this impact could require three times the standard DSL ratios because of impacts to a mitigation site. Long-term effects on vegetation (mature cottonwood forest) below the alignment at Vanport and the Expo Center wetlands cannot be quantified due to the preliminary design of this option. The diagonal realignment would not impact the Vanport, and would impact approximately the same area of the Expo Center wetland as the standard Marine Drive alignment.

### **Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)**

Light rail vehicles are electric powered, which reduces the risk of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality, a potential indirect impact of this project. Bus rapid transit vehicles carry fuel on board, which increases the risk of leaks or spills of petroleum from transit vehicles. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

The bus rapid transit option would impact about 0.05 acre more in the Expo Road wetland and 0.55 acre more of its buffer zone, compared to light rail.

Both maintenance base stations are situated partially on hydric soils, and wetlands or waters are present in the vicinities. Aerial photographs identified constructed stormwater wetland facilities within 0.5 mile of the proposed bus rapid transit maintenance facility in Vancouver, and excavated ponds (former gravel quarries) within 0.5 mile of the proposed light rail maintenance facility in Gresham. However, no wetlands or waters are present within the bases' boundaries. No long-term direct, temporary direct, or indirect impacts to wetlands or other waters of the U.S. are anticipated from either an expanded maintenance base in Gresham or an expanded base in Vancouver.

Even if the No-Build Alternative is chosen and CRC is not built, regional transit services are likely to increase from other projects, and expansion of the vehicle maintenance facilities would likely occur. If one of the build alternatives is chosen for CRC, this project would contribute to the size of that expansion.

#### **Transit Terminus Options (with all Alternatives)**

The cut/fill line for the Kiggins Bowl terminus intersects with 13 square feet of the buffer zone (80-foot radius) of the Burnt Bridge Creek wetlands. The Lincoln terminus would avoid this impact.

The Kiggins Bowl Park and Ride may impact approximately 152 square feet of the stormwater feature and wetland at the east side of Kiggins Bowl. A smaller park and ride facility is planned for the other terminus options, which could reduce potential indirect impacts from this facility. Jurisdictional determination of this feature is pending, but it is being treated as a jurisdictional water at this time.

The Mill Plain and Clark College terminus options would avoid potential direct impacts to the Burnt Bridge Creek wetlands. The Kiggins Bowl Park and Ride would still be constructed, so shorter-length transit options could still impact the Kiggins Bowl wetland stormwater feature.

#### **Transit Alignment Options (with all Alternatives)**

The transit alignment options (adjacent vs. offset; two-way Washington vs. Broadway-Washington; or 16th Street vs. McLoughlin) would have no measurable differences in long-term wetlands effects.

#### **How can I learn more?**

The Ecosystems Technical Report provides detailed information on construction effects to the Columbia River.

### **3.15.4 Temporary Effects**

The No-Build Alternative would not involve construction activities and so would not entail any temporary disturbance of jurisdictional waters, wetlands, or their functions.

No substantial differences between the alternatives are anticipated in terms of temporary effects from construction. Temporary wetland effects are generally indirect. For example, habitat function could be disturbed temporarily from nearby construction noise and lights. Altering vegetation, hydrology, and filling or excavating in wetlands or waterways are considered permanent changes.

The potential sites for a bridge assembly/casting yard are unknown at this time. However, they are likely to be adjacent to the Columbia River, Willamette River, or other water body in the region. The existing conditions on the assembly/casting yard could range from a developed and paved port terminal to a currently undeveloped site, and could contain wetlands. The development and operations of the assembly/casting yard would be subject to the same federal and state environmental regulations that apply to other aspects of project construction (depending on which state it is in), as well as any other federal, state or local regulations that may apply to the particular site. Before any site is selected, a thorough, site-specific environmental impact analysis will be conducted. All necessary permits will be secured prior to site development and operations.

All build alternatives would involve construction activities in the water of the Columbia River and North Portland Harbor. The Ecosystems section of this DEIS discusses the temporary effects of this activity to habitat functions, and the Water Quality section discusses its temporary effects to water quality and flood control functions.

### **3.15.5 Potential Mitigation for Adverse Effects**

In accordance with state and federal regulations and Executive Order 11990, the project has avoided and minimized impacts to wetlands to the extent practicable during the design of the highway and transit alignments, and will continue to consider this as the design process moves forward and the project sponsors select a preferred alternative.

During construction, best management practices will be used to avoid impacts to wetlands from erosion, spills, damage to vegetation, or disruption of hydrology. Both WSDOT and ODOT utilize standard specifications and special provisions to direct contractors to avoid and minimize impacts. In addition, standard terms and conditions of approvals from regulatory agencies have been incorporated into the preliminary designs analyzed in this document. The project team will work collaboratively with local, state, and federal permitting agencies to seek compensatory mitigation objectives and site selection after a preferred alternative is selected.

The build alternatives would impact between about 1.9 and 3.1 acres of waterways, about 0.06 to 0.16 acre of existing wetlands, and 0.56 to 1.31 acres of buffer areas. The southern realignment option for Marine Drive would impact an additional 0.48 acre of wetland and 1.58 acres of E-zone at the Vanport Wetland. Mitigation for these direct impacts is regulated by federal, state, and local jurisdictions as described in the Existing Conditions discussion in this section, and would typically require restoring or enhancing degraded wetland areas or establishing new wetlands nearby to compensate for functions lost or degraded by those impacts. Because Vanport is already a wetland mitigation site, it could require a 9:1 mitigation ratio for any impacts to it.

Potential compensatory mitigation sites would be identified after the selection of a locally preferred alternative. Likely mitigation sites depend on the area needed for mitigation, current and future ownership of potential mitigation sites, and site characteristics. Preference would be given to sites near the potential impacts, for example, between the

Columbia Slough and Marine Drive and near Burnt Bridge Creek. Mitigation sites would be selected based on soil types and topographic position that would increase the likelihood of successful restoration or establishment of wetland conditions. Options for off-site mitigation could also be considered.

Mitigation needs for Oregon wetlands could range from 0.06 to 0.48 acre (not including potential Vanport impact mitigation from the Marine Drive southern realignment option) depending on the type of mitigation (restoration, creation, and/or enhancement) and the amount of affected wetlands associated with the selected alternative. Mitigation for Oregon wetland buffers would require a replacement of lost functions and would likely be between 0.56 acre and 1.31 acres depending on the amount of affected buffer.

Mitigation needs for Washington wetlands could range from 0.02 to 0.24 acre depending on the type of mitigation and the amount of affected wetlands associated with the selected alternative, assuming that impacts occur only to Category 3 or Category 4 wetlands. Mitigation for Washington wetland buffers would require the replacement of lost functions and values and would likely be less than 0.01 acre, depending on the amount of affected buffer, and pending jurisdictional determinations.



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### 3.16 Hydrology and Water Quality

Communities depend on clean and reliable water for domestic use, agriculture, industry, and recreation. Fish and many wildlife species depend on clean water habitats to live. In urban areas, pollutants that wash off roadways during storms are a major contributor to poor water quality in rivers and streams. Pollutants from roadways typically include fuel, oil, grease, and other automotive fluids; heavy metals such as copper and zinc; and small particles from erosion or road sanding, which turns waterways turbid. The design and placement of roadways and stormwater systems can affect how these pollutants are treated or released into the environment.

In addition to potential pollution concerns, placing structures such as bridge piers or roadways in a river or its floodplain may increase the height of floods during storm events. Although an individual road or structure may be small in relationship to the volume of a stream, collectively, all of the roads and structures built along a river can have a dramatic effect on the severity of floods. For this reason, any construction in streams and rivers or in their floodplains is strictly regulated, and must take into account any incremental contribution toward worsening flood conditions on the waterway.

This section examines the potential effects of the project options on both water quality and hydrology, and relates these potential effects to the context of existing conditions in the waterways and surrounding areas. Ground water and aquifers are discussed in Section 3.17 of this DEIS.

Although specific stormwater treatment designs have not yet been developed, this section discusses a conceptual design that has been developed for analysis purposes and to compare alternatives. This is just one of multiple treatment designs that will be considered. More detailed and technical discussions of the information presented in this chapter can be found in the Hydrology and Water Quality Technical Report and the Conceptual Stormwater Design Report.

#### 3.16.1 Existing Conditions

Existing conditions in the watershed of each surface water feature are tied to the potential for water quality and hydrology impacts from the project. A watershed is the area of land that contributes water to a river or stream. This area will change based on the point along the river or stream course being examined—watersheds near the upstream ends are relatively small, while near the mouth of a river or stream the contributing watershed may be quite large.

#### Stormwater Runoff

When land is paved, covered by buildings, or compacted by heavy equipment, the surface of the ground becomes impervious. This means that water from rain or snow is no longer able to soak into the soil and recharge the underground water table. Instead, this water becomes runoff. It flows along the surface until it reaches a drain, stormwater pipe, ditch, stream, or other surface water body. In less-developed areas, soil and plants are able to help filter and absorb the water before it reaches waterways, keeping it relatively clean. Runoff that does not pass

#### What is the difference between water quality and hydrology?

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In this DEIS, **hydrology** refers to the flow of water—its volume, where it drains, and how quickly the flow rate changes in a storm.

**Water quality** refers to the characteristics of the water—its temperature and oxygen levels, how clear it is, and whether it contains pollutants.

#### TERMS & DEFINITIONS 303 (d) and TMDL

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States monitor and regulate water quality in their rivers and streams. They are required to do this under section 303(d) of the federal Clean Water Act. If a water body is "303(d) listed", that means it does not meet a particular water quality standard, determined by the state. Under this law, states also develop action plans to address water quality concerns, which include setting Total Maximum Daily Loads (TMDLs) for pollutants in a waterway.

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through vegetation and soil typically picks up oil or other pollutants on the surface of roads or buildings and carries them into streams or drainage systems, decreasing water quality.

Hard surfaces also send a much larger volume of water to streams more quickly than if the water had first soaked into the ground. This means that streams rise or flood much more quickly during storms, and can have higher peak flood levels. If stormwater is able to soak into the ground, it often slowly finds its way out again in seeps or springs, which help keep water flowing during the dry season. Impervious surfaces keep stormwater from recharging these springs, which leads to lower water levels and higher water temperatures during the summer. This can have an adverse effect on fish and water quality.

Bioinfiltration swales, a type of constructed wetland, are a common and accepted mechanism to treat stormwater, and are being considered to treat stormwater from this project. Bioinfiltration swales are designed to allow water to infiltrate into the ground rather than discharging into streams and rivers. Soil and plants in this type of swale act to filter many of the pollutants present in runoff, sediments can drop out onto the bottom of the swale, and can add some flow control capacity during storm events.

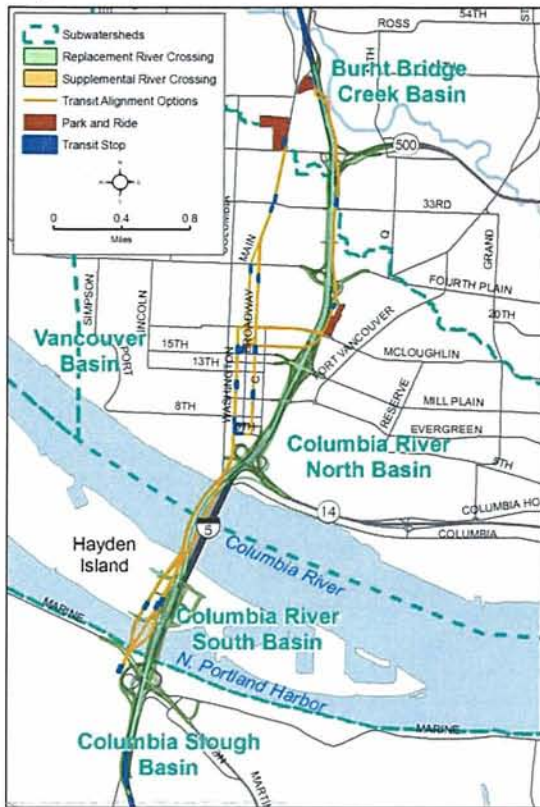
### **Watersheds and Surface Water**

This section discusses the project area's watersheds and their characteristics that are relevant to the project's potential impacts on water quality and hydrology.

### **How can I learn more?**

The Hydrology and Water Quality Technical Report describes in detail the existing conditions in nearby watersheds and water bodies.

Exhibit 3.16-1

**Map of Project Area Main Watersheds**

Source: CRC Hydrology and Water Quality Technical Report.

The area around the project contains eight mapped surface water features. Three of these waterways (Burnt Bridge Creek, the Columbia River, and the Columbia Slough) may receive project runoff and are therefore the focus of this section. The designated watersheds of these water features are illustrated in Exhibit 3.16-1. The other five water features in the broader vicinity—Salmon Creek, Whipple Creek, Cold Creek, Cougar Canyon Creek, and Tenny Creek—would not receive any direct runoff or hydrology effects from the project. FEMA floodplains near the project area can be seen in Exhibit 3.16-2.



Exhibit 3.16-2  
**FEMA Floodplains near the Project Area**



Source: CRC Hydrology and Water Quality Technical Report.

Since the regulatory process regulates specific water quality issues individually (for example, the amount of oxygen dissolved in the water, temperature, or nitrogen levels) there may be pollutants of concern that do not yet have regulatory standards set. For example, regulatory levels for copper are still in a state of flux for the waterways near CRC. The CRC project will work with regulatory agencies to determine appropriate thresholds for water quality impacts as project development continues.

#### COLUMBIA SLOUGH

The Columbia Slough is a 19-mile long complex of shallow channels located in low-lying land south of the Columbia River. It is a remnant of an extensive wetland and slough system that existed on the Columbia River floodplain before development of the area. It drains about 32,700 acres of land, beginning near Fairview Lake about 12 miles east of the I-5 crossing, and flowing into the Willamette River about seven miles west of the I-5 crossing, near the confluence of the Willamette and Columbia Rivers.

Over the years, the slough system has been extensively dredged, diked, filled, and channelized. The upper and middle portions of the slough are highly managed by a system of pumps and levees that provide watershed drainage and flood control. The lower portion of the slough, which

includes the waterway near the project area, is influenced by tides and by the amount of water released from dams upstream. Stream flow at the mouth reverses due to tidal influences, although this effect is not noticeable near the project area.

Near the project area, the Columbia Slough does not meet Oregon State water quality standards for temperature (it is too warm from spring through fall) and iron and manganese content. Total Maximum Daily Loads (TMDLs) have been set for contaminants of concern in the waterway, including chlorophyll *a*, DDE/DDT, dioxin, dissolved oxygen, fecal coliform, lead, PCB, pH, and phosphorus. The Oregon Public Health Division and City of Portland have issued warnings about eating fish from the slough due to contamination from PCBs, DDE, and DDT. The slough no longer receives discharges from Portland's combined sewer overflows.

Exhibit 3.16-3

**Columbia Slough Stormwater Map**

Source: CRC Conceptual Stormwater Design Technical Report.

The dashed lines are surface conveyances. Solid lines are pipes. Arrows show direction of flow, and points labeled CS/CR are stormwater outfalls.

Highway runoff typically contains suspended solids, oils, grease, copper, zinc, iron, manganese, and phosphorus.<sup>42</sup> Road de-icing (which happens infrequently in the project area) can contribute to low levels of dissolved oxygen. Fecal coliform, while not a product of roadway surfaces or activities, is known to be conveyed in road runoff. These are water

<sup>42</sup> EPA, 1993.

quality issues for the Columbia Slough that may be affected by the project alternatives. City of Portland guidelines do not require flow volume control for discharges to the Columbia Slough.<sup>43</sup> Flow levels in the slough are constrained by upstream water controls, pumps, dikes, and levees.

The Columbia Slough 100-year floodplain, as mapped by the Federal Emergency Management Agency (FEMA) extends only slightly into the project area, as shown in Exhibit 3.16-2.

Exhibit 3.16-3 shows existing stormwater outfalls from the I-5 roadway system that drain into the Columbia Slough. Runoff from the existing light rail track between Delta Park and the Expo Center stations also drains into the Columbia Slough system, after first flowing through Vanport Wetland, Schmeer Slough, or Northern Slough.

#### **COLUMBIA RIVER/NORTH PORTLAND HARBOR**

The river drains almost 220,000 square miles in seven states and Canada with land in forest, agricultural, residential, urban, and industrial uses. The Lower Columbia River, that section of the river most pertinent to the impact analysis, flows from Bonneville Dam at river mile 146 to the mouth of the river, and it drains an area of 18,000 square miles. Hayden Island divides the mainstem of the Columbia River, which flows to its north, from a side channel called the North Portland Harbor, which flows to its south. The I-5 highway crosses both channels near river mile 106.5.

Near the project area, the Columbia River fails to meet Oregon State water quality standards for temperature, PCBs, PAHs, DDE, arsenic, dioxin, and total dissolved gas. Upstream of the project area, it does not meet Washington State water quality standards for temperature. These water quality issues are not typically associated with highway runoff and the project alternatives are not likely to affect them. Flow control measures are not required for stormwater outfalls to the Columbia River by either Oregon or Washington.

The Columbia River 100-year floodplain has been mapped by FEMA, and portions near the project area are shown in Exhibit 3.16-2. Generally, the floodplain extends from the watercourse to the upper banks of the Columbia River and North Portland Harbor on Hayden Island, and to the levee system adjacent to the North Portland Harbor in North Portland. Impacts to 100-year floodplains will be analyzed in accordance with local regulations and Executive Order 11988 – Floodplain Management.

Exhibit 3.16-4 shows roadway areas and stormwater outfalls in the project area that drain directly to the Columbia River. Other private outfalls may exist that were not mapped. Stormwater from the existing I-5 bridge discharges directly to the river from road-side grates along the span. Runoff from the bridge is not treated prior to release into the Columbia River and North Portland Harbor. In South Vancouver, I-5 is generally below grade of the surrounding areas and the highway drainage system receives runoff from developed areas west of the highway, in addition to runoff from the road surface and right-of-way.

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<sup>43</sup> City of Portland Bureau of Environmental Services, 2004.